DGC-2020ES

Digital Genset Controller

Quick Start Instruction Manual

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⚠ **WARNING:** California's Proposition 65 requires special warnings for products that may contain chemicals known to the state of California to cause cancer, birth defects or other reproductive harm. Please note that by posting this Proposition 65 warning, we are notifying you that one or more of the Proposition 65 listed chemicals may be present in products we sell to you. For more information about the specific chemicals found in this product, please visit https://www.basler.com/Prop65.

Preface

This instruction manual provides basic installation and setup information for the DGC-2020ES Digital Genset Controller. To accomplish this, the following information is provided:

- Mounting
- Terminals and connectors
- Typical applications
- BESTCOMS*Plus*® software
- Configuration
- BESTlogic™*Plus*
- Controls and indicators

Conventions Used in this Manual

Important safety and procedural information is emphasized and presented in this manual through Warning, Caution, and Note boxes. Each type is illustrated and defined as follows.

Warning!
Warning boxes call attention to conditions or actions that may cause personal injury or death.

Caution
Caution boxes call attention to operating conditions that may lead to equipment or property damage.

Note
Note boxes emphasize important information pertaining to Digital Genset Controller installation or operation.

DGC-2020ES Instruction Manual Catalog

Available instruction manuals for the DGC-2020ES are listed in Table 1.

Table 1. Instruction Manuals

Part Number	Description
9469200993	Quick Start (this manual)
9469200994	Installation
9469200995	Configuration
9469200996	Operation
9469200997	Accessories

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Warning!
READ THIS MANUAL. Read this manual before installing, operating, or maintaining the DGC-2020ES. Note all warnings, cautions, and notes in this manual as well as on the product. Keep this manual with the product for reference. Only qualified personnel should install, operate, or service this system. Failure to follow warning and cautionary labels may result in personal injury or property damage. Exercise caution at all times.

Revision History

A historical summary of the changes made to this instruction manual is provided below. Revisions are listed in reverse chronological order.

Visit www.basler.com to download the latest hardware, firmware, and BESTCOMS*Plus*® revision histories.

Instruction Manual Revision History

Manual Revision and Date	Change
B, Nov-19	• Removed Rev Letter from all pages • Changed sequential numbering to sectional numbering • Moved Instruction Manual Revision History into Preface • Removed standalone Revision History chapter
A1, Apr-2019	• Added Prop 65 warning on back of cover page
A, Sep-2018	• Updated Revision History chapter
—, Apr-2017	• Initial release

Contents

1 • Introduction

This manual provides basic installation and setup information for the DGC-2020ES Digital Genset Controller. For complete information, refer to the appropriate DGC-2020ES instruction manual.

Caution
This Quick Start manual is intended for use by qualified personnel only.

Default Settings

Each DGC-2020ES is delivered with default settings that are based on average values and may not be appropriate for your application. All settings must be properly configured for your application before running the engine-generator set.

Warning!
Do not place the DGC-2020ES controller into service until all settings have been properly configured.

Features and Functions

The DGC-2020ES Digital Genset Controller provides integrated engine-genset control, protection, and metering in a rugged and economical package. Its features set make the DGC-2020ES ideal for standalone genset applications where paralleling or load sharing is not required. Microprocessor based technology allows for exact measurement, setpoint adjustment, and timing functions. Front panel controls and indicators enable quick and simple DGC-2020ES operation. Basler Electric communication software (BESTCOMS*Plus*®) allows units to be easily customized for each application. Because of the low sensing burden in the DGC-2020ES, dedicated potential transformers (PTs) are not required. A liquid crystal display (LCD) with backlighting can be viewed under a wide range of ambient light and temperature conditions.

The DGC-2020ES Digital Genset Controller has the following features:

- Generator Control
- Engine and Generator Protection
- Automatic Transfer Switch Control (Mains Failure)
- Automatic Generator Configuration Detection
- Programmable Analog Engine Senders
- Seven Programmable Contact Inputs
- Programmable Logic
- Exercise Timer
- ECU Communications via SAE J1939
- Additional contact input/output module available to expand the capabilities of the DGC-2020ES

DGC-2020ES Digital Genset Controllers perform the following functions:

Generator Protection and Metering

Multifunction generator protection guards against generator overvoltage, undervoltage, reverse power, loss of excitation, underfrequency, overfrequency, and overcurrent. Each generator protection function has an adjustable pickup and time delay setting.

Metered generator parameters include voltage, current, real power (watts), apparent power (VA), and power factor (PF).

Engine Protection and Metering

Engine protection features include oil pressure and coolant temperature monitoring, overcrank protection, ECU specific protection elements, and diagnostic reporting.

Metered engine parameters include oil pressure, coolant temperature, battery voltage, speed, fuel level, engine load, coolant level (from ECU), ECU specific parameters, and run-time statistics.

Event Recording

An event log retains a history of system events in nonvolatile memory. Up to 30 event types are retained and each record contains a time stamp of the first and last occurrence, and the number of occurrences for each event.

Contact Inputs and Outputs

DGC-2020ES controllers have seven programmable contact inputs. All contact inputs recognize dry contacts. The programmable inputs can be configured to initiate a pre-alarm or alarm. An input can be programmed to receive an input from an automatic transfer switch. Inputs can also be programmed to override DGC-2020ES alarms and protection functions. Each input can be assigned a user-defined name for easy identification at the front panel display and in fault records.

Output contacts include three dedicated relays for energizing an engine's glow plugs, fuel solenoid, and starter solenoid. Four additional user-programmable output contacts are provided.

Additional contact inputs and output contact requirements can be accommodated with an optional CEM-2020 (Contact Expansion Module). Contact Basler Electric for ordering information.

Automatic Transfer Switch Control (Mains Failure)

The DGC-2020ES can detect a mains failure via a single- or three-phase bus input. A mains failure is established when any one of the following conditions are met:

- Any phase of bus voltage falls below dead the bus threshold
- Any phase of bus voltage is unstable due to overvoltage or undervoltage
- Any phase of bus voltage is unstable due to overfrequency or underfrequency

At this time, the DGC-2020ES will start the genset and when ready, apply power to the load via the genset. The DGC-2020ES implements open transitions to and from the mains. When the mains returns and is considered stable, the DGC-2020ES will transfer the load back to the mains.

Communication

DGC-2020ES communication features include a standard USB port for local (and temporary) communication, SAE J1939 interface for remote communication, and RS-485 interface for communication with an optional Remote Display Panel.

USB Port

The USB communication port can be used with BESTCOMS*Plus* software to quickly configure a DGC-2020ES with the desired settings or retrieve metering values and event log records.

CAN Interface

The CAN interface provides high-speed communication between the DGC-2020ES and the engine control unit (ECU) on an electronically controlled engine. This interface provides access to oil pressure, coolant temperature, and engine speed data by reading these parameters directly from the ECU. When available, engine diagnostic data can also be accessed. The CAN interface supports the following protocols:

- SAE J1939 Protocol - Oil pressure, coolant temperature, and engine speed data are received from the ECU. In addition, DTCs (Diagnostic Trouble Codes) help diagnose any engine or related failures. The engine DTCs are displayed on the front panel of the DGC-2020ES and may be obtained using BESTCOMS*Plus*® software.

- MTU Protocol - A DGC-2020ES connected to a genset equipped with an MTU ECU receives oil pressure, coolant temperature, and engine speed data from the engine controller, along with various alarms and pre-alarms that are MTU specific. In addition, the DGC-2020ES tracks and displays the active fault codes issued by the MTU engine ECU.

Style Number

Standard-order DGC-2020ES controllers are identified by a style number which consists of a combination of letters and numbers that define the controller's electrical characteristics and operational features. The model number, together with the style number, describes the options included in a specific controller. Figure 1-1 illustrates the DGC-2020ES style number identification chart.

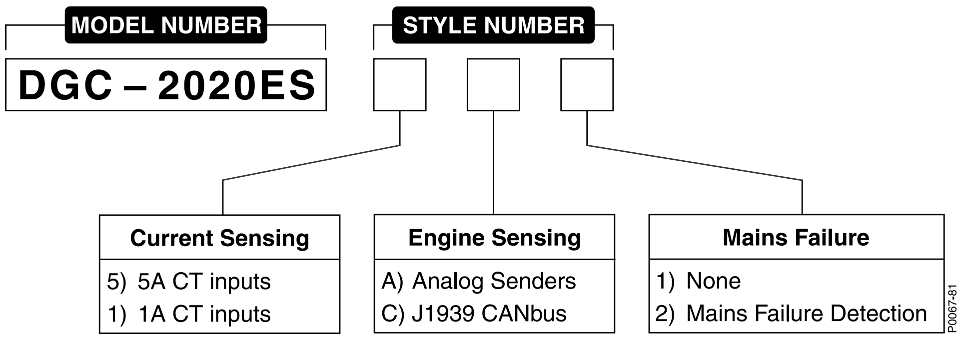


Figure 1-1. DGC-2020ES Style Chart

For example, a DGC-2020ES with style number **5A2**, has the following characteristics and features.

5 5 Aac Current Sensing Inputs
A Analog Senders
2 Mains Failure Detection

Optional Features and Capabilities

CEM-2020 (Contact Expansion Module)

The optional CEM-2020 provides 10 additional contact inputs and 18 or 24 additional output contacts (depending on module type) to the DGC-2020ES. The CEM-2020 communicates with the DGC-2020ES through a CAN interface. Refer to the *CEM-2020* chapter in the *Accessories* manual for more information.

Remote Display Panel

The optional Remote Display Panel provides remote indication of many pre-alarm and alarm conditions. The DGC-2020ES communicates with the Remote Display Panel through an RS-485 interface. Refer to the *Communication* chapter in the *Configuration* manual for more information.

2 • Mounting

DGC-2020ES controllers are delivered in sturdy cartons to prevent shipping damage. Upon receipt of a unit, check the part number against the requisition and packing list for agreement. Inspect for damage, and if there is evidence of such, immediately file a claim with the carrier and notify the Basler Electric regional sales office or your sales representative.

If the device is not installed immediately, store it in the original shipping package in a moisture- and dust-free environment.

Hardware

The front panel is resistant to moisture, salt fog, humidity, dust, dirt, and chemical contaminants. DGC-2020ES controllers are mounted using the four permanently attached 10-24 studs. The torque applied to the mounting hardware should not exceed 20 inch-pounds (2.2 newton meters).

Dimensions

Panel cutting and drilling dimensions are shown in Figure 2-1. Overall dimensions are shown in Figure 2-2. All dimensions are shown in inches with millimeters in parenthesis.

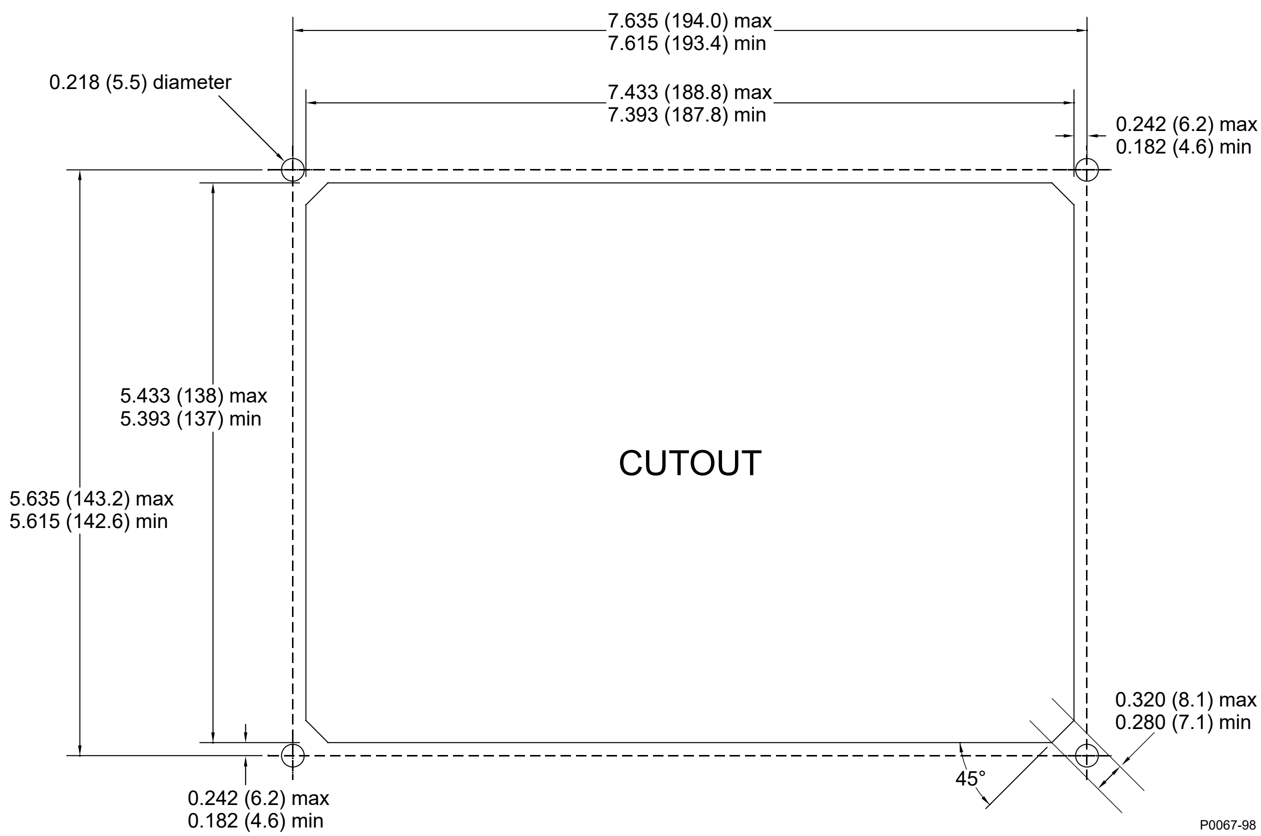


Figure 2-1. Panel Cutting and Drilling Dimensions

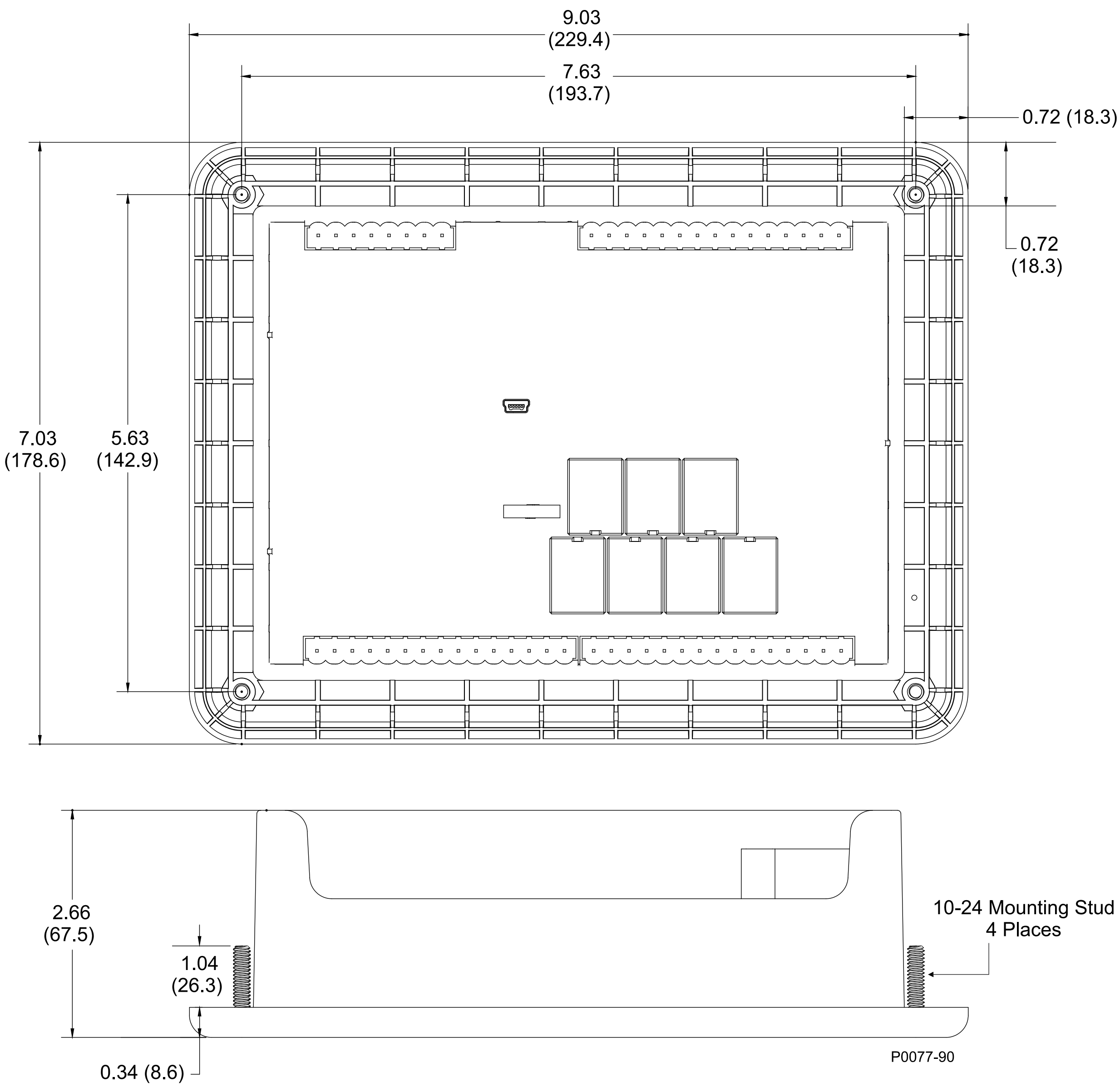


Figure 2-2. Overall Dimensions

3 • Terminals and Connectors

All DGC-2020ES terminals and connectors are located on the rear panel. DGC-2020ES terminals consist of a mini-B USB socket and plug-in connectors with spring clamp terminals.

Figure 3-1 illustrates the rear panel terminals. Locator letters in the illustration correspond to the terminal block and connector descriptions in Table 3-1.

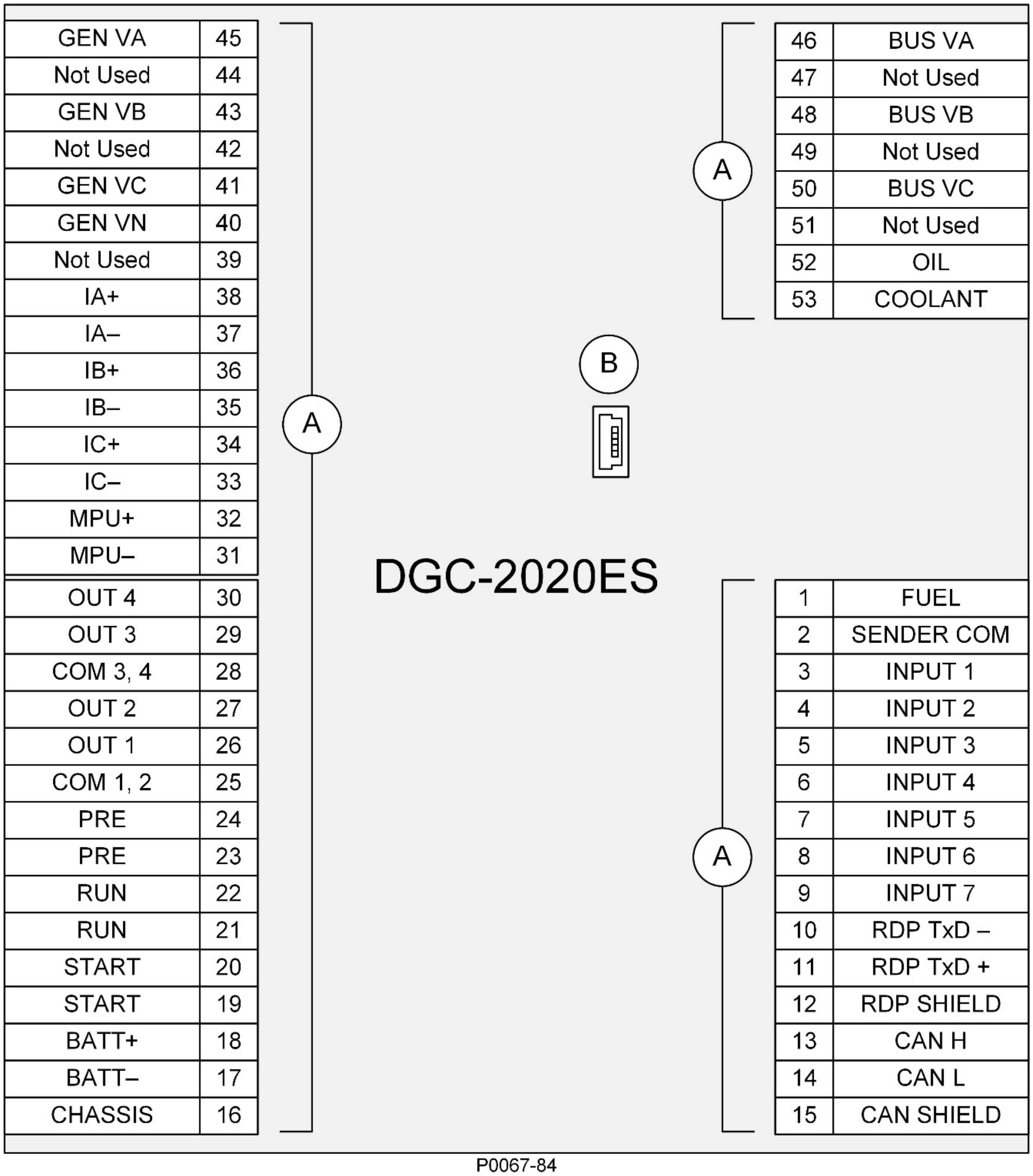


Figure 3-1. Rear Panel

Table 3-1. Rear Panel Terminal and Connector Descriptions

Locator	Description
A	The majority of external, DGC-2020ES wiring is terminated at 8- or 15-position connectors with spring clamp terminals. These connectors plug into headers on the DGC-2020ES. The connectors and headers have a dovetailed edge that ensures proper connector orientation. Each connector and header is uniquely keyed to ensure that a connector mates only with the correct header. Spring clamp terminals accept a maximum wire size of 12 AWG.
B	The mini-B USB socket mates with a standard USB cable and is used with a PC running BESTCOMS*Plus*® software for local communication with the DGC-2020ES.

Note

Be sure that the DGC-2020ES is hard-wired to earth ground with no smaller than 12 AWG copper wire attached to the chassis ground terminal (terminal 16) on the rear of the controller.

Operating power from the battery must be of the correct polarity. Although reverse polarity will not cause damage, the DGC-2020ES will not operate.

For the DGC-2020ES to correctly meter power factor, the generator must be rotating clockwise (A-B-C).

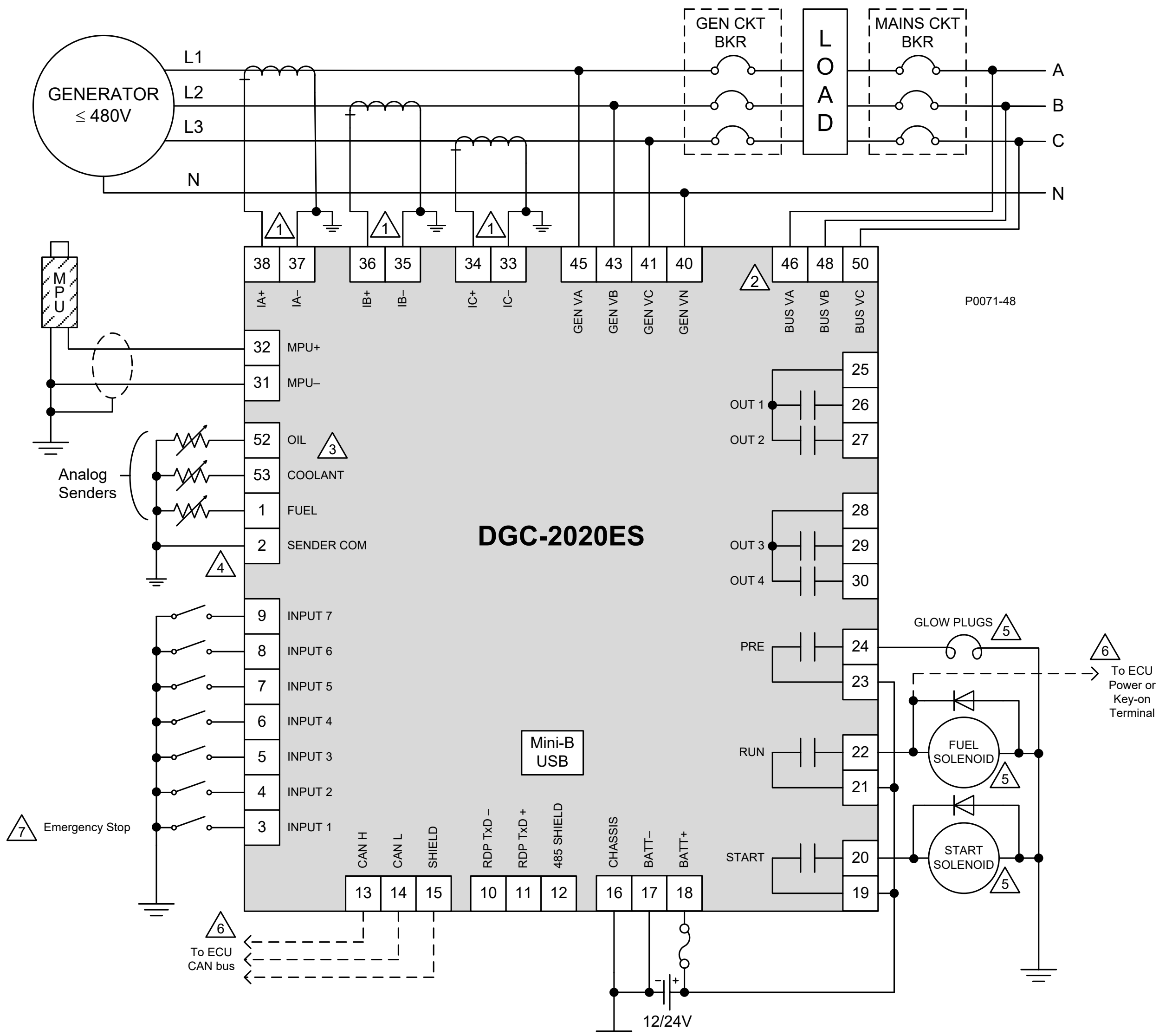
4 • Typical Connections

Typical connection diagrams are provided in this chapter as a guide when wiring the DGC-2020ES for communication, mechanical senders, contact inputs and outputs, sensing, and control power.

Connections for Typical Applications

Typical connections for applications using three-phase wye, three-phase delta, single-phase AB, and single-phase AC generator voltage sensing are shown on the following pages.

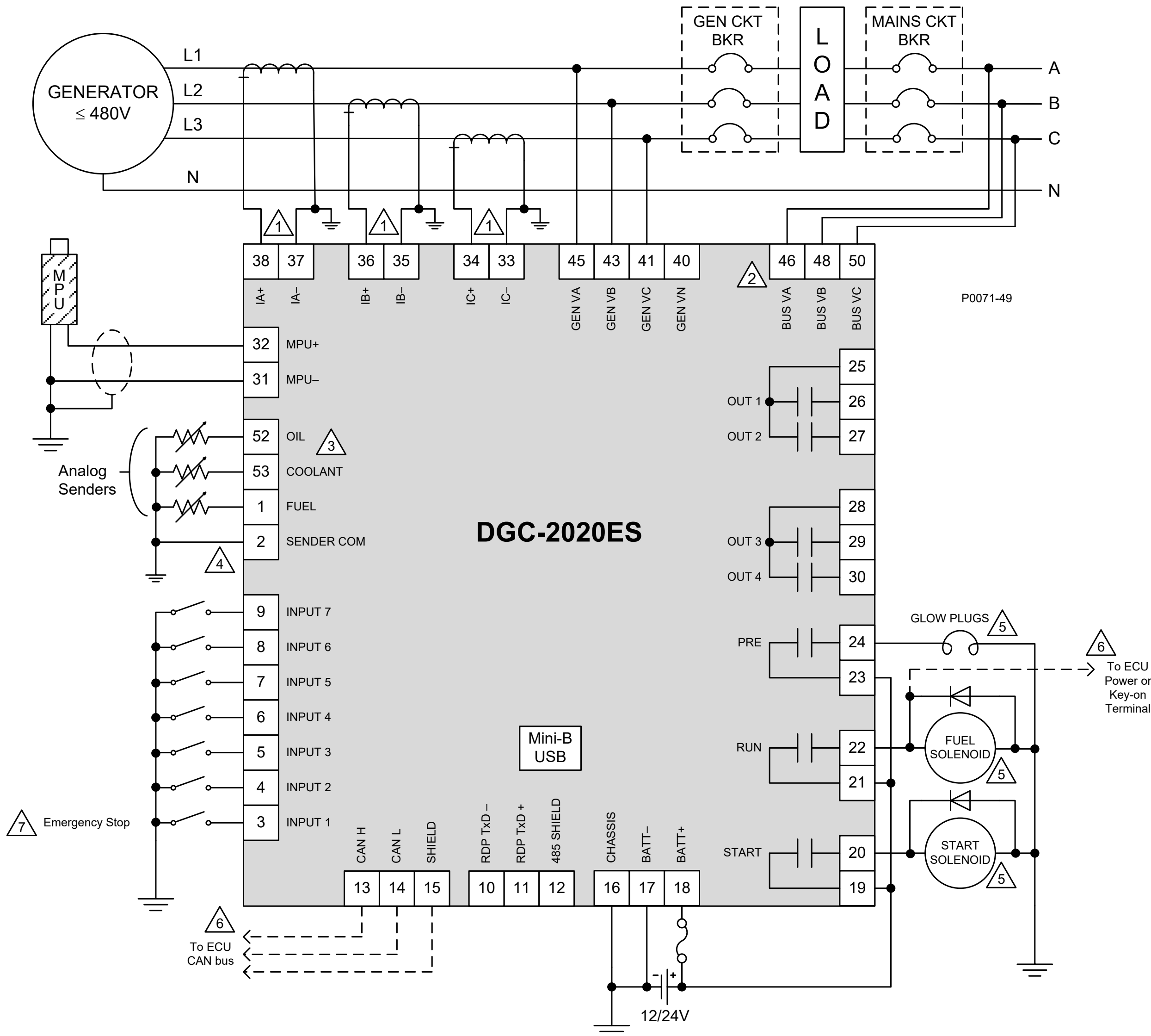
Figure 4-1 illustrates typical three-phase wye generator voltage sensing connections.



1. Current inputs are 1A or 5A, depending on style.
2. Bus sensing inputs are optional, depending on style.
3. Oil pressure and coolant temperature senders are *only* available when the DGC-2020ES has the Analog Senders option (style xAx). The fuel sender is always available.
4. Connect near engine block (negative battery terminal) side of senders.
5. If component is under ECU control, do not connect to DGC-2020ES.
6. Connect to the ECU on an electronically controlled engine when the DGC-2020ES has the J1939 CAN interface option (style xCx).
7. Labels indicate the functions assigned by the default programmable logic to the contact inputs.

Figure 4-1. Three-Phase Wye Connections for Typical Applications

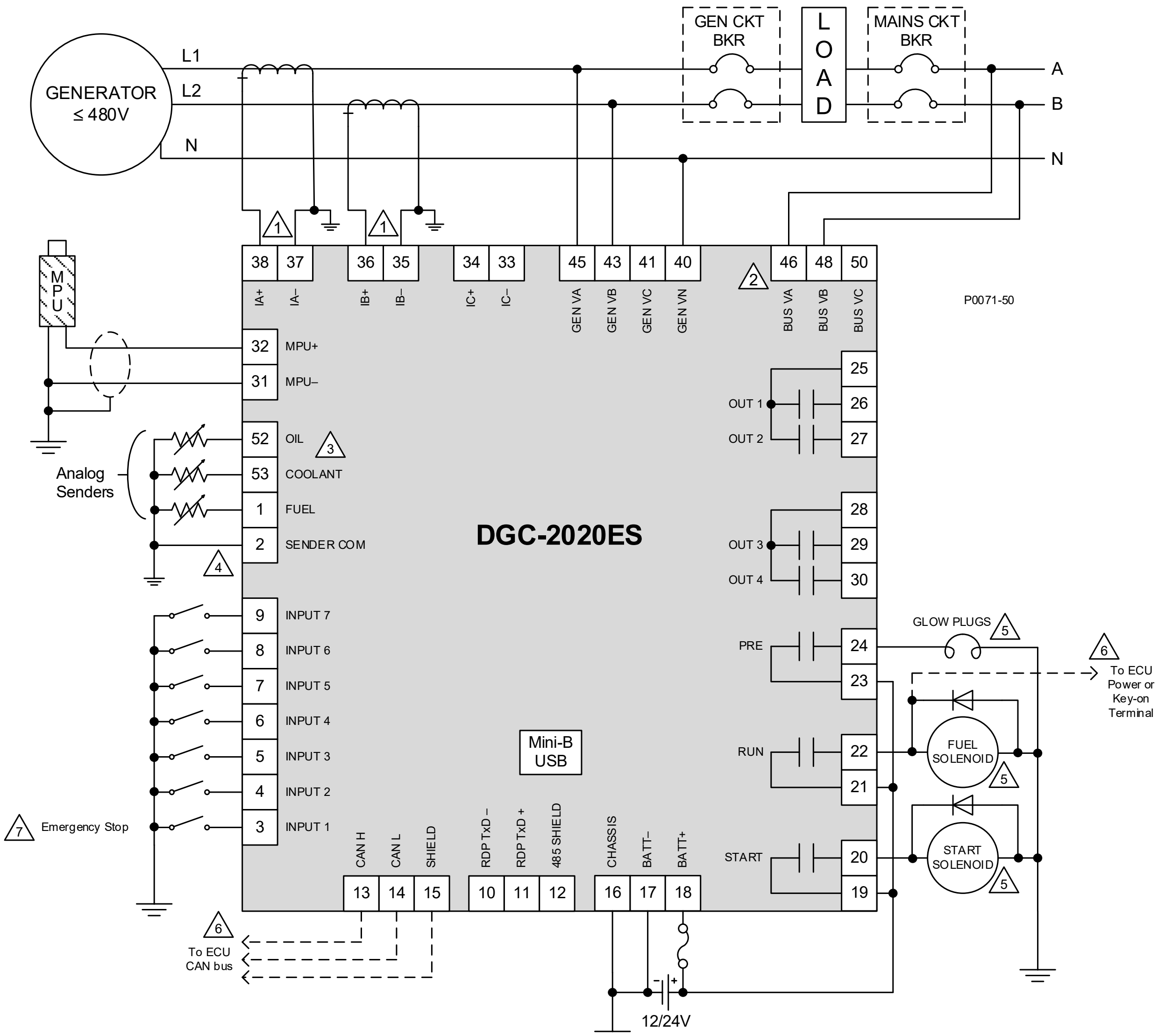
Figure 4-2 illustrates typical three-phase delta generator voltage sensing connections.



1. Current inputs are 1A or 5A, depending on style.
2. Bus sensing inputs are optional, depending on style.
3. Oil pressure and coolant temperature senders are *only* available when the DGC-2020ES has the Analog Senders option (style xAx). The fuel sender is always available.
4. Connect near engine block (negative battery terminal) side of senders.
5. If component is under ECU control, do not connect to DGC-2020ES.
6. Connect to the ECU on an electronically controlled engine when the DGC-2020ES has the J1939 CAN interface option (style xCx).
7. Labels indicate the functions assigned by the default programmable logic to the contact inputs.

Figure 4-2. Three-Phase Delta Connections for Typical Applications

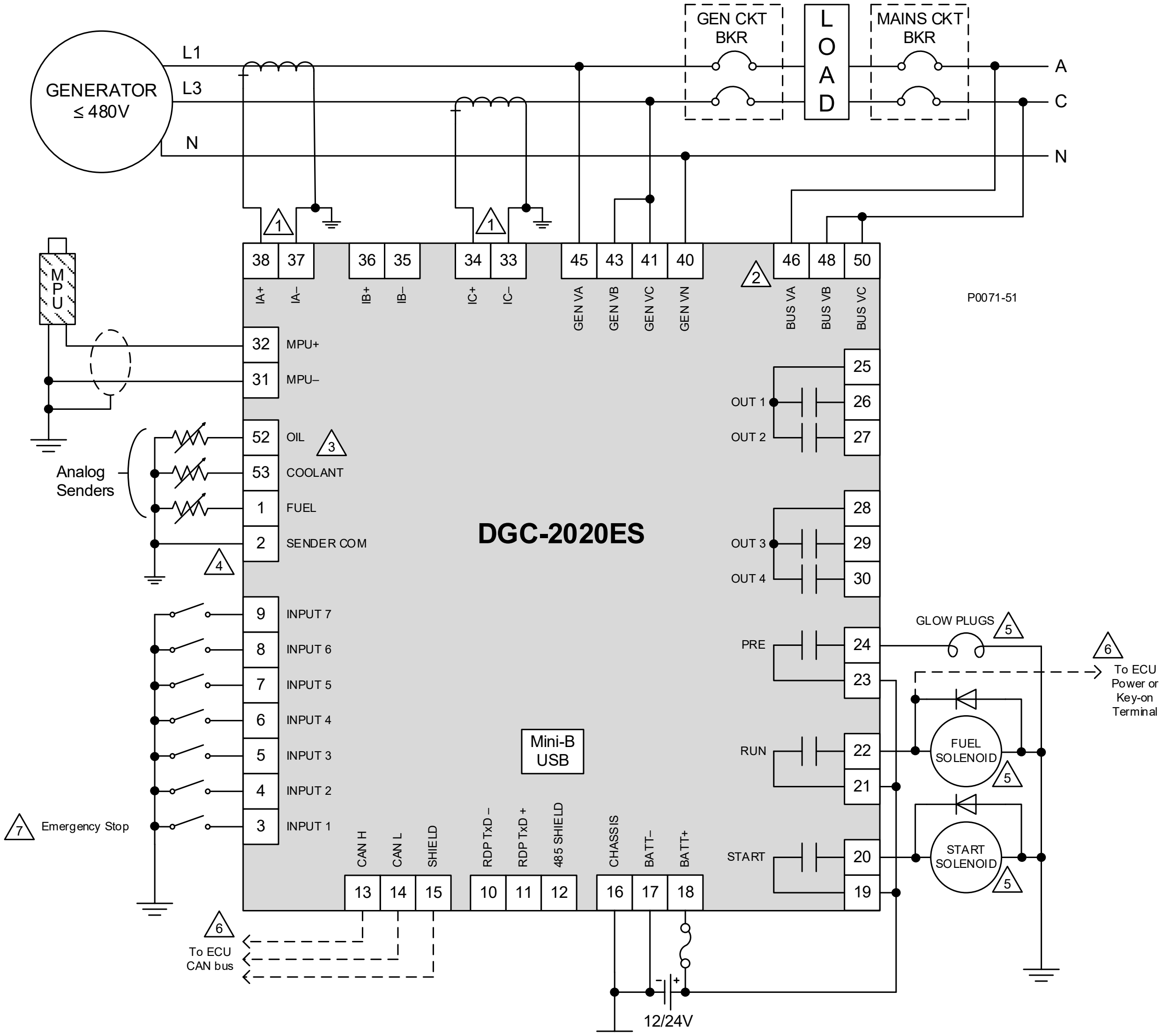
Figure 4-3 illustrates typical single-phase A-B generator voltage sensing connections.



1. Current inputs are 1A or 5A, depending on style.
2. Bus sensing inputs are optional, depending on style.
3. Oil pressure and coolant temperature senders are *only* available when the DGC-2020ES has the Analog Senders option (style xAx). The fuel sender is always available.
4. Connect near engine block (negative battery terminal) side of senders.
5. If component is under ECU control, do not connect to DGC-2020ES.
6. Connect to the ECU on an electronically controlled engine when the DGC-2020ES has the J1939 CAN interface option (style xCx).
7. Labels indicate the functions assigned by the default programmable logic to the contact inputs.

Figure 4-3. Single-Phase A-B Connections for Typical Applications

Figure 4-4 illustrates typical single-phase A-C generator voltage sensing connections.



1. Current inputs are 1A or 5A, depending on style.
2. Bus sensing inputs are optional, depending on style.
3. Oil pressure and coolant temperature senders are *only* available when the DGC-2020ES has the Analog Senders option (style xAx). The fuel sender is always available.
4. Connect near engine block (negative battery terminal) side of senders.
5. If component is under ECU control, do not connect to DGC-2020ES.
6. Connect to the ECU on an electronically controlled engine when the DGC-2020ES has the J1939 CAN interface option (style xCx).
7. Labels indicate the functions assigned by the default programmable logic to the contact inputs.

Figure 4-4. Single-Phase A-C Connections for Typical Applications

CAN Connections

Typical CAN connections are shown in Figure 4-5 and Figure 4-6.

Note

1. If the DGC-2020ES is providing one end of the J1939 bus, a 120 ohm, ½ watt terminating resistor should be installed across terminals 14 (CANL) and 13 (CANH).
2. If the DGC-2020ES is not providing one end of the J1939 bus, the stub connecting the DGC-2020ES to the bus should not exceed 914 mm (3 ft) in length.
3. The maximum bus length, not including stubs, is 40 m (131 ft).
4. The J1939 drain (shield) should be grounded at one point only. If grounded elsewhere, do not connect the drain to the DGC-2020ES.

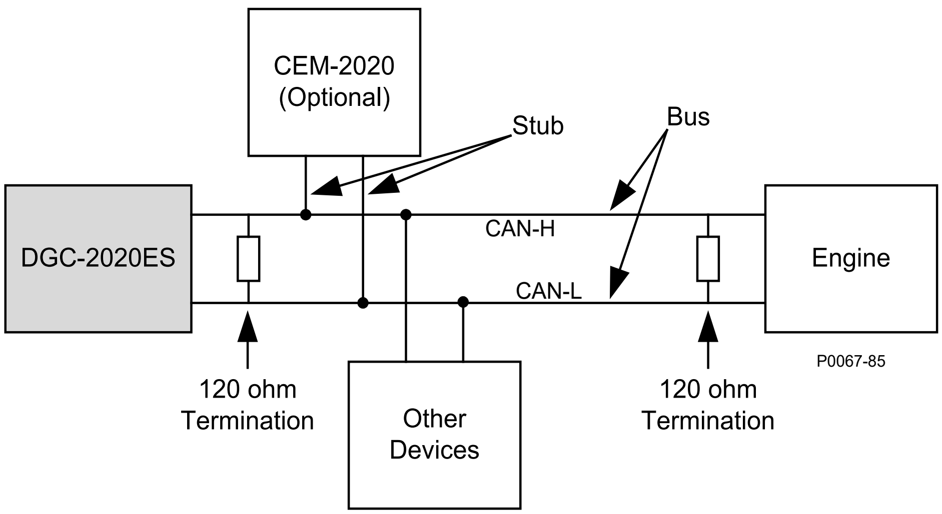


Figure 4-5. CAN Interface with DGC-2020ES Providing One End of the Bus

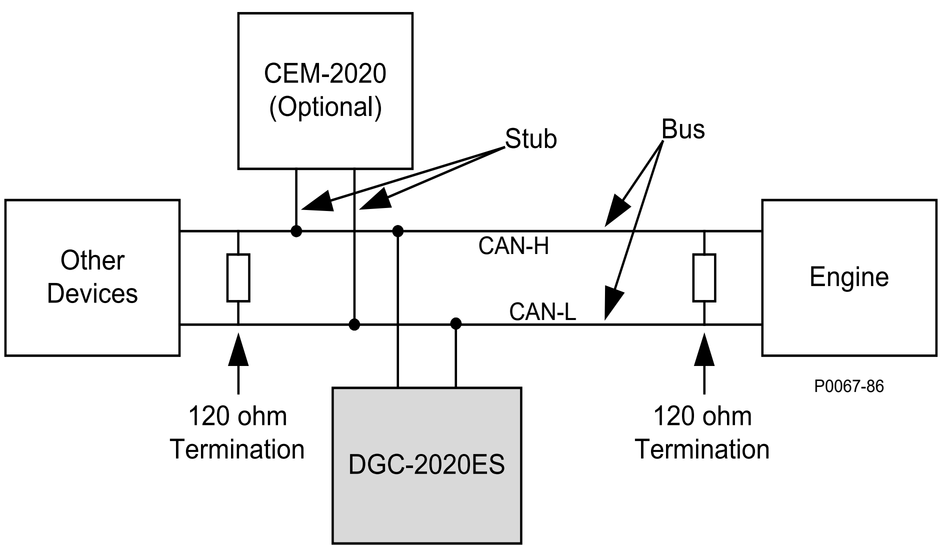


Figure 4-6. CAN Interface with Other Devices

CEM-2020 Connections

The CEM-2020 (Contact Expansion Module) is an optional module that may be installed with the DGC-2020ES. It is a remote auxiliary device that provides additional contact inputs and outputs for the DGC-2020ES. This module interfaces to the DGC-2020ES via CAN, thus the CAN terminals are the only common connections (Figure 4-7) between the DGC-2020ES and CEM-2020. Refer to the *CEM-2020* chapter for more information.

Refer to *Terminals and Connectors* for details on DGC-2020ES CAN connections.

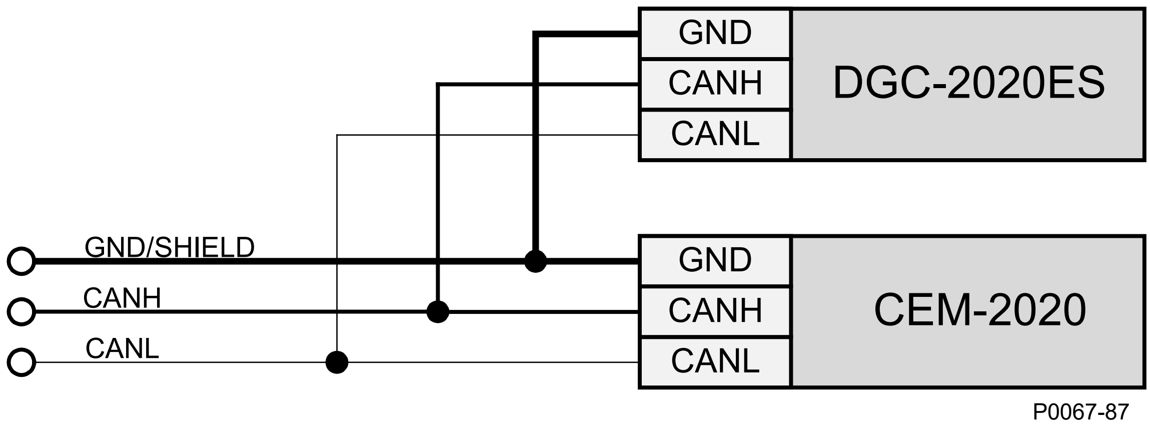


Figure 4-7. DGC-2020ES and CEM-2020 CAN Connections

Installation for CE Systems

For CE compliant systems, it may be required to route ac voltage and current sensing wires separately from other wires.

Installation in an Ungrounded System Application

When the DGC-2020ES is controlling equipment that is part of an ungrounded system, it is recommended that potential transformers be employed on the voltage sensing inputs to provide full isolation between the DGC-2020ES and monitored voltage phases.

5 • BESTCOMS*Plus*®

BESTCOMS*Plus* provides the user with a point-and-click means to set and monitor the DGC-2020ES. BESTCOMS*Plus* uses plugins, allowing the user to manage several different Basler Electric products. The DGC-2020ES plugin must be activated before use. The plugin can be activated automatically by connecting to a DGC-2020ES, or manually by requesting an activation key from Basler Electric.

Figure 5-1 illustrates the typical user interface components of the DGC-2020ES plugin with BESTCOMS*Plus*.

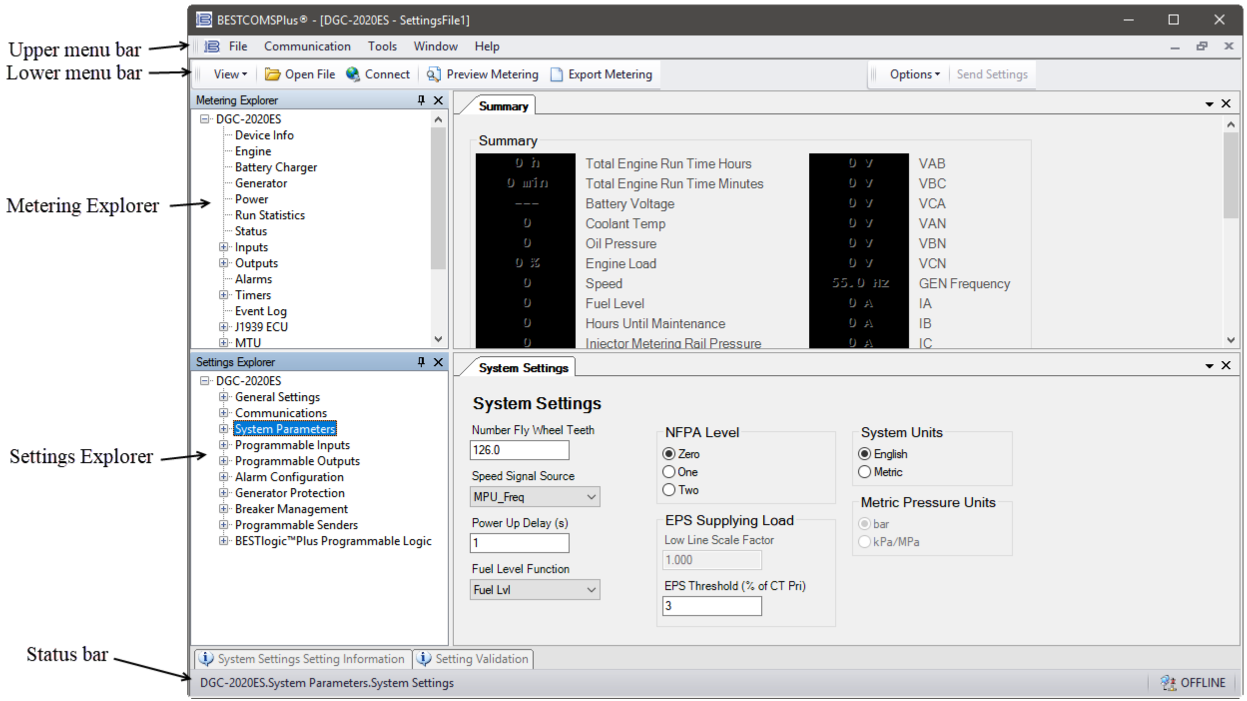


Figure 5-1. Typical User Interface Components

Installation

Note
Do not connect a USB cable until setup completes successfully. Connecting a USB cable before setup is complete may result in errors.

Download BESTCOMS*Plus*

DGC-2020ES controllers are delivered with a CD-ROM that contains BESTCOMS*Plus* software and instruction manuals. If a CD-ROM is not available, use the following procedure to download BESTCOMS*Plus* from the Basler Electric website.

1. Navigate to https://www.basler.com/Downloads.
2. Select DGC-2020ES from the model drop down menu.
3. Under the Software heading, click the download link for BESTCOMS*Plus*.
4. Sign in or create an account to continue with the download.

Install BESTCOMS*Plus* from CD

When BESTCOMS*Plus* installation is complete, a Basler Electric folder is added to the Windows programs menu. This folder is accessed by clicking the Windows *Start* button and then accessing the Basler Electric folder in the *Programs* menu. The Basler Electric folder contains an icon that starts BESTCOMS*Plus* when clicked.

Activation of the DGC-2020ES Plugin

The DGC-2020ES plugin is a module that runs inside the BESTCOMS*Plus* shell. The DGC-2020ES plugin contains specific operational and logic settings for only the DGC-2020ES. Uploading settings to the DGC-2020ES is possible only after activating the DGC-2020ES plugin.

The DGC-2020ES plugin can be activated automatically or manually. Automatic activation is achieved by using a USB cable to establish communication between the DGC-2020ES and BESTCOMS*Plus*. Manual activation is initiated by contacting Basler Electric for an activation key and entering the key into BESTCOMS*Plus*. Manual activation is useful if you want to create a settings file prior to receiving your DGC-2020ES. Refer to *Manual Activation of DGC-2020ES Plugin.*

Connect a USB Cable

The USB driver was copied to your PC during BESTCOMS*Plus* installation and is installed automatically after powering the DGC-2020ES. USB driver installation progress is shown in the Windows taskbar area. Windows will notify you when installation is complete.

Connect a USB cable between the PC and your DGC-2020ES. Apply control power to the DGC-2020ES. Wait until the boot sequence is complete.

Start BESTCOMS*Plus*® and Activate the DGC-2020ES Plugin Automatically

To start BESTCOMS*Plus*, click the Windows *Start* button, point to *Programs*, *Basler Electric*, and then click the *BESTCOMSPlus* icon. During initial startup, the *BESTCOMSPlus Select Language* screen is displayed (Figure 5-2). You can choose to have this screen displayed each time BESTCOMS*Plus* is started, or you can select a preferred language and this screen will be bypassed in the future. Click *OK* to continue. This screen can be accessed later by selecting *Tools* and *Select Language* from the menu bar.

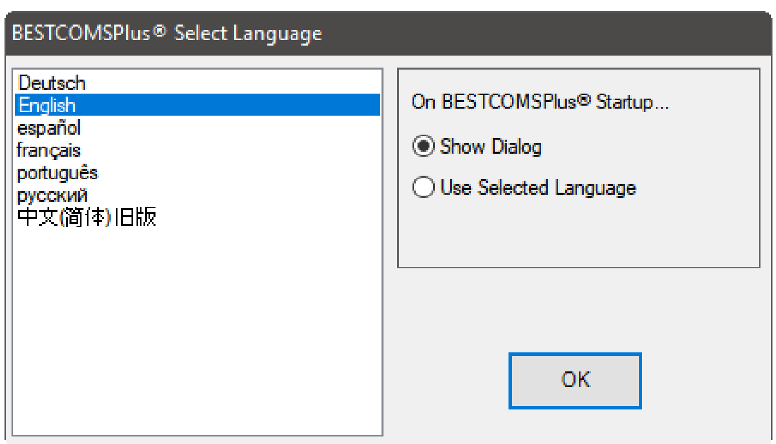


Figure 5-2. BESTCOMS*Plus* Language Selection Dialog

The BESTCOMS*Plus* platform window opens. Select *New Connection* from the *Communication* pull-down menu and select *DGC-2020ES*. See Figure 5-3. The DGC-2020ES plugin is activated automatically after connecting to a DGC-2020ES.

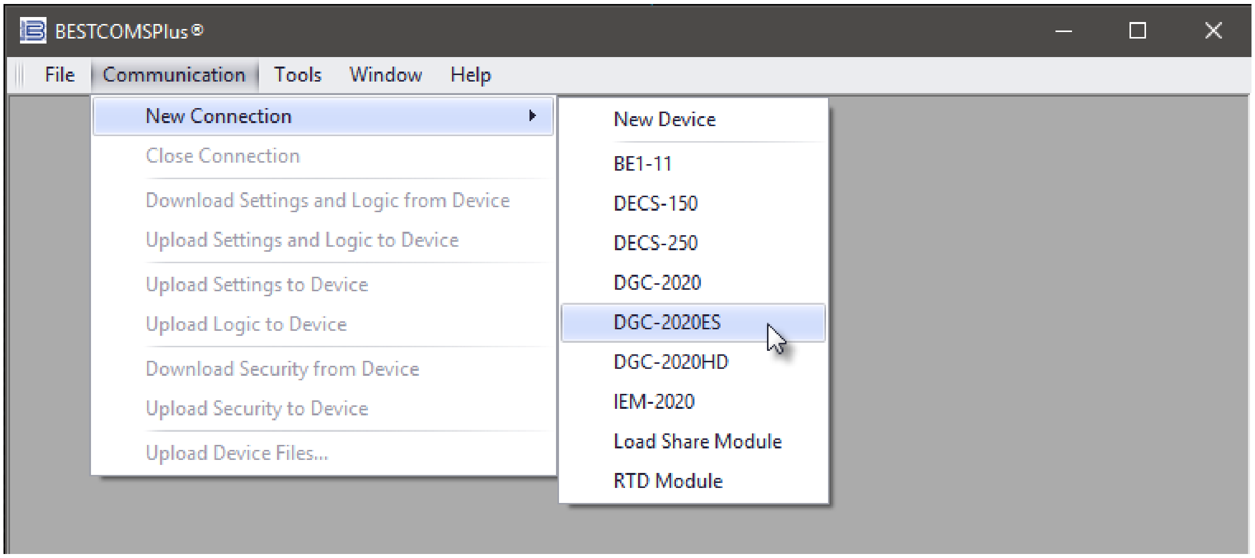


Figure 5-3. Communication Pull-Down Menu

The *DGC-2020ES Connection* screen, shown in Figure 5-4, appears.

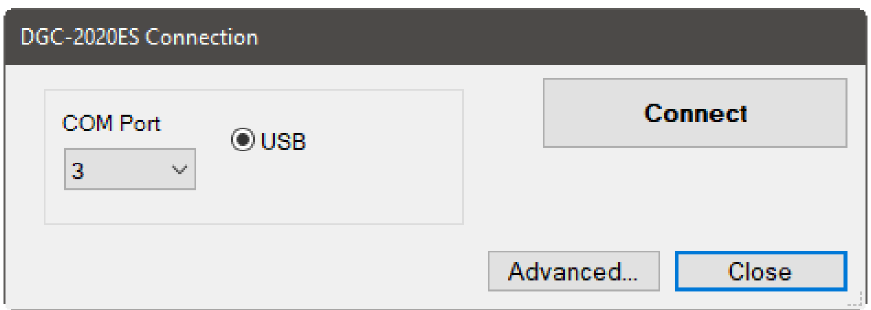


Figure 5-4. DGC-2020ES Connection Dialog

Select *COM Port.* The USB drivers are installed automatically during the BESTCOMS*Plus* installation process. To select the correct *COM Port,* open the Windows Device Manager and expand the *Ports (COM & LPT)* branch. Locate the device named *CP2101 USB to UART Bridge Controller (COMx).* The *COM Port* number will be displayed in parenthesis *(COMx).* Be sure control power is applied to the DGC-2020ES and the USB cable is connected before opening the Device Manager. See Figure 5-5.

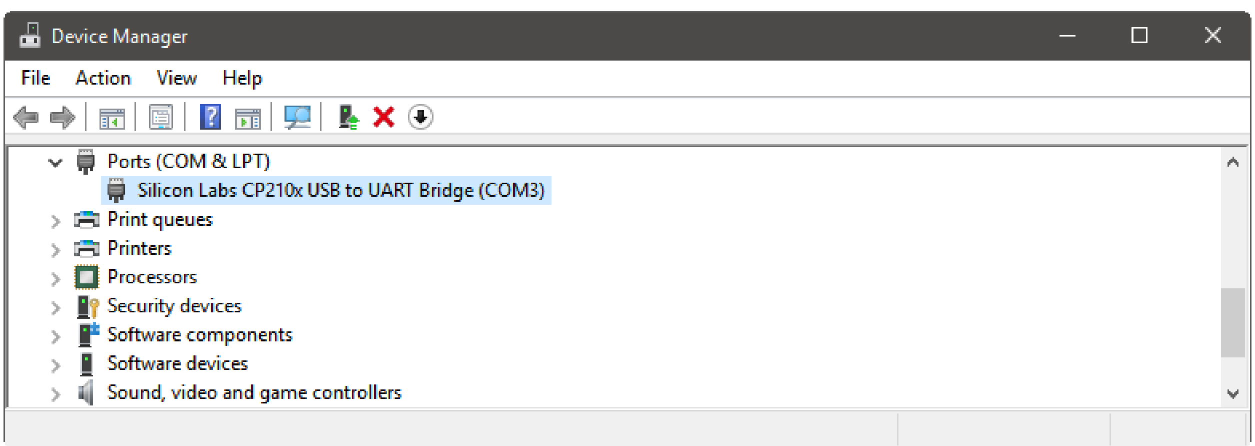


Figure 5-5. Device Manager

The DGC-2020ES plugin opens indicating that activation was successful. You can now configure the DGC-2020ES communication ports and other settings.

Installing the USB Driver if Automatic Installation Fails

To install the USB driver for the DGC-2020ES:

1. Apply control power to the DGC-2020ES and wait for the boot sequence to complete.
2. Connect a USB cable between the PC and DGC-2020ES.
3. The *Found New Hardware Wizard* dialog box appears.
4. Select "**No, not this time**" and select *Next* to continue.
5. Choose to "**Install from a list or specific location (Advanced)**" and select *Next* to continue.
6. Insert the CD-ROM labeled BESTCOMS*Plus* into the PC CD-ROM drive.
7. Navigate to C:\Program Files\Basler Electric\BESTCOMS*Plus*\USBDeviceDrivers\ and select *Next* to continue.

When installation of the driver is complete, you may be asked to restart your computer.

Manual Activation of the DGC-2020ES Plugin

Manual activation of the DGC-2020ES plugin is required only if your initial use of BESTCOMS*Plus* will be on a PC that is not connected to a DGC-2020ES. Manual activation is described in the following paragraphs.

Requesting an Activation Key

When initially running the DGC-2020ES plugin, the *Activate Device Plugin* pop-up appears. You must contact Basler Electric for an activation key before you can activate the DGC-2020ES plugin. You can request an activation key through email or the Basler Electric website. Click either the *Website* or *Email* button. Click the *Activate* button when you are ready to enter the activation key you received from Basler Electric. The *Activate Device Plugin* pop-up appears. Refer to Figure 5-6.

Entering an Activation Key

Select DGC-2020ES from the *Device* pull-down menu. Enter your *Email Address* and *Activation Key* provided by Basler Electric. If you received an email containing the *Activation Key*, you can select all of the text in the email and copy it to the Windows clipboard using normal Windows techniques. The *Get Data* button will extract the *Device, Email Address,* and *Activation Key* from the Windows clipboard and paste it into the appropriate fields. Click the *Activate* button to continue. The *Activate Device Plugin* screen is also found by selecting *Activate Device* from the *Tools* pull-down menu of the BESTCOMS*Plus* main screen.

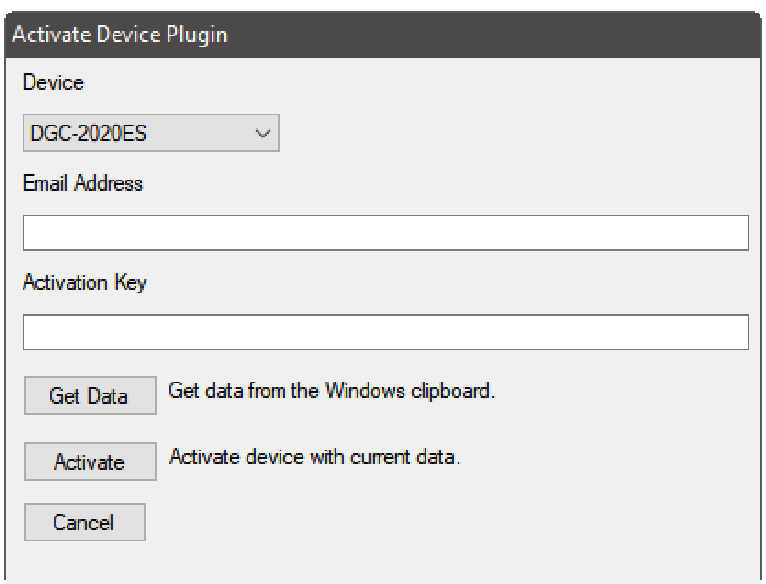


Figure 5-6. Activate Device Plugin

Establishing Communication

Communication between BESTCOMS*Plus* and the DGC-2020ES is established by clicking on the Connect button on the DGC-2020ES Connection screen (see Figure 5-4) or by clicking on the Connect button on the lower menu bar of the main BESTCOMS*Plus* screen (Figure 5-1). Download all settings and logic from the DGC-2020ES by selecting Download Settings and Logic from the Communication pull-down menu. BESTCOMS*Plus* will read all settings and logic from the DGC-2020ES and load them into BESTCOMS*Plus* memory. See Figure 5-7.

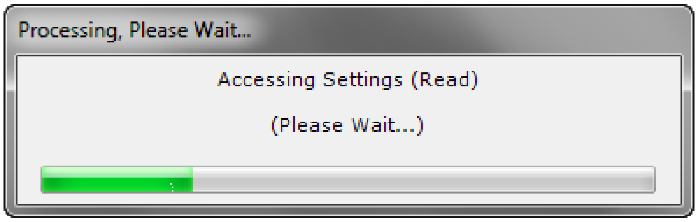


Figure 5-7. Processing, Please Wait…

Advanced Properties

Click the Advanced button on the Connection screen to display the Advanced Properties dialog. Default settings are shown in Figure 5-8.

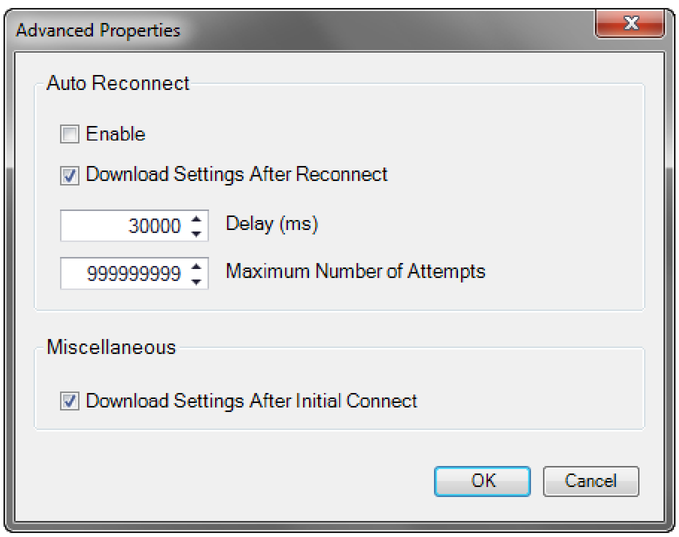


Figure 5-8. Advanced Properties Dialog

6 • Configuration

The DGC-2020ES must be properly configured for operation with a specific application prior to running. An incomplete list of basic settings to consider when configuring the DGC-2020ES is provided below with their locations in BESTCOMS*Plus* and the front panel. Ensure that all settings required for your application are configured in accordance with the generator/engine manufacturer(s) recommendations, authority having jurisdiction, and customer requirements. For detailed information on all settings, refer to the *Configuration* manual.

Basic Settings

For front panel interface components, refer to the *Controls and Indicators* chapter. For BESTCOMS*Plus* interface components, refer to the *BESTCOMSPlus Software* chapter.

System Settings

BESTCOMS*Plus* Navigation Path: Settings Explorer, System Parameters, System Settings
Front Panel Navigation Path: Settings > System Parameters > System Settings

CAN Bus Setup

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Communications, CAN Bus, CAN Bus Setup
Front Panel Navigation Path: Settings > Communication > CAN Bus 1 (I/O) Setup and CAN Bus 2 (ECU) Setup

ECU Setup

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Communications, CAN Bus, ECU Setup
Front Panel Navigation Path: Settings > Communication > CAN Bus 2 (ECU) Setup > ECU Setup

Rated Data

BESTCOMS*Plus* Navigation Paths:
Settings Explorer, System Parameters, Rated Data, Generator Rated Data
Front Panel Navigation Paths:
Settings > System Parameters > Rated Data, Gen

Remote Module Setup

BESTCOMS*Plus* Navigation Path: Settings Explorer, System Parameters, Remote Module Setup
Front Panel Navigation Path: Settings > System Settings > Remote Module Setup

Crank Settings

BESTCOMS*Plus* Navigation Path: Settings Explorer, System Parameters, Crank Settings
Front Panel Navigation Path: Settings > System Parameters > Crank Settings

Relay Control Settings

BESTCOMS*Plus* Navigation Path: Settings Explorer, System Parameters, Relay Control
Front Panel Navigation Path: Settings > System Parameters > Relay Control

Engine Sender Characteristic Curves Setup: Fuel, Temperature, and Oil

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Programmable Senders
Front Panel Navigation Path: Not available through the front panel

Contact Inputs

BESTCOMS*Plus* Navigation Path: Settings Explorer, Programmable Inputs, Contact Inputs
Front Panel Navigation Path: Settings > Programmable Inputs > Contact Inputs

Programmable Functions

BESTCOMS*Plus* Navigation Path: Settings Explorer, Programmable Inputs, Programmable Functions
Front Panel Navigation Path: Settings > Programmable Inputs > Programmable Functions

Programmable Output Configuration

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Programmable Outputs, Contact Outputs
Front Panel Navigation Path: Settings Explorer > Programmable Outputs > Contact Outputs

Configurable Elements

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Programmable Outputs, Configurable Elements
Front Panel Navigation Path: Settings Explorer > Programmable Outputs > Configurable Elements

Generator Breaker Settings

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Breaker Management, Breaker Hardware
Front Panel Navigation Path: Settings Explorer > Breaker Management > Breaker Hardware

Mains Breaker Settings

BESTCOMS*Plus*® Navigation Path: Settings Explorer, Breaker Management, Breaker Hardware
Front Panel Navigation Path: Settings Explorer > Breaker Management > Breaker Hardware

Generator Protection

BESTCOMS*Plus* Navigation Path: Settings Explorer, Generator Protection
Front Panel Navigation Path: Settings Explorer > Generator Protection

Saving Settings

Front Panel

When settings are configured through the front panel interface, they are automatically saved.

BESTCOMS*Plus*®

After the desired settings are configured in BESTCOMS*Plus*, the settings must be uploaded to a connected DGC-2020ES. Refer to the following procedure to upload settings via BESTCOMS*Plus*.

1. Ensure that communication between a PC running BESTCOMS*Plus* and the DGC-2020ES is established.
2. In the Upper Menu Bar, Click Communications > Upload Settings to Device
3. You are prompted to enter the password. The default password is “OEM”.
4. Press Enter or click Log In and the settings are uploaded to the connected DGC-2020ES.

7 • BESTlogic™*Plus*

BESTlogic*Plus* Programmable Logic is a programming method used for managing the input, output, protection, control, monitoring, and reporting capabilities of Basler Electric's DGC-2020ES Digital Genset Controller.

BESTlogic™Plus Composition

There are three main groups of objects used for programming BESTlogic*Plus*. These groups are *I/O, Components,* and *Elements.* For details on how these objects are used to program BESTlogic*Plus*, see the paragraphs on *Programming BESTlogicPlus,* later in this chapter.

Logic Schemes

A logic scheme is a group of logic variables written in equation form that defines the operation of a DGC-2020ES Digital Genset Controller. Each logic scheme is given a unique name. This gives you the ability to select a specific scheme and be confident that the selected scheme is in operation. One logic scheme is configured for typical control applications and is the default active logic scheme. Only one logic scheme can be active at a given time.

In most applications, preprogrammed logic schemes eliminate the need for custom programming. Preprogrammed logic schemes may provide more inputs, outputs, or features than are needed for a particular application. This is because a preprogrammed scheme is designed for a large number of applications with no special programming required. Unneeded logic block outputs may be left open to disable a function or a function block can be disabled through operating settings.

When a custom logic scheme is required, programming time is reduced by modifying the default logic scheme.

The Active Logic Scheme

Digital Genset Controllers must have an active logic scheme in order to function. All Basler Electric DGC-2020ES units are delivered with a default, active logic scheme pre-loaded in memory. If the function block configuration and output logic of the default logic scheme meets the requirements of your application, then only the operating settings (power system parameters and threshold settings) need to be adjusted before placing the DGC-2020ES in service.

Copying and Renaming Preprogrammed Logic Schemes

Copying a saved logic scheme to the active logic and assigning a unique name is accomplished by loading the saved logic scheme into BESTCOMS*Plus* and then typing over the logic scheme's name. Changes are not activated until the new settings have been saved and uploaded to the device.

Sending and Retrieving Logic Schemes

To retrieve settings from the DGC-2020ES, it must be connected to a computer through a communications port. Once the necessary connections are made, settings can be downloaded from the DGC-2020ES by selecting *Download Settings and Logic* on the *Communication* pull-down menu.

To send settings to the DGC-2020ES, it must be connected to a computer through a communications port. Once the necessary connections are made, settings can be uploaded to the DGC-2020ES by selecting *Upload Settings and Logic* on the *Communication* pull-down menu.

Caution

Always remove the DGC-2020ES from service prior to changing or modifying the active logic scheme. Attempting to modify a logic scheme while the DGC-2020ES is in service could generate unexpected or unwanted outputs.

Modifying a logic scheme in BESTCOMS*Plus* does not automatically make that scheme active in the DGC-2020ES. The modified scheme must be uploaded into the DGC-2020ES.

Programming BESTlogic™Plus

Use BESTCOMS*Plus* to program BESTlogic*Plus*. Using BESTCOMS*Plus* is analogous to physically attaching wire between discrete DGC-2020ES terminals. To program BESTlogic*Plus*, use the Settings Explorer within BESTCOMS*Plus* to open the *BESTlogicPlus Programmable Logic* tree branch as shown in Figure 7-1.

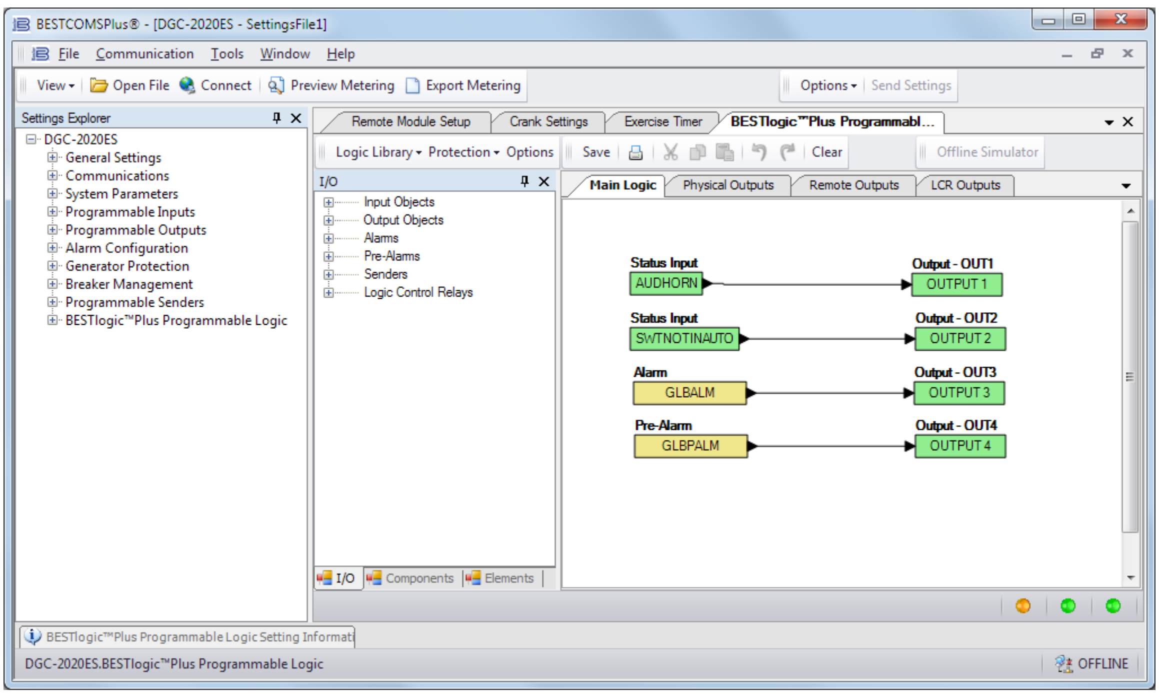


Figure 7-1. Settings Explorer, BESTlogic*Plus* Programmable Logic Screen

The drag and drop method is used to connect a variable or series of variables to the logic inputs, outputs, components, and elements. To draw a wire/link from port to port (triangles), click the left mouse button on a port, pull the wire onto another port, and release the left mouse button. A red port indicates that a connection to the port is required or missing. A black port indicates that a connection to the port is not required. Drawing wires/links from input to input or output to output is not allowed. Only one wire/link can be connected to any one output. If the proximity of the endpoint of the wire/link is not exact, it may attach to an unintended port.

If an object or element is disabled, it will have a yellow X on it. To enable the element, navigate to the settings page for that element. A red X indicates that an object or element is not available per the style number of the DGC-2020ES.

The view of the Main Logic, Physical Outputs, Remote Outputs, and LCR Outputs can be automatically arranged by clicking the right mouse button on the window and selecting *Auto-Layout.*

The following must be met before BESTCOMS*Plus* will allow logic to be uploaded to the DGC-2020ES:

- A minimum of two inputs and a maximum of four inputs on any multi-port (AND, OR, NAND, NOR, XOR, and XNOR) gate.
- A maximum of five logic levels for any particular path. A path being an input block or an output side of an element block through gates to an output block or an input side of an element block. This is to include any OR gates on the Physical Output or Remote Output tab/pages, but not the matched pairs of Physical Output blocks or Remote Output blocks.
- Only 20 gates per logic level. All output blocks and input sides of element blocks are at the maximum logic level of the diagram. All gates are pushed forward/upwards in logic levels and buffered to reach the final output block or element block if needed. A maximum of 50 gates allowed per diagram.
- At all levels there can only be 64 used link/wired or endpoints. Endpoints being inputs, outputs, both sides of element blocks.

Three status indicators are located in the lower right corner of the BESTlogic*Plus* window. These indicators show the *Logic Save Status*, *Logic Diagram Status*, and *Logic Layer Status*. Table 7-1 defines the colors for each indicator.

Table 7-1. Status Indicators

Indicator	Color	Definition
Logic Save Status (Left Indicator)	Amber	Logic has changed since last save.
	Green	Logic has NOT changed since last save.
Logic Diagram Status (Center Indicator)	Red	Requirements NOT met as listed above.
	Green	Requirements met as listed above.
Logic Layer Status (Right Indicator)	Red	Requirements NOT met as listed above.
	Green	Requirements met as listed above.

Offline Logic Simulator

The offline logic simulator allows you to change the state of various logic elements to illustrate how that state travels through the system. Before running the logic simulator, you must click the Save button on the BESTlogic*Plus* toolbar to save the logic to memory. Changes to the logic (other than changing the state) are disabled when the simulator is enabled. Colors are selected by clicking the Options button on the BESTlogic*Plus* toolbar. By default, Logic 0 is red and Logic 1 is green. Using your mouse, double-click on a logic element to change its state.

An example of the offline logic simulator is shown in Figure 7-2. Output 1 is Logic 0 (red) when Virtual Switch 1 is Logic 0 (red) and Fixed 1 is Logic 1 (green).

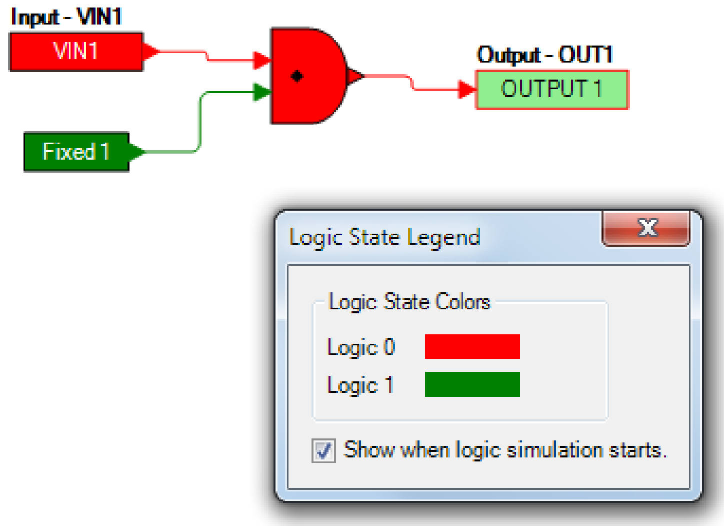


Figure 7-2. Offline Logic Simulator Example

BESTlogic™Plus Examples

Example 1 - GENBRK Logic Block Connections

Figure 7-3 illustrates the GENBRK logic block, three input logic blocks, and two output logic blocks. Output 3 is active while the GENBRK is sending an “open breaker” command and Output 4 is active while the GENBRK is sending the “close breaker” command.

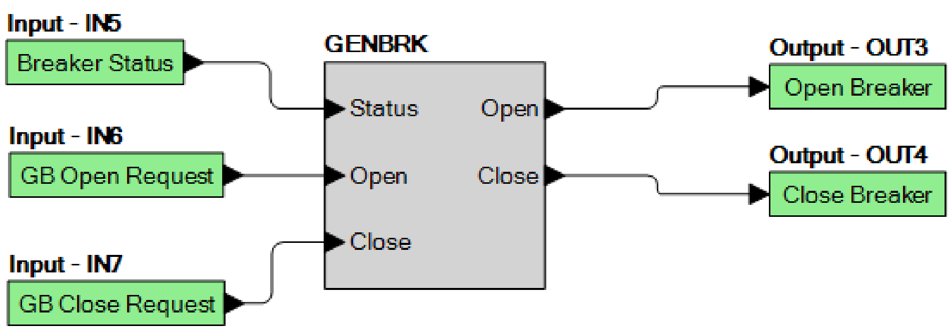


Figure 7-3. Example 1 – GENBRK Logic Block Connections

Example 2 - AND Gate Connections

Figure 7-4 illustrates a typical AND gate connection. In this example, Output 11 will become active when the Low Fuel alarm AND the Low Oil Pressure alarm are true.

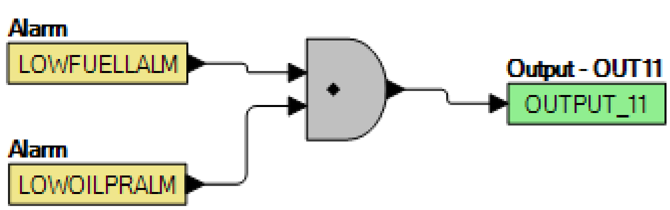


Figure 7-4. Example 2 – AND Gate Connections

Example 3 - Multiple Logic Connections

In this example, there are two comment boxes, which may be placed on the logic diagram. Double-click a comment box to modify the inside text. Output 3 becomes true when the 27TRIP is true. Output 1 becomes true when the High Coolant Temp is true. Output 2 becomes true when the DGC-2020ES is in RUN mode (RUN Mode true). Refer to Figure 7-5.

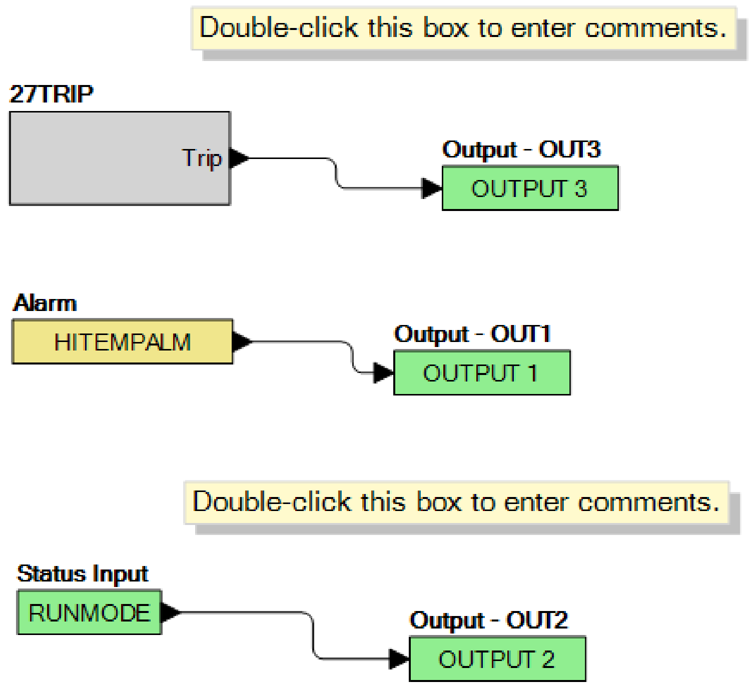


Figure 7-5. Example 3 – Multiple Logic Connections

8 • Controls and Indicators

DGC-2020ES controls and indicators are illustrated in Figure 8-1. Lettered locators in Figure 8-1 correspond to the control and indicator descriptions of Table 8-1.

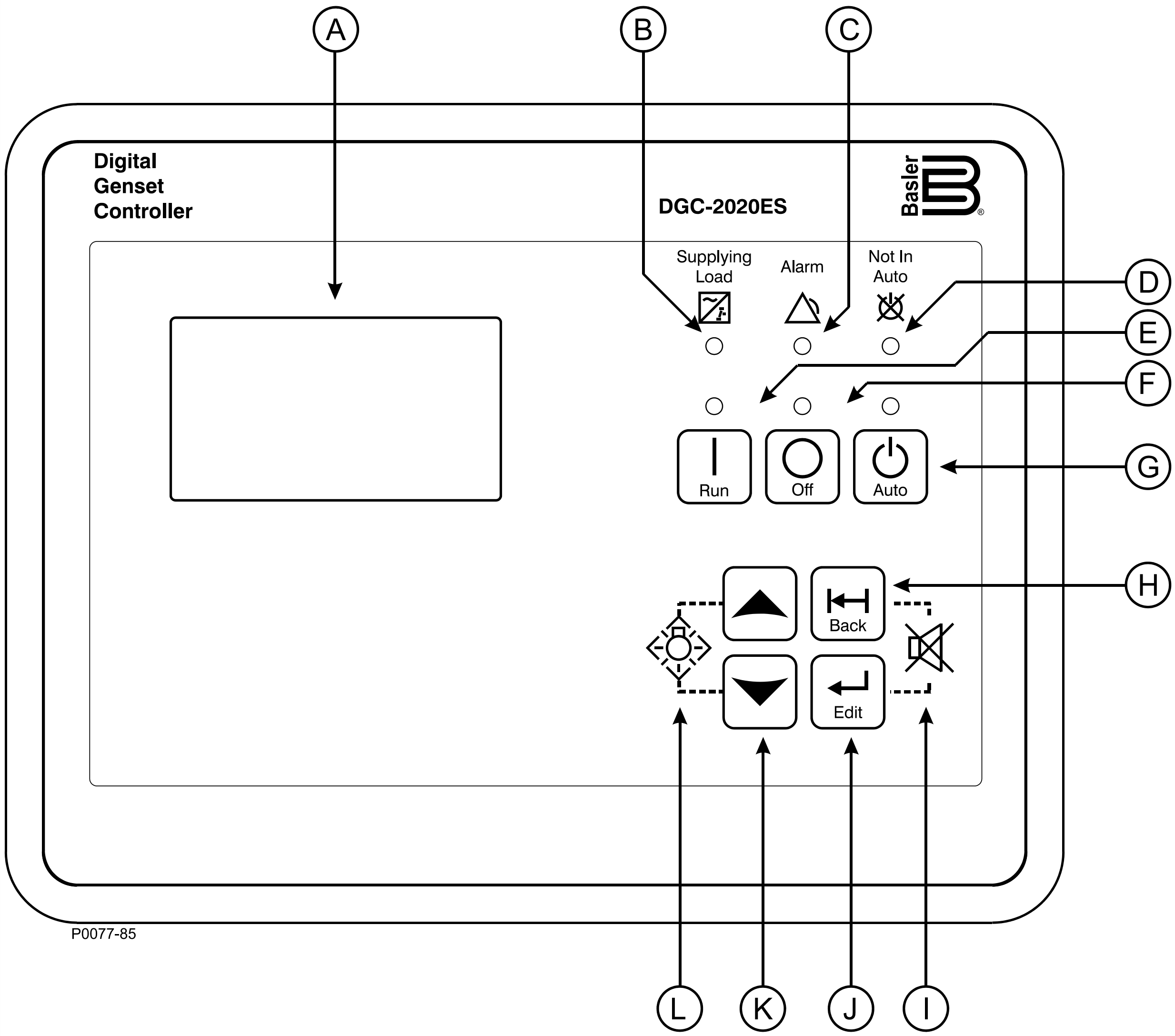


Figure 8-1. Front Panel

Table 8-1. Front-Panel HMI Descriptions

Locator	Description
A	*Liquid Crystal Display.* The backlit, 64 by 128 pixel LCD serves as the local information source for metering, alarms, pre-alarms, and protective functions. Display operation is maintained at –40°C.
B	*Supplying Load Indicator.* This green LED lights when the generator current is greater than Emergency Power Supply (EPS) threshold current.
C	*Alarm Indicator.* This red LED lights continuously during alarm conditions and flashes during pre-alarm conditions.
D	*Not in Auto Indicator.* This red LED lights when the DGC-2020ES is not operating in Auto mode. When the DGC-2020ES is operating in Run or Off mode, this LED is on.

E	*Run Pushbutton and Mode Indicator.* Pressing this button places the DGC-2020ES in Run mode. The green Run mode LED lights when Run mode is active.
F	*Off Pushbutton and Mode Indicator.* Pressing this button places the DGC-2020ES in Off mode. The red Off mode LED lights when the DGC-2020ES is in Off mode. This button also resets the Breaker Management Pre-Alarms and all MTU ECU Alarms.
G	*Auto Pushbutton and Mode Indicator.* Pressing the Auto button places the DGC-2020ES in Auto mode. The green Auto mode LED lights when Auto mode is active.
H	*Back Pushbutton.* This button is pressed to cancel a settings editing session and discard any settings changes. When navigating through menus, pressing this button moves upward a level. When pressed momentarily, this button also resets the Breaker Management Pre-Alarms and all MTU ECU Alarms. This button is also used to reset the Maintenance Interval when pressed for 10 seconds while viewing Hours Until Maintenance or Maintenance Due Pre-Alarm.
I	*Alarm Silence Pushbutton Combination*. Simultaneously pressing both the *Back* and *Edit* buttons opens the relay output programmed as the horn output.
J	*Edit Pushbutton.* Pressing this button starts an editing session and enables changes to DGC-2020ES settings. At the conclusion of an editing session, the Edit pushbutton is pressed again to save the setting changes. When navigating through menus, pressing this button moves downward one level. When entering a string, such as a password, this button locks the selected character and moves to the next position. When finished, press Edit twice to submit the string.
K	*Arrow Pushbuttons.* These two buttons are used to navigate through the front-panel display menus and modify settings. Within a level, the up- and down-arrow buttons are used to move among items within the menu level. Pressing the down-arrow button moves to items lower in the list. Pressing the up-arrow button moves to items higher in the list. During a settings editing session, the up- and down-arrow buttons are used to raise and lower the value of the selected setting.
L	*Lamp Test Pushbutton Combination*. Simultaneously pressing both the Up- and Down-arrow buttons tests the DGC-2020ES indicators by exercising all LCD pixels and lighting all LEDs for as long as both buttons are held.

9 • Troubleshooting

If you do not get the results that you expect from the DGC-2020ES, first check the programmable settings for the appropriate function. Use the following troubleshooting procedures when difficulties are encountered in the operation of your genset control system.

Communications

USB Port Does Not Operate Properly

Step 1. Verify that the proper port of your computer is being used. For more information, refer to the *Communication* chapter in the *Configuration* manual.

CAN Communication Does Not Operate Properly

Step 1: Verify that there is a 120-ohm termination resistor on each end of the bus section of the wiring, and that there are not any termination resistors at any node connections that are on stubs from the main bus.

Step 2: Check all CAN wiring for loose connections and verify that the CAN H and CAN L wires have not gotten switched somewhere on the network.

Step 3: Verify that the cable length of the bus section of the wiring does not exceed 40 meters (131 feet), and verify that any stubs from the main bus do not exceed 3 meters (9.8 feet) in length.

Step 4: If the engine is equipped with a Volvo or MTU ECU, verify that the ECU Configuration setting is set to match the actual ECU configuration.

Inputs and Outputs

Programmable Inputs Do Not Operate as Expected

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Confirm that the inputs are programmed properly.

Step 3. Ensure that the input at the DGC-2020ES is actually connected to the BATT– terminal (17).

Programmable Outputs Do Not Operate as Expected

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Confirm that the outputs are programmed properly.

Metering/Display

Incorrect Display of Battery Voltage, Coolant Temperature, Oil Pressure, or Fuel Level

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Confirm that the SENDER COM terminal (2) is connected to the negative battery terminal and the engine-block side of the senders. Current from other devices sharing this connection can cause erroneous readings.

Step 3. If the displayed battery voltage is incorrect, ensure that the proper voltage is present between the BATT+ terminal (18) and the SENDER COM terminal (2).

Step 4. Verify that the correct senders are being used.

Step 5. Use a voltmeter connected between the BATT– terminal (17) and the SENDER COM terminal (2) on the DGC-2020ES to verify that there is no voltage difference at any time. Any voltage differences may manifest themselves as erratic sender readings. Wiring should be corrected so that no differences exist.

Step 6: Check the sender wiring and isolate sender wiring from any of the ac wiring in the system. The sender wiring should be located away from any power ac wiring from the generator and any ignition wiring. Separate conduits should be used for sender wiring and any ac wiring.

Incorrect Display of Generator Voltage

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Ensure that the proper voltage is present at the DGC-2020ES voltage sensing inputs (40, 41, 43, and 45).

Step 3. Verify that the voltage transformer ratio and sensing configuration is correct.

Step 4. Confirm that the voltage sensing transformers are correct and properly installed.

Incorrect Measurement or Display of Generator Current

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Ensure that the proper current is present at the DGC-2020ES current sensing inputs 33, 34, 35, 36, 37, and 38.

Step 3. Verify that the current sensing transformer ratios are correct.

Step 4. Confirm that the current sensing transformers are correct and properly installed.

Incorrect Display of Engine RPM

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Verify that the flywheel teeth setting is correct.

Step 3. Verify that the prime mover governor is operating properly.

Step 4. Verify that the measured frequency of the voltage at the MPU input (31 and 32) is correct.

Step 5. If the MPU is shared with the governor, verify that the polarity of the MPU input to the governor matches the polarity of the MPU input to the DGC-2020ES.

DGC-2020ES Indicates Incorrect Power Factor

Check the rotation of the machine and the labeling of the A-B-C terminals. The machine must be rotating in the same phase sequence as dictated by the generator phase rotation setting for correct power factor metering. A power factor indication of 0.5 with resistive load present is a symptom of incorrect phase rotation.

LCD is Blank and all LEDs are Flashing at Approximately Two-Second Intervals

This indicates that the DGC-2020ES does not detect that valid application firmware is installed. The unit is running its boot loader program, waiting to accept a firmware upload.

Step 1. Start BESTCOMS*Plus*®. Use the top pull-down menu and select FILE > NEW > DGC-2020ES.

Step 2. Select COMMUNICATIONS > UPLOAD DEVICE FILES and select the device package file that contains the firmware and language you want to upload.

Step 3. Check the boxes for DGC-2020ES Firmware and DGC-2020ES Language Module. Click the UPLOAD button to start the upload process.

Ground Faults Detected in Ungrounded System Applications

Step 1: Verify that there is no connection from the neutral connection of the generator to the system ground.

Step 2: Perform insulation resistance tests on the system wiring to check for insulation integrity in the overall system.

Step 3: If ground faults are detected on a DGC-2020ES in an ungrounded system application, it is recommended that potential transformers be employed on the voltage sensing inputs to provide full isolation between the DGC-2020ES and monitored voltage phases.

Step 4: If potential transformers are in place, remove the connectors from the DGC-2020ES one at a time. If removal of a connector removes the ground fault, check the system wiring to that connector and out into the system to verify that connections are secure and all wiring insulation is in good condition.

Generator Breaker and Mains Breaker

Generator Breaker Will Not Close to a Dead Bus

Step 1: Review the description of how the generator breaker logic element functions contained in the GENBRK logic element description in the BESTlogic™*Plus* chapter in the *Configuration* manual.

Step 2: Review the section on breaker close requests in the *Breaker Management* chapter in the *Configuration* manual.

Step 3: Navigate to the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE > GEN BREAKER screen and set DEAD BUS CL ENBL to ENABLE.

Step 4: Verify that the Generator status is stable. The breaker will not close if the generator status is not stable. Check status by using the Metering Explorer in BESTCOMS*Plus* and verify that when the generator is running, the GEN STABLE status LED is lit. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen.

Step 5: Verify the bus status is DEAD. Check status by using the Metering Explorer in BESTCOMS*Plus* and verify that when the generator is running, the BUS DEAD status LED is lit. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen.

Step 6: Verify the connections in BESTlogic*Plus* Programmable Logic to the generator breaker logic element. The *Status* input must be driven by an “A” or normally open contact from the generator breaker. The OPEN and CLOSE command inputs on the left side of the logic block are inputs for open and close commands. These can be wired to physical inputs if it is desired to have open and close command switches. If they are wired, they must either be pulsed inputs, or some logic must be employed so that the open and close command inputs are never driven at the same time. If these are both driven at the same time, the breaker is receiving open and close commands simultaneously. The breaker will not change state if it is being commanded to open and close at the same time.

Step 7: Verify the breaker is receiving a close command. Breaker close command sources are:

- The DGC-2020ES itself when the automatic mains fail transfer (ATS) feature is enabled.
- The DGC-2020ES itself when the RUN WITH LOAD logic element receives a *Start* pulse in the programmable logic.
- The DGC-2020ES itself when started from the Exercise Timer and the Run with Load box is checked in the Generator Exerciser settings.
- Manual Breaker Close Input Contacts applied to the Open and Close inputs on the left side of the Generator Breaker logic element in the programmable logic.

Step 8: Verify the wiring to the breaker from the DGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker open output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

Generator Breaker Does Not Open When It Should

Step 1: Review the description of how the generator breaker logic element functions contained in the GENBRK logic element description in the *BESTlogicPlus* chapter in the *Configuration* manual.

Step 2: Review the section on breaker operation requests in the *Breaker Management* chapter in the *Configuration* manual.

Step 3: Verify the connections in BESTlogic*Plus* Programmable Logic to the generator breaker logic element. The *Status* input must be driven by an "A" or normally open contact from the generator breaker. The OPEN and CLOSE command inputs on the left side of the logic block are inputs for open and close commands. These can be wired to physical inputs if it is desired to have open and close command switches. If they are wired, they must either be pulsed inputs, or some logic must be employed so that the open and close command inputs are never driven at the same time. If these are both driven at the same time, the breaker is receiving open and close commands simultaneously. The breaker will not change state if it is being commanded to open and close at the same time.

Step 4: Verify the breaker is receiving an open command. Breaker open command sources are:

- The DGC-2020ES itself when the automatic transfer (ATS) feature is enabled.
- The DGC-2020ES itself when the RUN WITH LOAD logic element receives a *Stop* pulse in the programmable logic.
- The DGC-2020ES itself when shutting down the engine due to an active alarm.
- The DGC-2020ES itself when ending a run session from the Exercise Timer and the *Run with Load* box is checked in the Generator Exerciser settings.
- Manual Breaker Open Input Contacts applied to the Open and Close inputs on the left side of the Generator Breaker logic element in the programmable logic.

Step 5: Verify the wiring to the breaker from the DGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker open output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

Mains Breaker Does Not Open When Mains Fails

Step 1: Verify that a Mains Breaker has been configured by examining the settings on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 2: Verify the mains breaker has been correctly included in the programmable logic.

Step 3: Verify that the MAINS FAIL TRANSFER parameter is set to ENABLE on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 4: Verify that a failure of the mains is detected by the DGC-2020ES. Check status using the Metering Explorer in BESTCOMS*Plus* and verify that the MAINS FAIL status LED is lit when

the power on the DGC-2020ES bus voltage input is either out of voltage or frequency range. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen to achieve correct detection.

Step 5: Verify the wiring to the breaker from the DGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker close output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

Mains Breaker Does Not Close After Mains Returns

Step 1: Verify that a Mains Breaker has been configured by examining the settings on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 2: Verify the mains breaker has been correctly included in the programmable logic.

Step 3: Verify that the MAINS FAIL TRANSFER parameter is set to ENABLE on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 4: Verify that stable mains power is detected by the DGC-2020ES. Check status using the Metering Explorer in BESTCOMS*Plus* and verify that the MAINS STABLE status LED is lit when the power on the DGC-2020ES bus voltage input is good. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen to achieve correct detection.

Step 5: Verify the wiring to the breaker from the DGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker open output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

DGC-2020ES Front Panel Debug Screen

There is one debug screen in the DGC-2020ES that can be useful for debugging I/O module related issues. The following debug screen is available: CEM DEBUG

CEM DEBUG

This screen shows the binary data that is being sent between the CEM-2020 (Contact Expansion Module) and the DGC-2020ES.

The CEM DEBUG screen is located on the front panel at SETTINGS > SYSTEM PARAMS > REMOTE MODULE SETUP > CEM SETUP > CEM DEBUG MENU.

The following parameters are visible on the CEM DEBUG screen:

- DGC TO CEM BP: DGC-2020ES to CEM-2020 Binary Points. This is the status of the CEM-2020 output relays being transmitted from the DGC-2020ES to the CEM-2020. This is a 32-bit, bit packed number representing the desired states of the CEM-2020 outputs. The left most bit is the first output, etc.
- CEM TO DGC BP: CEM-2020 to DGC-2020ES Binary Points. This is the status of the CEM-2020 inputs being transmitted from the CEM-2020 to the DGC-2020ES. This is a 32-bit, bit packed number representing the metered states of the CEM-2020 inputs. The left most bit is the first input, etc.

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DGC-2020ES

Digital Genset Controller

Installation Instruction Manual

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⚠ **WARNING:** California's Proposition 65 requires special warnings for products that may contain chemicals known to the state of California to cause cancer, birth defects, or other reproductive harm. Please note that by posting this Proposition 65 warning, we are notifying you that one or more of the Proposition 65 listed chemicals may be present in products we sell to you. For more information about the specific chemicals found in this product, please visit https://www.basler.com/Prop65.

Preface

This instruction manual provides information about the installation of the DGC-2020ES Digital Genset Controller. To accomplish this, the following information is provided:

- Mounting
- Terminals and connectors
- Typical applications
- Power input
- Voltage and current sensing
- Speed signal inputs
- Specifications
- Maintenance and troubleshooting

Conventions Used in this Manual

Important safety and procedural information is emphasized and presented in this manual through Warning, Caution, and Note boxes. Each type is illustrated and defined as follows.

Warning!
Warning boxes call attention to conditions or actions that may cause personal injury or death.

Caution
Caution boxes call attention to operating conditions that may lead to equipment or property damage.

Note
Note boxes emphasize important information pertaining to Digital Genset Controller installation or operation.

DGC-2020ES Instruction Manual Catalog

Available instruction manuals for the DGC-2020ES are listed in Table 1.

Table 1. Instruction Manuals

Part Number	Description
9469200993	Quick Start
9469200994	Installation (this manual)
9469200995	Configuration
9469200996	Operation
9469200997	Accessories

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First printing: April 2017

Warning!

READ THIS MANUAL. Read this manual before installing, operating, or maintaining the DGC-2020ES. Note all warnings, cautions, and notes in this manual as well as on the product. Keep this manual with the product for reference. Only qualified personnel should install, operate, or service this system. Failure to follow warning and cautionary labels may result in personal injury or property damage. Exercise caution at all times.

Revision History

A historical summary of the changes made to this instruction manual is provided below. Revisions are listed in reverse chronological order.

Visit www.basler.com to download the latest hardware, firmware, and BESTCOMS*Plus*® revision histories.

Instruction Manual Revision History

Manual Revision and Date	Change
B, Nov-19	• Removed Rev Letter from all pages. • Changed sequential numbering to sectional numbering. • Moved Instruction Manual Revision History into Preface. • Removed standalone Revision History chapter. • Corrected Figures 3-3 and 3-4. Added GEN VN connection.
A1, Apr-19	• Updated Proposition 65 statement
A, Sep-18	• Updated *Revision History* chapter
—, Apr-17	• Initial release

Contents

1 • Mounting

DGC-2020ES controllers are delivered in sturdy cartons to prevent shipping damage. Upon receipt of a unit, check the part number against the requisition and packing list for agreement. Inspect for damage, and if there is evidence of such, immediately file a claim with the carrier and notify the Basler Electric regional sales office or your sales representative.

If the device is not installed immediately, store it in the original shipping package in a moisture- and dust-free environment.

Hardware

The front panel is resistant to moisture, salt fog, humidity, dust, dirt, and chemical contaminants. DGC-2020ES controllers are mounted using the four permanently attached 10-24 studs. The torque applied to the mounting hardware should not exceed 20 inch-pounds (2.2 newton meters).

Dimensions

Panel cutting and drilling dimensions are shown in Figure 1-1. Overall dimensions are shown in Figure 1-2. All dimensions are shown in inches with millimeters in parenthesis.

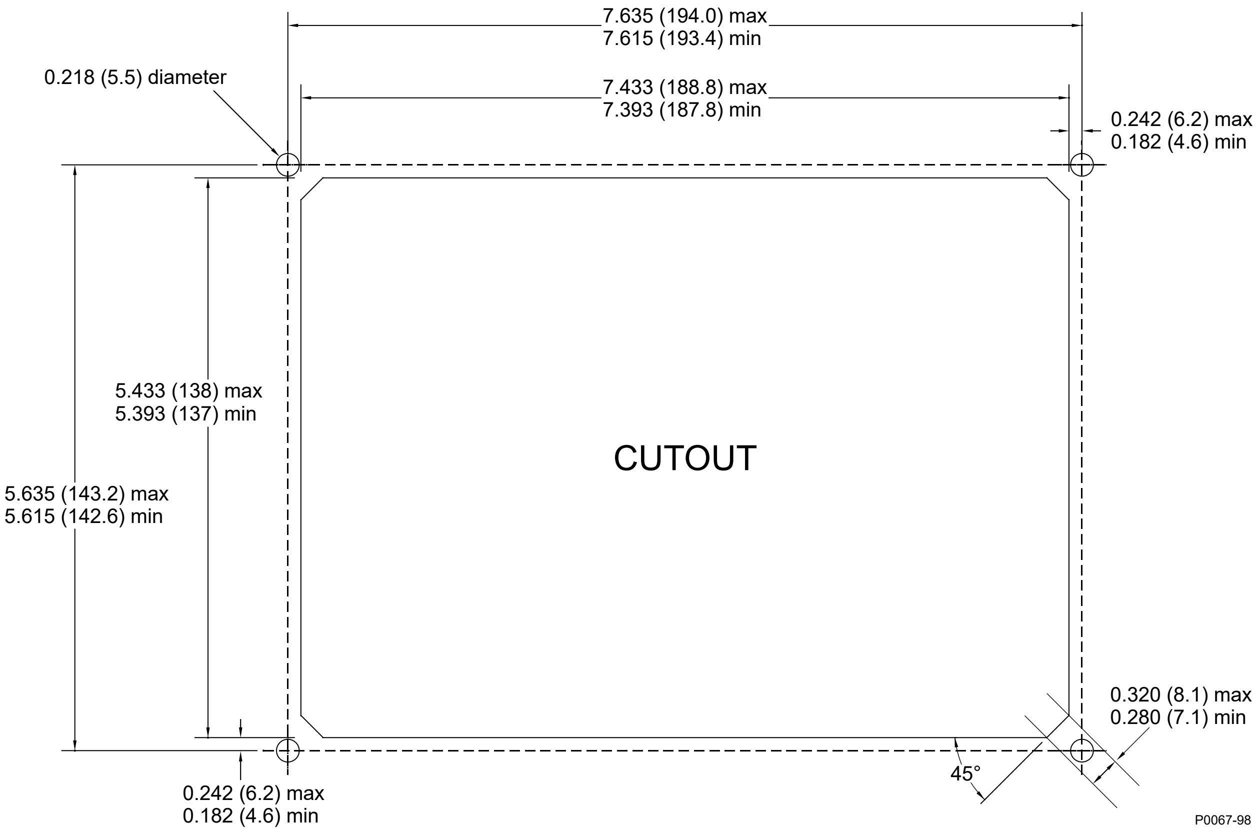


Figure 1-1. Panel Cutting and Drilling Dimensions

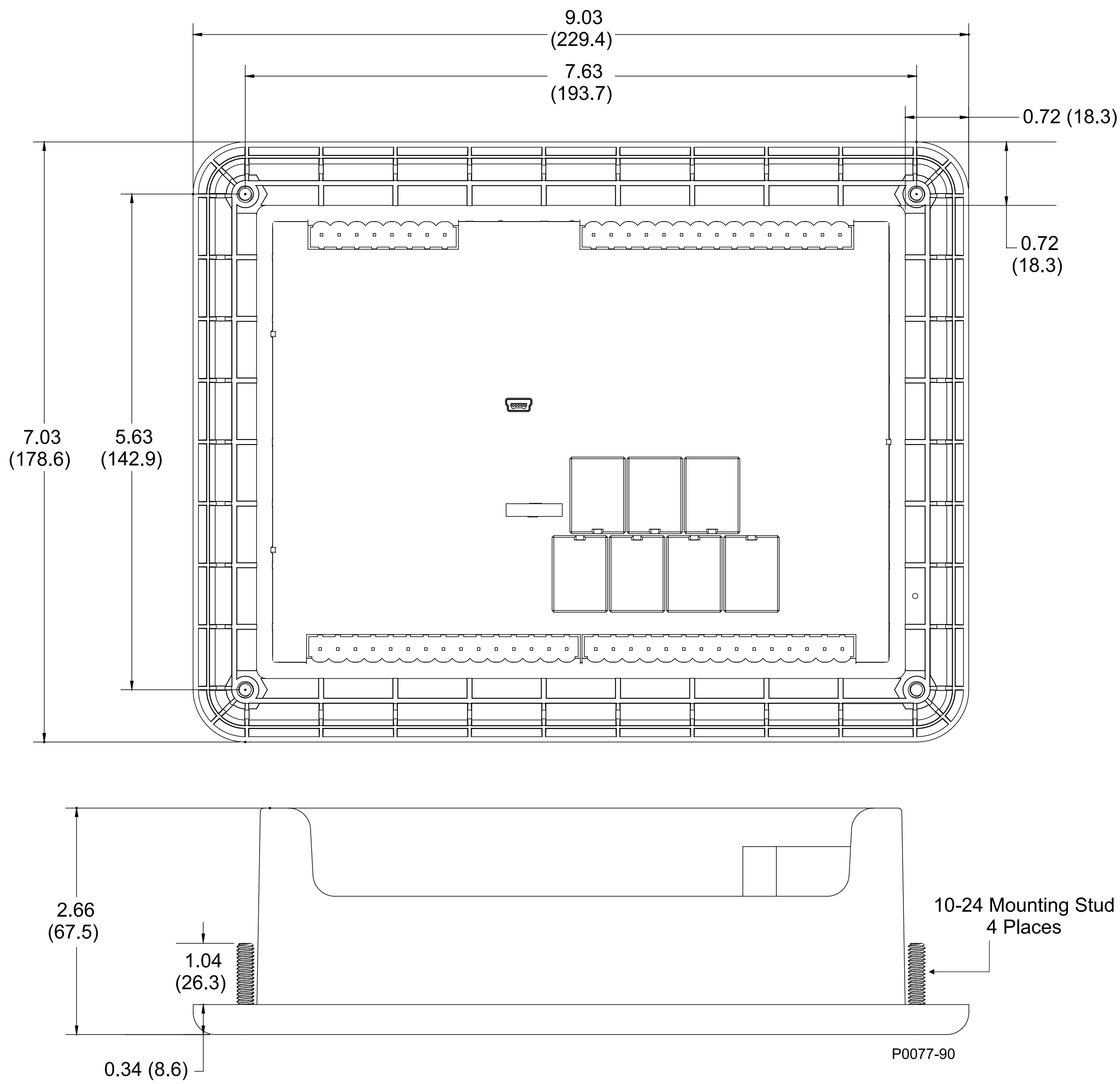
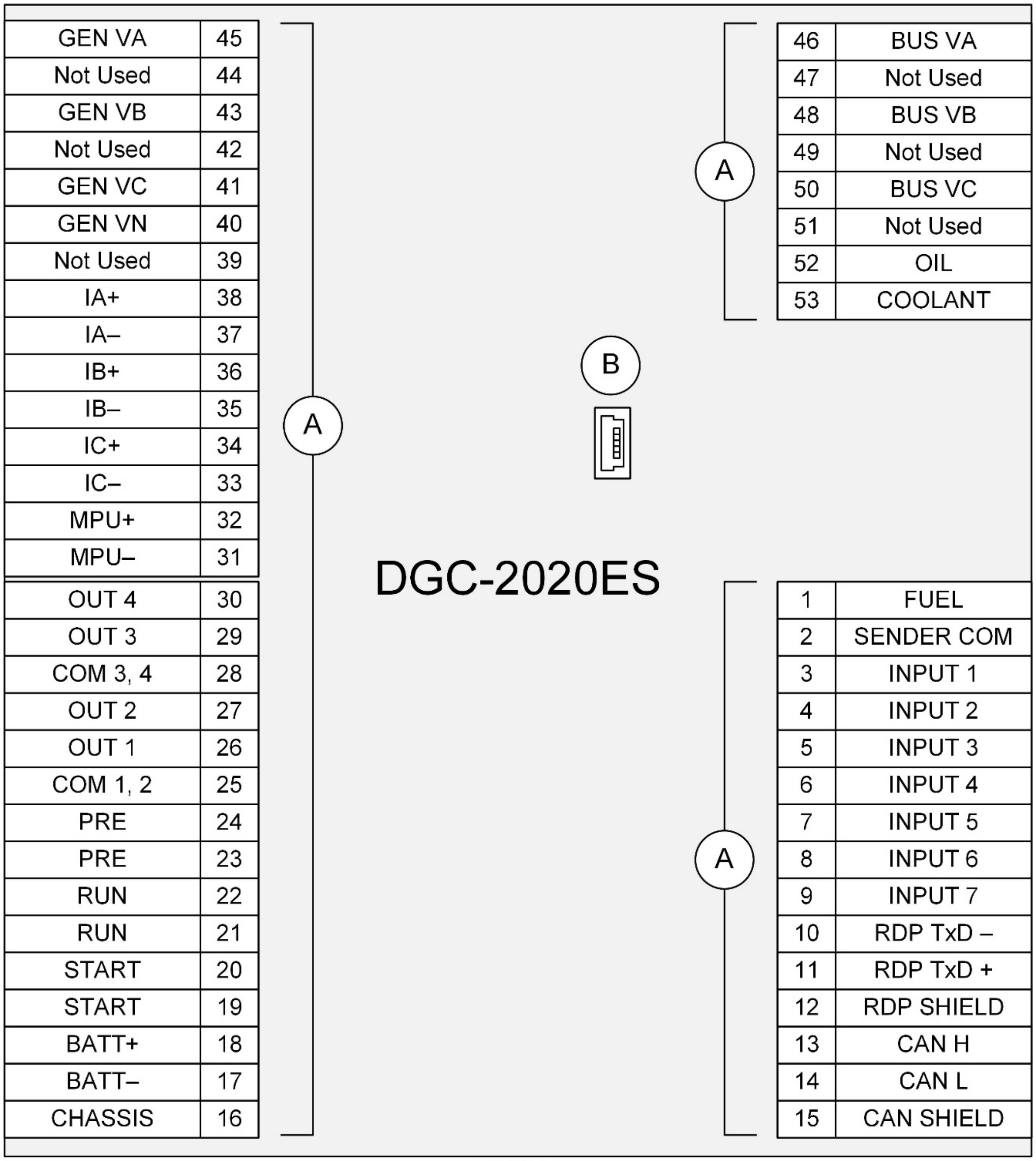


Figure 1-2. Overall Dimensions

2 • Terminals and Connectors

All DGC-2020ES terminals and connectors are located on the rear panel. DGC-2020ES terminals consist of a mini-B USB socket and plug-in connectors with spring clamp terminals.

Figure 2-1 illustrates the rear panel terminals. Locator letters in the illustration correspond to the terminal block and connector descriptions in Table 2-1.



P0067-84

Figure 2-1. Rear Panel

Table 2-1. Rear Panel Terminal and Connector Descriptions

Locator	Description
A	The majority of external, DGC-2020ES wiring is terminated at 8- or 15-position connectors with spring clamp terminals. These connectors plug into headers on the DGC-2020ES. The connectors and headers have a dovetailed edge that ensures proper connector orientation. Each connector and header is uniquely keyed to ensure that a connector mates only with the correct header. Spring clamp terminals accept a maximum wire size of 12 AWG.
B	The mini-B USB socket mates with a standard USB cable and is used with a PC running BESTCOMS*Plus*® software for local communication with the DGC-2020ES.

Connections

DGC-2020ES connections are dependent on the application. Incorrect wiring may result in damage to the controller.

Note

Be sure that the DGC-2020ES is hard-wired to earth ground with no smaller than 12 AWG copper wire attached to the chassis ground terminal (terminal 16) on the rear of the controller.

Operating power from the battery must be of the correct polarity. Although reverse polarity will not cause damage, the DGC-2020ES will not operate.

For the DGC-2020ES to correctly meter power factor, the generator must be rotating clockwise (A-B-C).

The DGC-2020ES terminals are grouped by function and include operating power, generator current sensing, generator voltage sensing, bus voltage sensing, analog engine sender inputs, magnetic pickup input, contact sensing inputs, output contacts, USB interface, CAN interface, and Remote Display Panel connections.

DGC-2020ES terminal groups are described in the following paragraphs.

Operating Power

The DGC-2020ES operating power input accepts either 12 Vdc or 24 Vdc and tolerates voltage over the range of 6 to 32 Vdc. Operating power must be of the correct polarity. Although reverse polarity will not cause damage, the DGC-2020ES will not operate. Operating power terminals are listed in Table 2-2.

It is recommended that a fuse be added for additional protection for the wiring to the battery input of the DGC-2020ES. A fuse helps prevent wire damage and nuisance trips due to initial power supply inrush current. To follow UL guidelines, a 5 A maximum, 32 Vdc supplementary fuse must be implemented in the battery input circuit to the DGC-2020ES

Table 2-2. Operating Power Terminals

Terminal	Description
16 (CHASSIS)	Chassis ground connection
17 (BATT–)	Negative side of operating power input
18 (BATT+)	Positive side of operating power input

Generator Current Sensing

The DGC-2020ES has sensing inputs for A-phase, B-phase, and C-phase generator current. A DGC-2020ES with a style number of 1xx has a 1 Aac nominal current sensing and a DGC-2020ES with a style number of 5xx indicates 5 Aac nominal current sensing. Generator current sensing terminals are listed in Table 2-3.

Table 2-3. Generator Current Sensing Terminals

Terminals	Description
37 (IA–)	A-phase current sensing input
38 (IA+)	
35 (IB–)	B-phase current sensing input
36 (IB+)	
33 (IC–)	C-phase current sensing input
34 (IC+)	

Note

Unused current sensing inputs should be shorted to minimize noise pickup.

Caution

Generator current sensing terminals 37 (IA–), 35 (IB–), and 33 (IC–) must be terminated to ground for proper operation.

Generator Voltage Sensing

The DGC-2020ES accepts either line-to-line or line-to-neutral generator sensing voltage over the range of 12 to 576 volts, rms line-to-line. Generator voltage sensing terminals are listed in Table 2-4.

Table 2-4. Generator Voltage Sensing Terminals

Terminal	Description
40 (GEN VN)	Neutral generator voltage sensing input
41 (GEN VC)	C-phase generator voltage sensing input
43 (GEN VB)	B-phase generator voltage sensing input
45 (GEN VA)	A-phase generator voltage sensing input

Installation in an Ungrounded System Application

When the DGC-2020ES is controlling equipment that is part of an ungrounded system, it is recommended that potential transformers be employed on the voltage sensing inputs to provide full isolation between the DGC-2020ES and monitored voltage phases.

Bus Voltage Sensing

Sensing of bus voltage enables the DGC-2020ES to detect failures of the mains (utility). The DGC-2020ES senses A-phase, B-phase, and C-phase bus voltage. Bus voltage sensing terminals are listed in Table 2-5.

Table 2-5. Bus Voltage Sensing Terminals

Terminal	Description
46 (BUS VA)	A-phase bus voltage sensing input
48 (BUS VB)	B-phase bus voltage sensing input
50 (BUS VC)	C-phase bus voltage sensing input

Installation in an Ungrounded System Application

When the DGC-2020ES is controlling equipment that is part of an ungrounded system, it is recommended that potential transformers be employed on the voltage sensing inputs to provide full isolation between the DGC-2020ES and monitored voltage phases.

Analog Engine Sender Inputs

Inputs are provided for oil pressure, fuel level, and coolant temperature senders. For a listing of oil pressure, fuel level, and coolant temperature senders that are compatible with the DGC-2020ES, refer to the *Engine Sender Inputs* chapter in the *Configuration* manual. Analog engine sender input terminals are listed in Table 2-6.

Table 2-6. Sender Input Terminals

Terminal	Description
1 (FUEL)	Fuel level sender input
2 (SENDER COM)	Sender return terminal
52 (OIL)	Oil pressure sender input
53 (COOLANT)	Coolant temperature sender input

Magnetic Pickup Input

The magnetic pickup input accepts a speed signal over the range of 3 to 35 volts peak and 32 to 10,000 hertz. Magnetic pickup input terminals are listed in Table 2-7.

Table 2-7. Magnetic Pickup Input Terminals

Terminals	Description
31 (MPU–)	Magnetic pickup return input
32 (MPU+)	Magnetic pickup positive input

Contact Sensing Inputs

Contact sensing inputs consist of seven programmable inputs. The programmable inputs accept normally open, dry contacts. Terminal 17 (BATT–) serves as the common return line for the programmable inputs. While input 1 is programmed to recognize an emergency stop input by default, it can be programmed for any function. Information about configuring the programmable inputs is provided in the *Contact Inputs* chapter in the *Configuration* manual. Contact sensing input terminals are listed in Table 2-8.

Table 2-8. Contact Sensing Inputs

Terminal	Description
17 (BATT–)	Common return line for programmable contact inputs
3 (INPUT 1)	Programmable contact input 1 (ESTOP by default)
4 (INPUT 2)	Programmable contact input 2
5 (INPUT 3)	Programmable contact input 3

Terminal	Description
6 (INPUT 4)	Programmable contact input 4
7 (INPUT 5)	Programmable contact input 5
8 (INPUT 6)	Programmable contact input 6
9 (INPUT 7)	Programmable contact input 7

Output Contacts

The DGC-2020ES has three sets of fixed-function output contacts: Pre, Start, and Run. The Pre contacts supply battery power to the engine glow plugs, the Start contacts supply power to the starter solenoid, and the Run contacts supply power to the fuel solenoid. Connections to the three sets of contacts are made at terminals 19 through 24. The Pre, Start, and Run relay terminals are listed in Table 2-9.

Table 2-9. Fixed-Function Output Contact Terminals

Terminal	Description
19 (START)	Start output contact (Start solenoid)
20 (START)	
21 (RUN)	Run output contact (Fuel solenoid)
22 (RUN)	
23 (PRE)	Pre-start output contact (Glow plugs)
24 (PRE)	

Four programmable output contacts are provided in two sets. Each set of two output contacts share a common terminal. Programmable output contact terminals are listed in Table 2-10.

Table 2-10. Programmable Output Contact Terminals

Terminal	Description
25 (COM 1, 2)	Common connection for outputs 1 and 2
26 (OUT 1)	Programmable output 1
27 (OUT 2)	Programmable output 2
28 (COM 3, 4)	Common connection for outputs 3 and 4
29 (OUT 3)	Programmable output 3
30 (OUT 4)	Programmable output 4

USB Interface

A mini-B USB socket enables local communication with a PC running BESTCOMS*Plus* software. The DGC-2020ES is connected to a PC using a standard USB cable equipped with a type A plug on one end (PC termination) and a mini-B plug on the other end (DGC-2020ES termination).

CAN Interface

These terminals provide communication using the SAE J1939 protocol or the MTU protocol and provide high-speed communication between the DGC-2020ES and an ECU on an electronically controlled engine. Connections between the ECU and DGC-2020ES should be made with twisted-pair, shielded cable. CAN interface terminals are listed in Table 2-11. For typical CAN connections, refer to the *Typical Connections* chapter.

Table 2-11. CAN Interface Terminals

Terminals	Description
13 (CAN H)	CAN high connection
14 (CAN L)	CAN low connection
15 (SHIELD)	CAN drain connection

Note

1. If the DGC-2020ES is providing one end of the J1939 bus, a 120 ohm, ½ watt terminating resistor should be installed across terminals 14 (CANL) and 13 (CANH).
2. If the DGC-2020ES is not providing one end of the J1939 bus, the stub connecting the DGC-2020ES to the bus should not exceed 914 mm (3 ft) in length.
3. The maximum bus length, not including stubs, is 40 m (131 ft).
4. The J1939 drain (shield) should be grounded at one point only. If grounded elsewhere, do not connect the drain to the DGC-2020ES

Optional Remote Display Panel Connections

Terminals are provided for connection with the optional Remote Display Panel. These terminals provide dc operating power to the Remote Display Panel and enable communication between the DGC-2020ES and Remote Display Panel. Twisted-pair conductors are recommended for connecting the communication terminals of the DGC-2020ES and Remote Display Panel. Communication may become unreliable if the connection wires exceed 1,219 m (4,000 ft). Table 2-12 lists the DGC-2020ES terminals that connect to the Remote Display Panel.

Table 2-12. Remote Display Panel Interface Terminals

Terminal	Description
10 (RDP TxD–)	Remote Display Panel terminal (TxD–)
11 (RDP TxD+)	Remote Display Panel terminal (TxD+)
17 (BATT–)	Remote Display Panel terminal DC COM (–)
18 (BATT+)	Remote Display Panel terminal 12/24 (+)

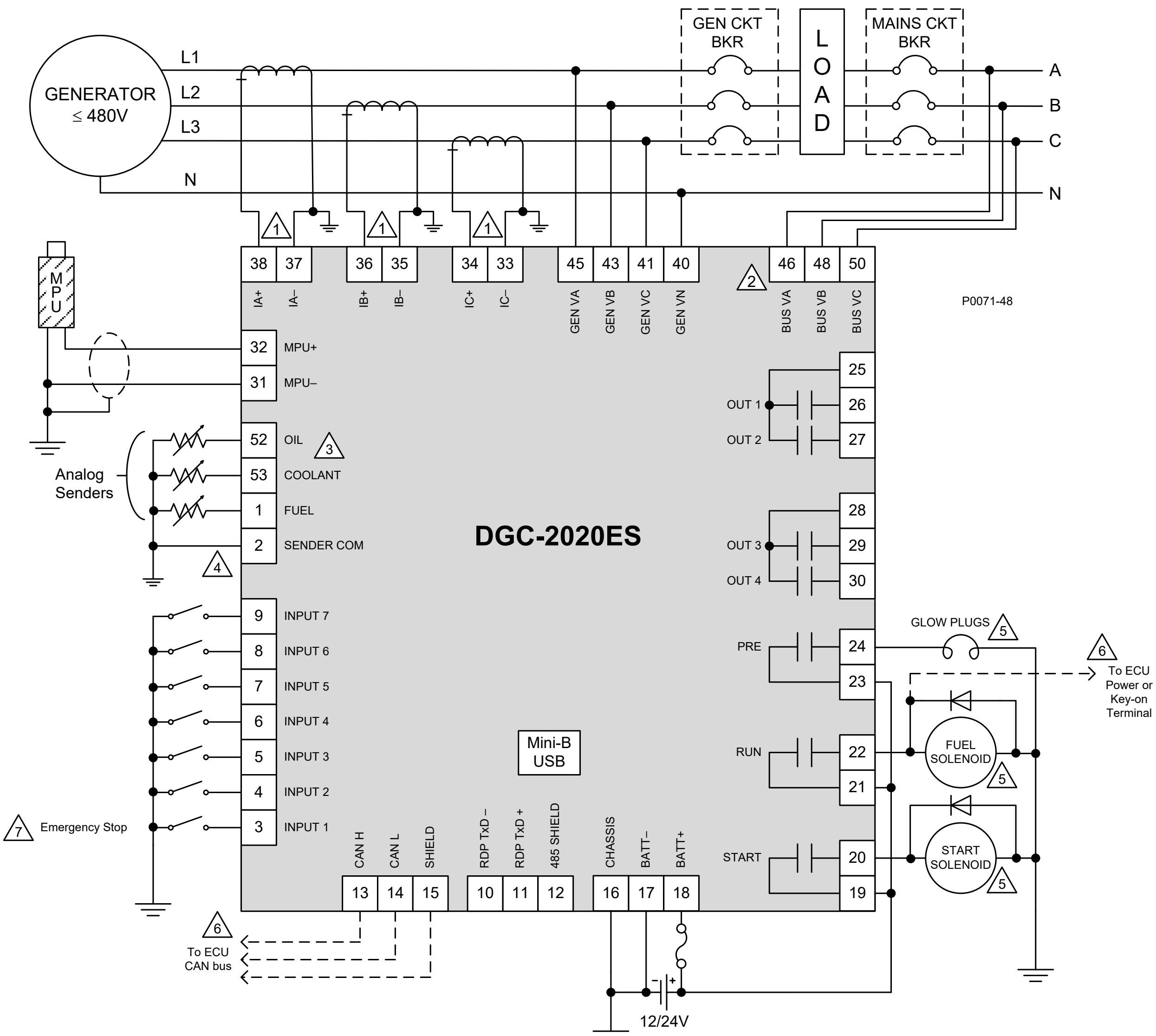
3 • Typical Connections

Typical connection diagrams are provided in this chapter as a guide when wiring the DGC-2020ES for communication, mechanical senders, contact inputs and outputs, sensing, and control power.

Connections for Typical Applications

Typical connections for applications using three-phase wye, three-phase delta, single-phase AB, and single-phase AC generator voltage sensing are shown on the following pages.

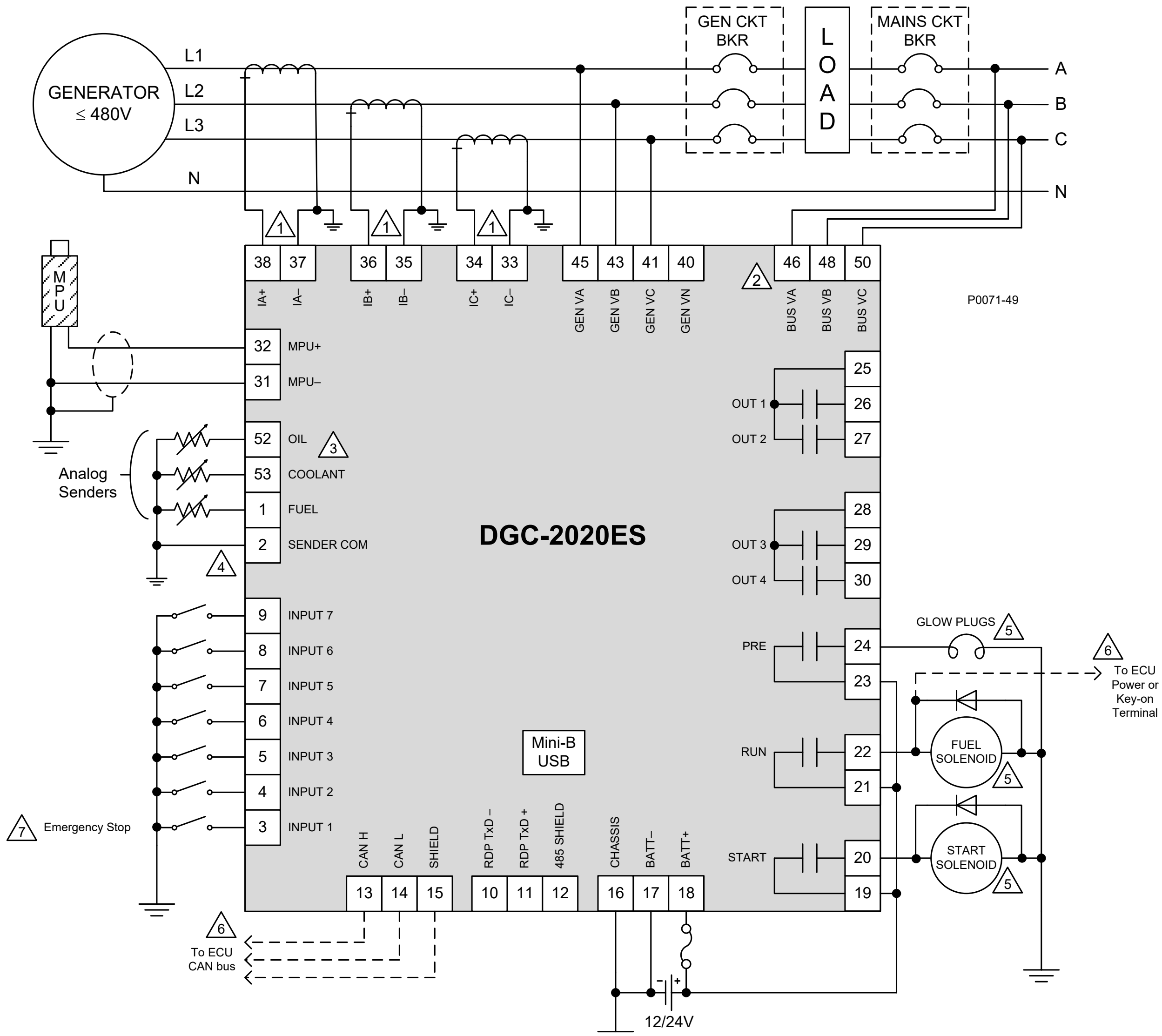
Figure 3-1 illustrates typical three-phase wye generator voltage sensing connections.



1. Current inputs are 1A or 5A, depending on style.
2. Bus sensing inputs are optional, depending on style.
3. Oil pressure and coolant temperature senders are *only* available when the DGC-2020ES has the Analog Senders option (style xAx). The fuel sender is always available.
4. Connect near engine block (negative battery terminal) side of senders.
5. If component is under ECU control, do not connect to DGC-2020ES.
6. Connect to the ECU on an electronically controlled engine when the DGC-2020ES has the J1939 CAN interface option (style xCx).
7. Labels indicate the functions assigned by the default programmable logic to the contact inputs.

Figure 3-1. Three-Phase Wye Connections for Typical Applications

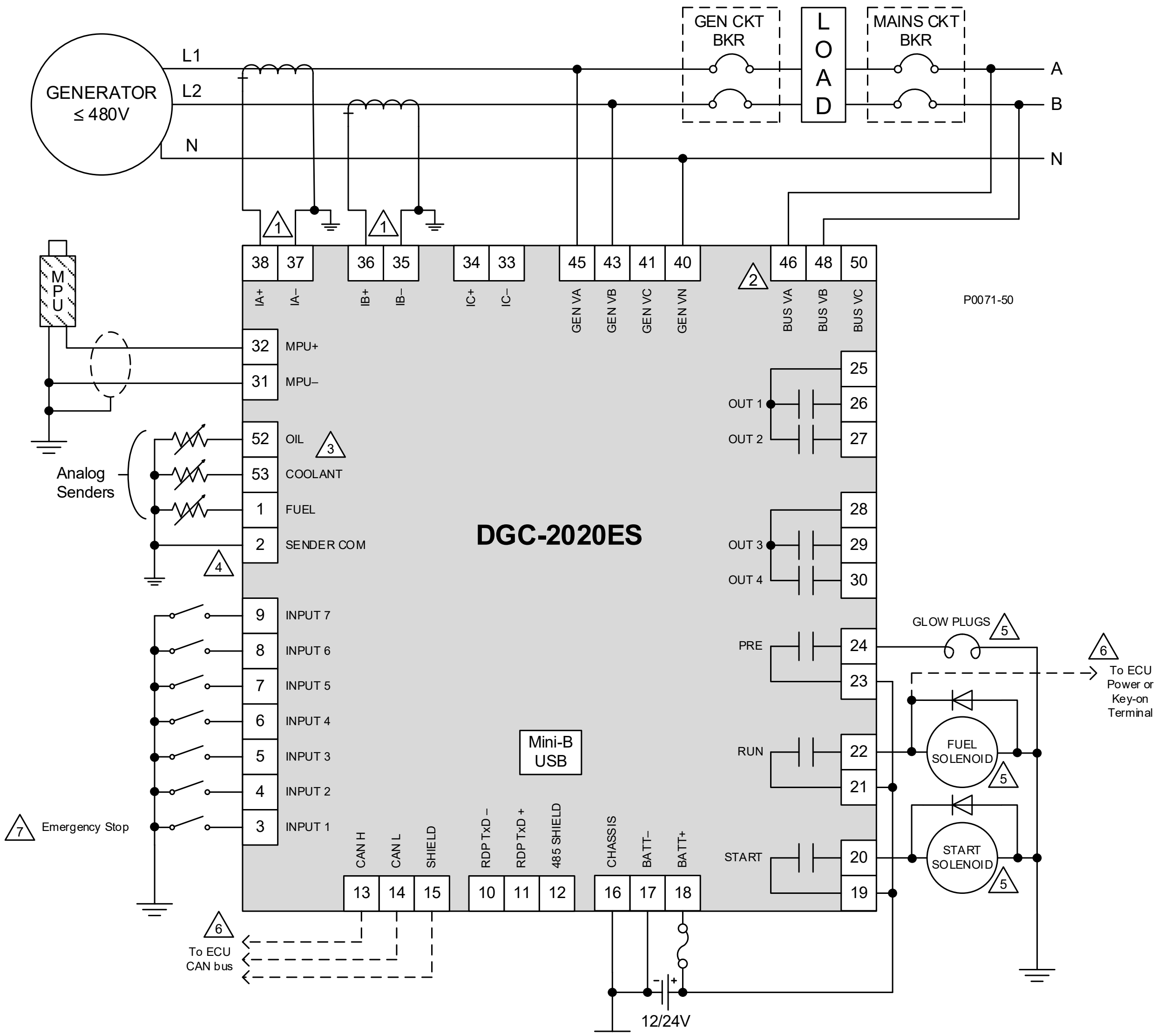
Figure 3-2 illustrates typical three-phase delta generator voltage sensing connections.



1. Current inputs are 1A or 5A, depending on style.
2. Bus sensing inputs are optional, depending on style.
3. Oil pressure and coolant temperature senders are *only* available when the DGC-2020ES has the Analog Senders option (style xAx). The fuel sender is always available.
4. Connect near engine block (negative battery terminal) side of senders.
5. If component is under ECU control, do not connect to DGC-2020ES.
6. Connect to the ECU on an electronically controlled engine when the DGC-2020ES has the J1939 CAN interface option (style xCx).
7. Labels indicate the functions assigned by the default programmable logic to the contact inputs.

Figure 3-2. Three-Phase Delta Connections for Typical Applications

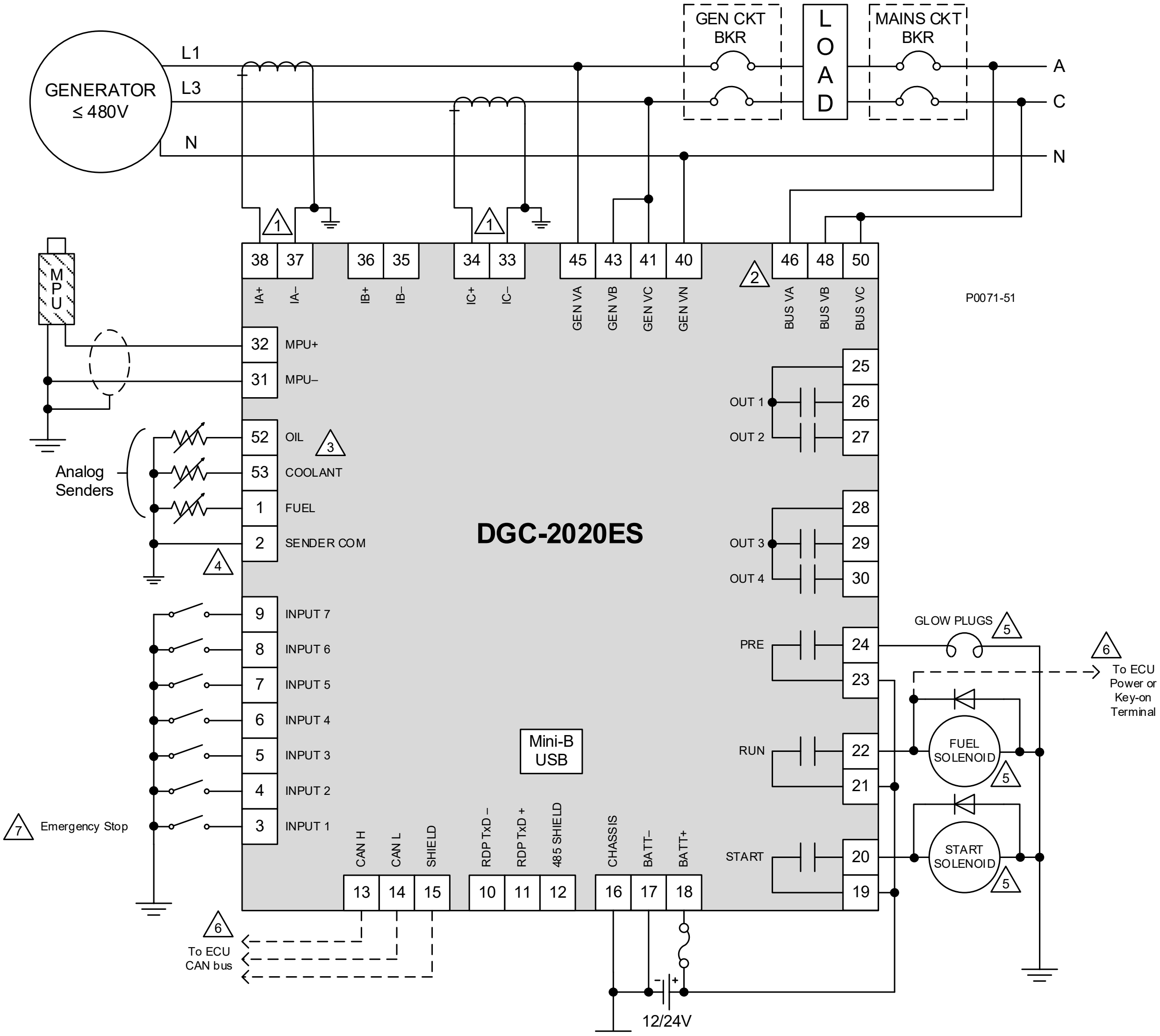
Figure 3-3 illustrates typical single-phase A-B generator voltage sensing connections.



1. Current inputs are 1A or 5A, depending on style.
2. Bus sensing inputs are optional, depending on style.
3. Oil pressure and coolant temperature senders are *only* available when the DGC-2020ES has the Analog Senders option (style xAx). The fuel sender is always available.
4. Connect near engine block (negative battery terminal) side of senders.
5. If component is under ECU control, do not connect to DGC-2020ES.
6. Connect to the ECU on an electronically controlled engine when the DGC-2020ES has the J1939 CAN interface option (style xCx).
7. Labels indicate the functions assigned by the default programmable logic to the contact inputs.

Figure 3-3. Single-Phase A-B Connections for Typical Applications

Figure 3-4 illustrates typical single-phase A-C generator voltage sensing connections.



1. Current inputs are 1A or 5A, depending on style.
2. Bus sensing inputs are optional, depending on style.
3. Oil pressure and coolant temperature senders are *only* available when the DGC-2020ES has the Analog Senders option (style xAx). The fuel sender is always available.
4. Connect near engine block (negative battery terminal) side of senders.
5. If component is under ECU control, do not connect to DGC-2020ES.
6. Connect to the ECU on an electronically controlled engine when the DGC-2020ES has the J1939 CAN interface option (style xCx).
7. Labels indicate the functions assigned by the default programmable logic to the contact inputs.

Figure 3-4. Single-Phase A-C Connections for Typical Applications

CAN Connections

Typical CAN connections are shown in Figure 3-5 and Figure 3-6.

Note
1. If the DGC-2020ES is providing one end of the J1939 bus, a 120 ohm, ½ watt terminating resistor should be installed across terminals 14 (CANL) and 13 (CANH).
2. If the DGC-2020ES is not providing one end of the J1939 bus, the stub connecting the DGC-2020ES to the bus should not exceed 914 mm (3 ft) in length.
3. The maximum bus length, not including stubs, is 40 m (131 ft).
4. The J1939 drain (shield) should be grounded at one point only. If grounded elsewhere, do not connect the drain to the DGC-2020ES.

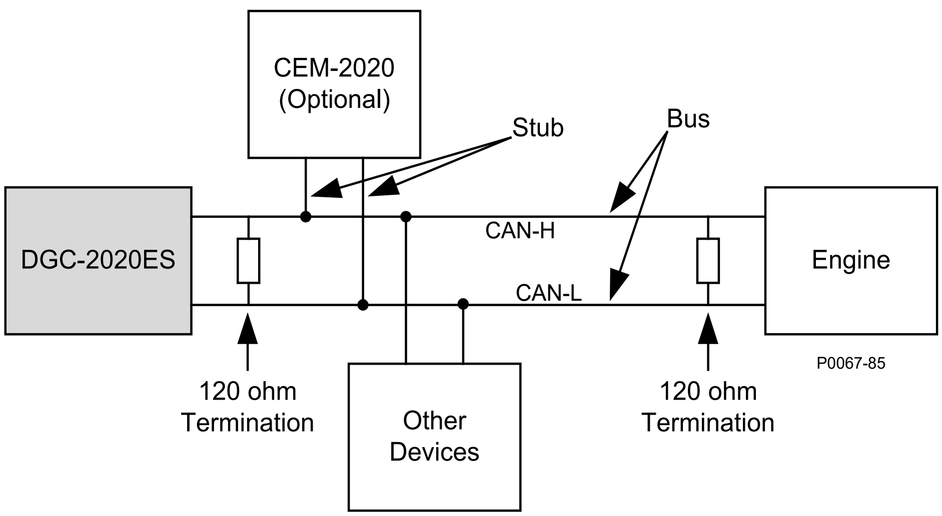


Figure 3-5. CAN Interface with DGC-2020ES Providing One End of the Bus

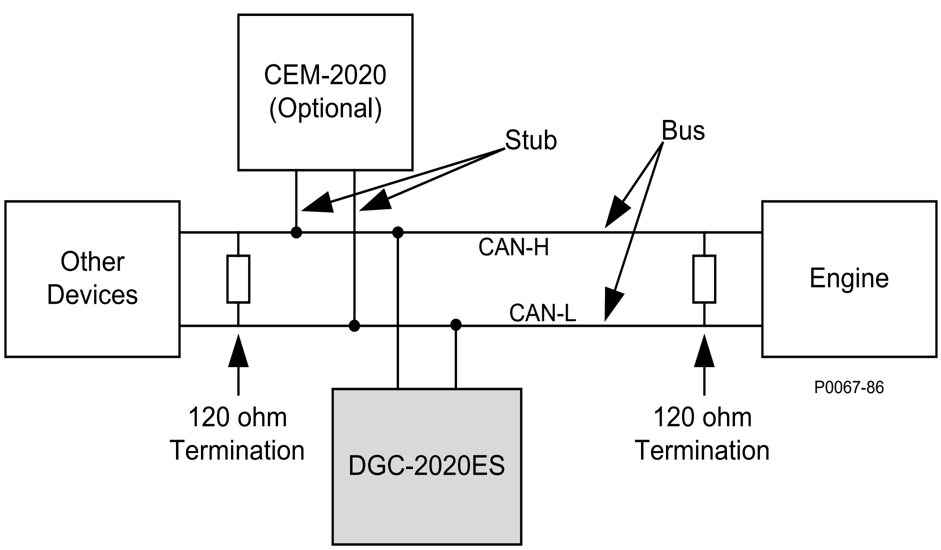


Figure 3-6. CAN Interface with Other Devices

CEM-2020 Connections

The CEM-2020 (Contact Expansion Module) is an optional module that may be installed with the DGC-2020ES. It is a remote auxiliary device that provides additional contact inputs and outputs for the DGC-2020ES. This module interfaces to the DGC-2020ES via CAN, thus the CAN terminals are the only common connections (Figure 3-7) between the DGC-2020ES and CEM-2020. Refer to the *CEM-2020* chapter for more information.

Refer to *Terminals and Connectors* for details on DGC-2020ES CAN connections.

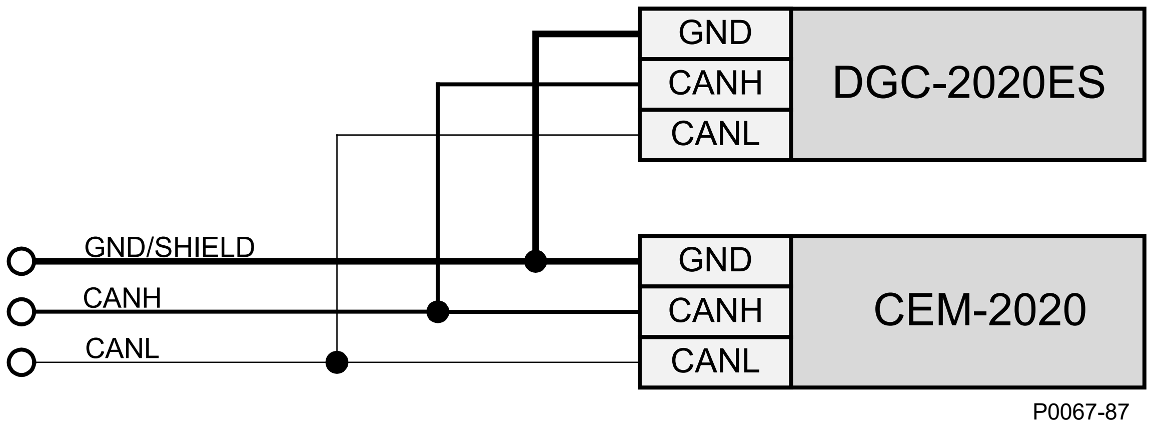


Figure 3-7. DGC-2020ES and CEM-2020 CAN Connections

Installation for CE Systems

For CE compliant systems, it may be required to route ac voltage and current sensing wires separately from other wires.

Installation in an Ungrounded System Application

When the DGC-2020ES is controlling equipment that is part of an ungrounded system, it is recommended that potential transformers be employed on the voltage sensing inputs to provide full isolation between the DGC-2020ES and monitored voltage phases.

4 • Power Input

Control power for the DGC-2020ES is typically supplied by the genset starter battery. Power from the battery is supplied to an internal power supply that provides power for DGC-2020ES logic, protection, and control functions.

Nominal Voltage Input and Acceptable Range of Input Voltage

A nominal voltage of 12 or 24 Vdc within a range of 6 to 32 Vdc is accepted. Control power must be of the correct polarity. Although reverse polarity will not cause damage, the DGC-2020ES will not operate.

Terminal Assignments

Input power is applied to terminals 18 (BATT+), 17 (BATT–), and 16 (CHASSIS).

Power Consumption

The amount of power consumed by the DGC-2020ES varies based on the selected mode. The power saving Sleep mode consumes 4.5 W with all relays de-energized. The Normal Operational Mode consumes 6.5 watts in Run mode with the LCD heater off and 3 relays energized. The Maximum Operational Mode consumes 14 watts in Run mode with the LCD heater on and 7 relays energized.

Battery Ride-Through Capability

Starting at 10 Vdc, withstands cranking ride-through down to 0 Vdc for 50 milliseconds.

Fuse Protection

To follow UL guidelines, a 5 A maximum, 32 Vdc supplementary fuse must be implemented in the battery input circuit to the DGC-2020ES.

5 • Voltage and Current Sensing

The DGC-2020ES senses generator voltage, generator current, and bus voltage through dedicated, isolated inputs.

Generator Voltage

The DGC-2020ES accepts either line-to-line or line-to-neutral generator sensing voltage over the range of 12 to 576 volts, rms line-to-line. Single-phase generator voltage is sensed across phases A and B. Generator voltage sensing terminals are listed in Table 5-1.

Table 5-1. Generator Voltage Sensing Terminals

Terminal	Description
40 (GEN VN)	Neutral generator voltage sensing input
41 (GEN VC)	C-phase generator voltage sensing input
43 (GEN VB)	B-phase generator voltage sensing input
45 (GEN VA)	A-phase generator voltage sensing input

Bus Voltage

Bus sensing over the range of 12 to 576 volts rms line-to-line is accepted by the DGC-2020ES. Sensing of bus voltage enables the DGC-2020ES to detect failures of the mains (utility). Controllers with style number xx2 measure bus voltage sensing to perform automatic mains failure transfers. Single-phase bus voltage is sensed across phases A and B. Bus voltage sensing terminals are listed in Table 5-2.

Table 5-2. Bus Voltage Sensing Terminals

Terminal	Description
46 (BUS VA)	A-phase bus voltage sensing input
48 (BUS VB)	B-phase bus voltage sensing input
50 (BUS VC)	C-phase bus voltage sensing input

Generator Current

The DGC-2020ES has sensing inputs for A-phase, B-phase, and C-phase generator current. Depending on the style number, a DGC-2020ES has a nominal sensing current rating of 1 Aac or 5 Aac. A style number of 1xx indicates 1 Aac nominal current sensing and a style number of 5xx indicates 5 Aac nominal current sensing. Generator current sensing terminals are listed in Table 5-3.

Table 5-3. Generator Current Sensing Terminals

Terminal	Description
38 (IA+)	A-phase generator current sensing input
37 (IA–)	
36 (IB+)	B-phase generator current sensing input
35 (IB–)	
34 (IC+)	C-phase generator current sensing input
33 (IC–)	

Note

Unused current sensing inputs should be shorted to minimize noise pickup.

Caution

Generator current sensing terminals 37 (IA–), 35 (IB–), and 33 (IC–) must be terminated to ground for proper operation.

6 • Speed Signal Inputs

The DGC-2020ES uses signals from the generator voltage sensing inputs and magnetic pickup (MPU) input to detect machine speed.

Magnetic Pickup

Voltage supplied by a magnetic pickup is scaled and conditioned for use by the internal circuitry as a speed signal source. The MPU input accepts a signal over the range of 3 to 35 volts peak and 32 to 10,000 hertz.

Terminals

Magnetic pickup connections are provided at terminals 31 (+) and 32 (–).

Generator Sensing Voltage

The generator voltage sensed by the DGC-2020ES is used to measure frequency and can be used to measure machine speed.

Terminals

Sensing voltage is applied to terminals 45 (A-phase), 43 (B-phase).

7 • Specifications

DGC-2020ES electrical and physical characteristics are listed in the following paragraphs.

Control Power

Nominal .... 12 or 24 Vdc
Range.. 6 to 32 Vdc
Terminals... 18 (+), 17 (–), 16 (chassis ground)

Power Consumption

Sleep Mode .... 4.5 W - LCD heater off, all relays de-energized
Normal Operational Mode .... 6.5 W - Run mode, LCD heater off, 3 relays energized
Maximum Operational Mode .... 14 W - Run mode, LCD heater on, 7 relays energized

Battery Ride Through

Starting at 10 Vdc, withstands cranking ride-through down to 0 Vdc for 50 ms

Current Sensing

Burden... 1 VA
Terminals... 38, 37 (A-phase)
36, 35 (B-phase)
34, 33 (C-phase)

1 Aac Current Sensing

Continuous Rating........................... 0.02 to 1.0 Aac
1 Second Rating............................... 5 Aac
0.050 Second Rating........................ 10 Aac

5 Aac Current Sensing

Continuous Rating........................... 0.1 to 5.0 Aac
1 Second Rating............................... 25 Aac
0.050 Second Rating........................ 50 Aac

Voltage Sensing

Range.. 12 to 576 V rms, line-to-line
Frequency .... 50/60 Hz
Frequency Range............................. 10 to 72 Hz
Burden... 1 VA
1 Second Rating............................... 720 V rms

Generator Sensing

Configuration .... Line-to-line or line-to-neutral
Generator Sensing Terminals .... 45 (A-phase)
43 (B-phase)
41 (C-phase)
40 (Neutral)

Bus Sensing

Configuration .... Line-to-line
Bus Sensing Terminals .... 46 (A-phase)
(Optional with style number xx2) 48 (B-phase)
50 (C-phase)

Contact Sensing

Contact sensing inputs include seven programmable inputs. All inputs accept dry contacts.

Time from a DGC-2020ES input application to:

- Shutdown the generator via an alarm = 490 ms max
- Close a relay on board the DGC-2020ES = 215 ms max
- Close a relay on board the CEM-2020 = 400 ms max

Notes

A contact input is true (on) if the input is connected to battery ground with a resistance of less than 240 ohms.

The maximum length of wire that can be accommodated depends on the resistance of the wire, and the resistance of the contacts of the device driving the input at the far end of the wire.

The maximum wire length can be calculated as follows:

L_{max} = (240 – R_{device})/(Resistance per Foot of Desired Wire)

Terminals

Input 1 .... 3, 17
Input 2 .... 4, 17
Input 3 .... 5, 17
Input 4 .... 6, 17
Input 5 .... 7, 17
Input 6 .... 8, 17
Input 7 .... 9, 17

Engine System Inputs

Stated accuracies are subject to the accuracy of the senders used. Values within these ranges are deemed “good” and the DGC-2020ES will use them for the appropriate calculation and protection. Values outside these ranges are deemed “bad” and the DGC-2020ES will begin timing towards a sender failure condition.

Fuel Level Sensing

Resistance Range .... 5 to 250 Ω nominal
Terminals....................................... 1, 2 (sender common)
Accuracy... ±1.3 Ω or ±2.1% of actual resistance

Coolant Temperature Sensing

Resistance Range .... 5 to 2,750 Ω nominal
Terminals....................................... 53, 2 (sender common)
Accuracy... ±6 Ω or ±2.4% of actual resistance

Oil Pressure Sensing

Resistance Range.......................... 5 to 250 Ω nominal
Terminals.. 52, 2 (sender common)
Accuracy.. ±1.4 Ω or ±2.3% of actual resistance

Engine Speed Sensing

Magnetic Pickup

Voltage Range .... 3 to 35 V peak (6 to 70 V peak-peak)
Frequency Range............................ 32 to 10,000 Hz
Terminals.. 32 (+), 31 (–)

Generator Voltage

Range.. 12 to 576 V rms
Terminals.. 45 (A-phase)
43 (B-phase)
41 (C-phase)

Output Contacts

Start, Run, and Prestart Relays

Rating .... 5 A, 28 Vdc—general purpose, 1.2 A pilot duty, the load must be in parallel with a diode rated at least 3 times the coil current and 3 times the coil voltage.

Terminals

START... 19, 20
RUN... 21, 22
PRE 23, 24

Programmable Relays (4)

Rating .... 2 A, 28 Vdc—general purpose, 1.2 A pilot duty, the load must be in parallel with a diode rated at least 3 times the coil current and 3 times the coil voltage.

Terminals

Output 1.. 26, 25 (common)
Output 2.. 27, 25 (common)
Output 3.. 29, 28 (common)
Output 4.. 30, 28 (common)

The programmable relays share common terminals: terminal 25 is used for outputs 1 and 2, terminal 28 is used for outputs 3 and 4.

Metering

Generator and Bus Voltage (rms)

Metering Range............................... 0 to 576 Vac (direct measurement)
577 to 99,999 Vac (through VT using VT ratio setting)
VT Ratio Range............................... 1:1 to 125:1 in primary increments of 1
Accuracy*....................................... ±3.0% of programmed rated voltage or ±3 Vac
Display Resolution .... 1 Vac

* Voltage metering indicates 0 V when generator voltage is below 2% of the full-scale rating.

Generator Current (rms)

Generator current is measured at the secondary windings of user-supplied 1 A or 5 A CTs.

Metering Range................................ 0 to 5,000 Aac
CT Primary Range .... 1 to 5,000 Aac in primary increments of 1 Aac
Accuracy*....................................... ±3.0% of programmed rated current or ±3 Aac
Display Resolution .... 1 Aac

* Current metering indicates 0 A when generator current is below 2% of the full-scale rating.

Generator and Bus Frequency

Frequency is sensed through the generator and bus voltage inputs (phases A and B).

Metering Range................................ 10 to 72 Hz
Accuracy.. ±0.25% or 0.05 Hz
Display Resolution .... 0.1 Hz

Apparent Power

Indicates total kVA and individual line kVA (4-wire, line-to-neutral or 3-wire, line-to-line).

Measurement/Calculation Methods

Total .... kVA = ($V_{L-L} \times I_L \times \sqrt{3}$) ÷ 1000
4-Wire, Line-to-Neutral..................... kVA calculated with respect to neutral
3-Wire, Line-to-Line.......................... A-phase kVA = $V_{AB} \times I_A \div 1000 \div \sqrt{3}$
B-phase kVA = $V_{BC} \times I_B \div 1000 \div \sqrt{3}$
C-phase kVA = $V_{CA} \times I_C \div 1000 \div \sqrt{3}$
Accuracy.. ±5% of the full-scale indication or ±6 kVA ∗

∗ Applies when temperature is between –40°C to +70°C. KVA metering indicates 0 kVA when the generator kVA is below 2% of the full-scale rating.

Power Factor

Metering Range................................ 0.2 leading to 0.2 lagging
Calculation Method .... PF = cosine of the angle between phase AB voltage (Vab) and phase A current (Ia) *
Accuracy.. ±0.02 †

* In single-phase AC-connected machines, it is the cosine of the angle between phase CA voltage (Vca) and phase C current (Ic).

† Applies when temperature is between –40°C to +70°C (–40°F to +158°F).

Note
For the DGC-2020ES to correctly meter power factor, the generator must be rotating in the same phase sequence as dictated by the generator phase rotation setting.

Real Power

Indicates total kW and individual line kW (4-wire, line-to-neutral or 3-wire line-to-line)

Measurement/Calculation Methods

Total .... PF × Total kVA
4-Wire, Line-to-Neutral..................... kW calculated with respect to neutral

3-Wire, Line-to-Line.......................... A-phase kW = $V_{AB} \times I_A \times PF \div 1000 \div \sqrt{3}$
B-phase kW = $V_{BC} \times I_B \times PF \div 1000 \div \sqrt{3}$
C-phase kW = $V_{CA} \times I_C \times PF \div 1000 \div \sqrt{3}$
Accuracy.. ±5% of the full-scale indication or ±4 kW ∗

∗ Applies when temperature is between –40°C to +70°C. KW metering indicates 0 kW when the generator kW is below 2% of the full-scale rating.

Oil Pressure

Metering Range................................ 0 to 150 psi, 0 to 10.3 bar, or 0 to 1,034 kPa
Accuracy.. ±3% of actual indication or ±2 psi, ±0.12 bar, or ±12 kPa (subject to accuracy of sender)
Display Resolution .... 1 psi, 0.1 bar, or 1 kPa

Coolant Temperature

Metering Range................................ 32 to 410°F or 0 to 204°C
Accuracy.. ±3% of actual indication or ±2° (subject to accuracy of sender)

Battery Voltage

Metering Range................................ 6 to 32 Vdc
Accuracy.. ±3% of actual indication or ±0.2 Vdc
Display Resolution .... 0.1 Vdc

Engine RPM

Metering Range................................ 0 to 4,500 rpm
Accuracy*.. ±2% of actual indication or ±2 rpm
Display Resolution .... 2 rpm

* When engine speed is below 2% of full-scale, reported rpm is 0.

Engine Run Time

Engine run time is retained in nonvolatile memory.

Metering Range................................ 0 to 99,999 hours
Update Interval................................ 6 min
Accuracy.. ±1% of actual indication or ±12 min
Display Resolution .... 1 minute

Maintenance Timer

Maintenance timer indicates the time remaining until genset service is due. Value is retained in nonvolatile memory.

Metering Range................................ 0 to 5,000 hours
Update Interval................................ 6 min
Accuracy.. ±1% or actual indication or ±12 min
Display Resolution .... 1 minute

Fuel Level

Metering Range................................ 0 to 100%
Accuracy.. ±3% (subject to accuracy of sender)
Display Resolution 1.0%

Generator Protection Functions

Overvoltage (59) and Undervoltage (27)

Pickup Range .... 70 to 1,000 Vac
Pickup Increment .... 1 Vac
Inhibit Frequency Range .... 20 to 66 Hz (27 function only)
Activation Delay Range .... 0 to 30 s
Activation Delay Increment .... 0.1 s

Note
The maximum voltage that can be safely applied to the DGC-2020ES is 576 V. The pickup range is higher so that when the low-line override is used, and the scale factor is 0.5 or less, effective protection levels of 500 V can be reached with a scale factor of 0.5.

Underfrequency (81U) and Overfrequency (81O)

Pickup Range .... 45 to 66 Hz
Pickup Increment .... 0.1 Hz
Activation Delay Range .... 0 to 30 s
Activation Delay Increment .... 0.1 s
Inhibit Voltage Range .... 70 to 576 Vac (81U function only)

Overcurrent (50)

Pickup Range .... 0.18 to 1.18 Aac (1 A current sensing)
0.9 to 7.75 Aac (5 A current sensing)
Time Dial Range .... 0 to 7,200 s (fixed time curve)
Time Dial Increment 0.1

Phase Imbalance (47)

Pickup Range .... 5 to 100 Vac
Pickup Increment .... 1 Vac
Activation Delay Range .... 0 to 30 s
Activation Delay Increment .... 0.1 s

Logic Timers

Hours Setting Range .... 0 to 250
Hours Setting Increment 1
Minutes Setting Range .... 0 to 250
Minutes Setting Increment 1
Seconds Setting Range .... 0 to 1,800
Seconds Setting Increment 0.1
Accuracy .... ±15 ms

Communication Interface

USB

Specification Compatibility .... USB 2.0
Data Transfer Speed .... 115,200 baud
Connector Type .... Mini-B jack

RDP-110

Minimum Wire Size .... 20 AWG

Maximum Wire Length .... 4,000 feet (1,219 meters)
Terminals... 11 (RDP TxD+), 10 (RDP TxD–)

CAN

Differential Bus Voltage.................... 1.5 to 3 Vdc
Maximum Voltage .... –32 to +32 Vdc with respect to negative battery terminal
Communication Rate......................... 250 kb/s
Terminals... 14 (low), 13 (high), and 15 (shield)

Notes

1. If the DGC-2020ES is providing one end of the J1939 bus, a 120 ohm, ½ watt terminating resistor should be installed across terminals 14 (CANL) and 13 (CANH).
2. If the DGC-2020ES is not providing one end of the J1939 bus, the stub connecting the DGC-2020ES to the bus should not exceed 914 mm (3 ft) in length.
3. The maximum bus length, not including stubs, is 40 m (131 ft).
4. The J1939 drain (shield) should be grounded at one point only. If grounded elsewhere, do not connect the drain to the DGC-2020ES.

Real-Time Clock

Clock has leap year and selectable daylight saving time correction. Backup capacitor and backup battery sustain timekeeping during losses of DGC-2020ES control power.

Resolution .... 1 s
Accuracy.. ±1.73 s/d at 25°C

Clock Holdup

Capacitor Holdup Time .... Up to 24 hours depending on conditions
Battery Holdup Time .... Approximately 10 years depending on conditions

Liquid Crystal Display (LCD)

Display .... 128 by 64 dot pixels LCD with LED Backlight
Operating Temperature.................... –40 to +70°C (–40 to +158°F)
Storage Temperature....................... –40 to +80°C (–40 to +176°F)

LCD Heater

The ambient temperature is monitored by a temperature sensor located near the LCD inside the DGC-2020ES. The LCD heater turns on when the ambient temperature falls below 0°C (32°F). The heater turns off when the ambient temperature rises above 5°C (41°F). This range of operation implements 5°C (9°F) of hysteresis between when the heater turns on and turns off.

Type Tests

Shock and Vibration EN60068-2-6
Dielectric Strength............................ IEC 255-5
Impulse EN60664-1
Transients.. EN61000-4-4
Static Discharge EN61000-4-2

Shock

Withstands 15 G in three perpendicular planes.

Vibration

Tested in three mutually perpendicular planes for 8 hours over the following ranges:
3 to 25 Hz at 0.063 inches (1.6 mm), peak amplitude
25 to 2,000 Hz at 5G

Radio Interference

Type tested using a 5 W, hand-held transceiver operating at random frequencies centered around 144 and 440 MHz with the antenna located within 150 mm (6”) of the device in both vertical and horizontal planes.

HALT (Highly Accelerated Life Testing)

HALT is used by Basler Electric to prove that our products will provide the user with many years of reliable service. HALT subjects the device to extremes in temperature, shock, and vibration to simulate years of operation, but in a much shorter period span. HALT allows Basler Electric to evaluate all possible design elements that will add to the life of this device. As an example of some of the extreme testing conditions, the DGC-2020ES was subjected to temperature tests (tested over a temperature range of –100°C to +130°C), vibration tests (of 5 to 50 G at +20°C), and temperature/vibration tests (tested at 50 G over a temperature range of –95°C to +125°C). Combined temperature and vibration testing at these extremes proves that the DGC-2020ES is expected to provide long-term operation in a rugged environment. Note that the vibration and temperature extremes listed in this paragraph are specific to HALT and do not reflect recommended operation levels.

Ignition System

Tested in close proximity to an unshielded, unsuppressed Altronic DISN 800 Ignition System.

Environment

Operating Temperature .... –40 to +158°F (–40 to +70°C)
Storage Temperature .... –40 to +185°F (–40 to +85°C)
Humidity .... IEC 68-2-38
Salt Spray... IEC 68-2-52
Ingress Protection .... IEC IP56 for front panel

UL Approval

The DGC-2020ES is a Recognized Component applicable to the Canadian and US safety standards and requirements by UL. The product is covered under UL File (E97035 FTPM2/FTPM8) and evaluated to the following standards through UL:

- UL6200
- CSA C22.2 No. 14

CSA Certification

The DGC-2020ES is Certificated under CSA report 1042505 (LR23131-138S) and evaluated to the following standards through CSA:

- CSA C22.2 No. 0
- CSA C22.2 No. 14

CE Compliance

This product has been evaluated and complies with the relevant essential requirements set forth in the following EC Directives and by the EU legislation:

- Low Voltage Devices (LVD) - 2014/35/EU
- Electromagnetic Compatibility (EMC) - 2014/30/EU
- Hazardous Substances (ROHS2) -2011/65/EU

Harmonized Standards used for evaluation:

- EN 50178 - *Electronic Equipment for use in Power Installations*
- EN 61000-6-4 - *Electromagnetic Compatibility (EMC), Generic Standards, Emission Standard for Industrial Environments*
- EN 61000-6-2 - *Electromagnetic Compatibility (EMC), Generic Standards, Immunity for Industrial Environments*
- EN 50581 – *Technical Documentation for the Assessment of Electrical and Electric Products with Respect to the Restriction of Hazardous Substances (ROHS2)*

NFPA Compliance

Designed to comply with NFPA Standard 110, *Standard for Emergency and Standby Power.*

EAC Mark (Eurasian Conformity)

- TC RUUS.HO03.B.00742

Physical

Weight .... 1.9 lb (0.86 kg)
Dimensions...................................... See the *Mounting* chapter.

8 • Maintenance

Preventive maintenance consists of periodically checking that the connections between the DGC-2020ES and the system are clean and tight. Periodically check that the mounting hardware is clean and fastened with the proper amount of torque. DGC-2020ES units are manufactured using state-of-the-art, surface-mount technology. These components are encased in potting material. As such, Basler Electric recommends that no repair procedures be attempted by anyone other than Basler Electric personnel.

Storage

This device contains long-life aluminum electrolytic capacitors. For devices that are not in service (spares in storage), the life of these capacitors can be maximized by energizing the device for 30 minutes once per year.

9 • Troubleshooting

If you do not get the results that you expect from the DGC-2020ES, first check the programmable settings for the appropriate function. Use the following troubleshooting procedures when difficulties are encountered in the operation of your genset control system.

Communications

USB Port Does Not Operate Properly

Step 1. Verify that the proper port of your computer is being used. For more information, refer to the *Communication* chapter in the *Configuration* manual.

CAN Communication Does Not Operate Properly

Step 1: Verify that there is a 120-ohm termination resistor on each end of the bus section of the wiring, and that there are not any termination resistors at any node connections that are on stubs from the main bus.

Step 2: Check all CAN wiring for loose connections and verify that the CAN H and CAN L wires have not gotten switched somewhere on the network.

Step 3: Verify that the cable length of the bus section of the wiring does not exceed 40 meters (131 feet), and verify that any stubs from the main bus do not exceed 3 meters (9.8 feet) in length.

Step 4: If the engine is equipped with a Volvo or MTU ECU, verify that the ECU Configuration setting is set to match the actual ECU configuration.

Inputs and Outputs

Programmable Inputs Do Not Operate as Expected

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter.

Step 2. Confirm that the inputs are programmed properly.

Step 3. Ensure that the input at the DGC-2020ES is actually connected to the BATT– terminal (17).

Programmable Outputs Do Not Operate as Expected

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter.

Step 2. Confirm that the outputs are programmed properly.

Metering/Display

Incorrect Display of Battery Voltage, Coolant Temperature, Oil Pressure, or Fuel Level

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter.

Step 2. Confirm that the SENDER COM terminal (2) is connected to the negative battery terminal and the engine-block side of the senders. Current from other devices sharing this connection can cause erroneous readings.

Step 3. If the displayed battery voltage is incorrect, ensure that the proper voltage is present between the BATT+ terminal (18) and the SENDER COM terminal (2).

Step 4. Verify that the correct senders are being used.

Step 5. Use a voltmeter connected between the BATT– terminal (17) and the SENDER COM terminal (2) on the DGC-2020ES to verify that there is no voltage difference at any time. Any voltage differences may manifest themselves as erratic sender readings. Wiring should be corrected so that no differences exist.

Step 6: Check the sender wiring and isolate sender wiring from any of the ac wiring in the system. The sender wiring should be located away from any power ac wiring from the generator and any ignition wiring. Separate conduits should be used for sender wiring and any ac wiring.

Incorrect Display of Generator Voltage

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter.

Step 2. Ensure that the proper voltage is present at the DGC-2020ES voltage sensing inputs (40, 41, 43, and 45).

Step 3. Verify that the voltage transformer ratio and sensing configuration is correct.

Step 4. Confirm that the voltage sensing transformers are correct and properly installed.

Incorrect Measurement or Display of Generator Current

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter.

Step 2. Ensure that the proper current is present at the DGC-2020ES current sensing inputs 33, 34, 35, 36, 37, and 38.

Step 3. Verify that the current sensing transformer ratios are correct.

Step 4. Confirm that the current sensing transformers are correct and properly installed.

Incorrect Display of Engine RPM

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter.

Step 2. Verify that the flywheel teeth setting is correct.

Step 3. Verify that the prime mover governor is operating properly.

Step 4. Verify that the measured frequency of the voltage at the MPU input (31 and 32) is correct.

Step 5. If the MPU is shared with the governor, verify that the polarity of the MPU input to the governor matches the polarity of the MPU input to the DGC-2020ES.

DGC-2020ES Indicates Incorrect Power Factor

Check the rotation of the machine and the labeling of the A-B-C terminals. The machine must be rotating in the same phase sequence as dictated by the generator phase rotation setting for correct power factor metering. A power factor indication of 0.5 with resistive load present is a symptom of incorrect phase rotation.

LCD is Blank and all LEDs are Flashing at Approximately Two-Second Intervals

This indicates that the DGC-2020ES does not detect that valid application firmware is installed. The unit is running its boot loader program, waiting to accept a firmware upload.

Step 1. Start BESTCOMS*Plus*®. Use the top pull-down menu and select FILE > NEW > DGC-2020ES.

Step 2. Select COMMUNICATIONS > UPLOAD DEVICE FILES and select the device package file that contains the firmware and language you want to upload.

Step 3. Check the boxes for DGC-2020ES Firmware and DGC-2020ES Language Module. Click the UPLOAD button to start the upload process.

Ground Faults Detected in Ungrounded System Applications

Step 1: Verify that there is no connection from the neutral connection of the generator to the system ground.

Step 2: Perform insulation resistance tests on the system wiring to check for insulation integrity in the overall system.

Step 3: If ground faults are detected on a DGC-2020ES in an ungrounded system application, it is recommended that potential transformers be employed on the voltage sensing inputs to provide full isolation between the DGC-2020ES and monitored voltage phases.

Step 4: If potential transformers are in place, remove the connectors from the DGC-2020ES one at a time. If removal of a connector removes the ground fault, check the system wiring to that connector and out into the system to verify that connections are secure and all wiring insulation is in good condition.

Generator Breaker and Mains Breaker

Generator Breaker Will Not Close to a Dead Bus

Step 1: Review the description of how the generator breaker logic element functions contained in the GENBRK logic element description in the BESTlogic™*Plus* chapter in the *Configuration* manual.

Step 2: Review the section on breaker close requests in the *Breaker Management* chapter in the *Configuration* manual.

Step 3: Navigate to the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE > GEN BREAKER screen and set DEAD BUS CL ENBL to ENABLE.

Step 4: Verify that the Generator status is stable. The breaker will not close if the generator status is not stable. Check status by using the Metering Explorer in BESTCOMS*Plus* and verify that when the generator is running, the GEN STABLE status LED is lit. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen.

Step 5: Verify the bus status is DEAD. Check status by using the Metering Explorer in BESTCOMS*Plus* and verify that when the generator is running, the BUS DEAD status LED is lit. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen.

Step 6: Verify the connections in BESTlogic*Plus* Programmable Logic to the generator breaker logic element. The *Status* input must be driven by an “A” or normally open contact from the generator breaker. The OPEN and CLOSE command inputs on the left side of the logic block are inputs for open and close commands. These can be wired to physical inputs if it is desired to have open and close command switches. If they are wired, they must either be pulsed inputs, or some logic must be employed so that the open and close command inputs are never driven at the same time. If these are both driven at the same time, the breaker is receiving open and close commands simultaneously. The breaker will not change state if it is being commanded to open and close at the same time.

Step 7: Verify the breaker is receiving a close command. Breaker close command sources are:

- The DGC-2020ES itself when the automatic mains fail transfer (ATS) feature is enabled.
- The DGC-2020ES itself when the RUN WITH LOAD logic element receives a *Start* pulse in the programmable logic.
- The DGC-2020ES itself when started from the Exercise Timer and the Run with Load box is checked in the Generator Exerciser settings.
- Manual Breaker Close Input Contacts applied to the Open and Close inputs on the left side of the Generator Breaker logic element in the programmable logic.

Step 8: Verify the wiring to the breaker from the DGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker open output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the

Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

Generator Breaker Does Not Open When It Should

Step 1: Review the description of how the generator breaker logic element functions contained in the GENBRK logic element description in the *BESTlogicPlus* chapter in the *Configuration* manual.

Step 2: Review the section on breaker operation requests in the *Breaker Management* chapter in the *Configuration* manual.

Step 3: Verify the connections in BESTlogic*Plus* Programmable Logic to the generator breaker logic element. The *Status* input must be driven by an "A" or normally open contact from the generator breaker. The OPEN and CLOSE command inputs on the left side of the logic block are inputs for open and close commands. These can be wired to physical inputs if it is desired to have open and close command switches. If they are wired, they must either be pulsed inputs, or some logic must be employed so that the open and close command inputs are never driven at the same time. If these are both driven at the same time, the breaker is receiving open and close commands simultaneously. The breaker will not change state if it is being commanded to open and close at the same time.

Step 4: Verify the breaker is receiving an open command. Breaker open command sources are:

- The DGC-2020ES itself when the automatic transfer (ATS) feature is enabled.
- The DGC-2020ES itself when the RUN WITH LOAD logic element receives a *Stop* pulse in the programmable logic.
- The DGC-2020ES itself when shutting down the engine due to an active alarm.
- The DGC-2020ES itself when ending a run session from the Exercise Timer and the *Run with Load* box is checked in the Generator Exerciser settings.
- Manual Breaker Open Input Contacts applied to the Open and Close inputs on the left side of the Generator Breaker logic element in the programmable logic.

Step 5: Verify the wiring to the breaker from the DGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker open output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

Mains Breaker Does Not Open When Mains Fails

Step 1: Verify that a Mains Breaker has been configured by examining the settings on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 2: Verify the mains breaker has been correctly included in the programmable logic.

Step 3: Verify that the MAINS FAIL TRANSFER parameter is set to ENABLE on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 4: Verify that a failure of the mains is detected by the DGC-2020ES. Check status using the Metering Explorer in BESTCOMS*Plus* and verify that the MAINS FAIL status LED is lit when the power on the DGC-2020ES bus voltage input is either out of voltage or frequency range. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen to achieve correct detection.

Step 5: Verify the wiring to the breaker from the 14BDGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the

OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker close output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

Mains Breaker Does Not Close After Mains Returns

Step 1: Verify that a Mains Breaker has been configured by examining the settings on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 2: Verify the mains breaker has been correctly included in the programmable logic.

Step 3: Verify that the MAINS FAIL TRANSFER parameter is set to ENABLE on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 4: Verify that stable mains power is detected by the DGC-2020ES. Check status using the Metering Explorer in BESTCOMS*Plus* and verify that the MAINS STABLE status LED is lit when the power on the DGC-2020ES bus voltage input is good. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen to achieve correct detection.

Step 5: Verify the wiring to the breaker from the DGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker open output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

DGC-2020ES Front Panel Debug Screen

There is one debug screen in the DGC-2020ES that can be useful for debugging I/O module related issues. The following debug screen is available: CEM DEBUG

CEM DEBUG

This screen shows the binary data that is being sent between the CEM-2020 (Contact Expansion Module) and the DGC-2020ES.

The CEM DEBUG screen is located on the front panel at SETTINGS > SYSTEM PARAMS > REMOTE MODULE SETUP > CEM SETUP > CEM DEBUG MENU.

The following parameters are visible on the CEM DEBUG screen:

- DGC TO CEM BP: DGC-2020ES to CEM-2020 Binary Points. This is the status of the CEM-2020 output relays being transmitted from the DGC-2020ES to the CEM-2020. This is a 32-bit, bit packed number representing the desired states of the CEM-2020 outputs. The left most bit is the first output, etc.
- CEM TO DGC BP: CEM-2020 to DGC-2020ES Binary Points. This is the status of the CEM-2020 inputs being transmitted from the CEM-2020 to the DGC-2020ES. This is a 32-bit, bit packed number representing the metered states of the CEM-2020 inputs. The left most bit is the first input, etc.

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DGC-2020ES

Digital Genset Controller

Configuration Instruction Manual

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⚠ **WARNING:** California's Proposition 65 requires special warnings for products that may contain chemicals known to the state of California to cause cancer, birth defects, or other reproductive harm. Please note that by posting this Proposition 65 warning, we are notifying you that one or more of the Proposition 65 listed chemicals may be present in products we sell to you. For more information about the specific chemicals found in this product, please visit https://www.basler.com/Prop65.

Preface

This instruction manual provides information about the configuration of the DGC-2020ES Digital Genset Controller. To accomplish this, the following information is provided:

- Device information and security settings
- Configuration via BESTCOMS*Plus*® and the front panel
- Communication settings
- Timekeeping
- Inputs and outputs
- Breaker management, synchronizer, bias control, and multiple generator management
- Alarm configuration
- Protection settings
- BESTlogic™*Plus* programmable logic
- Troubleshooting

Conventions Used in this Manual

Important safety and procedural information is emphasized and presented in this manual through Warning, Caution, and Note boxes. Each type is illustrated and defined as follows.

Warning!
Warning boxes call attention to conditions or actions that may cause personal injury or death.

Caution
Caution boxes call attention to operating conditions that may lead to equipment or property damage.

Note
Note boxes emphasize important information pertaining to Digital Genset Controller installation or operation.

DGC-2020ES Instruction Manual Catalog

Available instruction manuals for the DGC-2020ES are listed in Table 1.

Table 1. Instruction Manuals

Part Number	Description
9469200993	Quick Start
9469200994	Installation
9469200995	Configuration (this manual)
9469200996	Operation
9469200997	Accessories

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Warning!
READ THIS MANUAL. Read this manual before installing, operating, or maintaining the DGC-2020ES. Note all warnings, cautions, and notes in this manual as well as on the product. Keep this manual with the product for reference. Only qualified personnel should install, operate, or service this system. Failure to follow warning and cautionary labels may result in personal injury or property damage. Exercise caution at all times.

Basler Electric does not assume any responsibility to compliance or noncompliance with national code, local code, or any other applicable code. This manual serves as reference material that must be well understood prior to installation, operation, or maintenance.
For terms of service relating to this product and software, see the *Commercial Terms of Products and Services* document available at www.basler.com/terms.
This publication contains confidential information of Basler Electric Company, an Illinois corporation. It is loaned for confidential use, subject to return on request, and with the mutual understanding that it will not be used in any manner detrimental to the interests of Basler Electric Company and used strictly for the purpose intended. It is not the intention of this manual to cover all details and variations in equipment, nor does this manual provide data for every possible contingency regarding installation or operation. The availability and design of all features and options are subject to modification without notice. Over time, improvements and revisions may be made to this publication. Before performing any of the following procedures, contact Basler Electric for the latest revision of this manual.
The English-language version of this manual serves as the only approved manual version.

Revision History

A historical summary of the changes made to this instruction manual is provided below. Revisions are listed in reverse chronological order.

Visit www.basler.com to download the latest hardware, firmware, and BESTCOMS*Plus*® revision histories.

Instruction Manual Revision History

Manual Revision and Date	Change
B, Dec-19	• Removed Rev Letter from all pages. • Changed sequential numbering to sectional numbering. • Moved Instruction Manual Revision History into Preface. • Removed standalone Revision History chapter. (Revision histories for hardware, firmware, and software are now in separate documents on www.basler.com.) • Added support for firmware version 1.04.00 and BESTCOMS*Plus* version 4.01.00.
A1, Apr-19	• Updated Proposition 65 statement
A, Sep-18	• Added description of voltage sensing fail function in the Engine Sender Inputs chapter • Updated Revision History chapter
—, Apr-17	• Initial release

Contents

1 • Security

Password protection guards against unauthorized changing of DGC-2020ES settings. Three levels of password protection are available. Each level is described in the following paragraphs.

- *OEM Access.* This password level allows access to all settings. The default, OEM-access password is **OEM**.
- *Settings Access.* This password level allows all except uploading of firmware and clearing of device event log. The default, settings-access password is **SET**.
- *Operator Access.* The default, operator-access password is **OP**. This password level allows all settings to be read and allows changes to be made to the following:
    - LCD Contrast
    - Sleep Mode
    - Date/Time
    - All Sender Fail Time Delays
    - Metric Conversion
    - Low Fuel Pre-Alarm Level
    - Low Fuel Alarm Level
    - Pre-Start Contact after Cranking
    - Cooldown Time
    - Pre-Crank Time Delay
    - Reset of Maintenance Interval
    - All controls on the Control screen available via the Metering Explorer in BESTCOMS*Plus*®

Changing Passwords

Passwords can be changed only after communication between the PC and DGC-2020ES is established. Changes to passwords are made through the *Device Security Setup* screen. Use the Settings Explorer in BESTCOMS*Plus* to open the *General Settings, Device Security Setup* screen.

The content of the *Device Security Setup* screen depends on the password level used when accessing the screen. For example, someone logged in with a settings-access password will be able to change only the settings-access and operator-access passwords - not the OEM-access password.

The BESTCOMS*Plus* Device Security Setup screen is illustrated in Figure 1-1. All three access levels are shown.

A password is changed by clicking on the access level, entering the new password, and then clicking on the *Save Password* button. DGC-2020ES passwords are case sensitive.

Saving Passwords in a DGC-2020ES Settings File

The passwords can be modified while BESTCOMS*Plus* is connected to a DGC-2020ES. The settings from the BESTCOMS*Plus* session can then be saved into a settings file. The settings file will contain the new passwords. Also, the passwords in a settings file can be modified off line, saved with the file, and then later loaded into a DGC-2020ES.

Saving Passwords to a Settings File when On Line

The following procedure describes how to save passwords to a settings file when BESTCOMS*Plus* is connected to a DGC-2020ES (on line):

1. When connected to a DGC-2020ES with BESTCOMS*Plus*, click on SETTINGS EXPLORER > GENERAL SETTINGS > DEVICE SECURITY.
2. You will be prompted to enter a password.

3. Enter a password that is of a level as high as or higher than the password you wish to modify. BESTCOMS*Plus* will display all passwords of a level equal to and below the level of the password that was entered.
4. Click on the password you wish to modify. Type in the new password under the “Password” setting that became active when the password to modify was clicked.
5. Click the “Save” button to save the new password into BESTCOMS*Plus* memory (it’s not in the DGC-2020ES yet).
6. Repeat steps 4 and 5 for all password levels you with to modify.
7. Once all password modifications are complete, in the main menu of BESTCOMS*Plus*, select *Upload Security* from the *Communications* pull-down menu. This is the step where passwords are sent to the DGC-2020ES. Failure to perform this step might cause all password modifications to be lost.
8. Close the *Device Security* tab in BESTCOMS*Plus*.
9. Re-open the *Device Security* tab in BESTCOMS*Plus*. This will read the passwords back out of the DGC-2020ES.
10. Verify the passwords obtained from the DGC-2020ES are correct.
11. Once all desired settings have been loaded into the DGC-2020ES, save the settings file. The resulting settings file has the passwords saved as part of the saved settings.
12. At this point, the password information has been successfully saved in the settings file. The process of saving the passwords into the settings file is complete.

Saving Passwords to a Settings File when Off Line

The following procedure describes how to save passwords to a settings file when working off line:

1. When the settings file is open in BESTCOMS*Plus*, click on SETTINGS EXPLORER > GENERAL SETTINGS > DEVICE SECURITY.
2. You will be prompted to enter a password.
3. Enter a password that is of a level as high as or higher than the password you wish to modify. BESTCOMS*Plus* will display all passwords of a level equal to and below the level of the password that was entered.
4. Click on the password you wish to modify. Type in the new password under the “Password” setting that became active when the password to modify was clicked.
5. Click the “Save” button to save the new password into BESTCOMS*Plus* memory.
6. Repeat steps 4 and 5 for all password levels you wish to modify.
7. Close the *Device Security* tab in BESTCOMS*Plus*.
8. Save the settings file.
9. Close the settings file by clicking on the X in the upper right-hand corner of the settings file, or close BESTCOMS*Plus*.
10. Restart BESTCOMS*Plus* if you have shut it down.
11. Re-open the settings file that you have saved with the password information.
12. When the settings file is open in BESTCOMS*Plus*, click on SETTINGS EXPLORER > GENERAL SETTINGS > DEVICE SECURITY.
13. You will be prompted to enter a password.
14. Enter the password for the highest level of password modified; it should be the new modified password.
15. When passwords are shown, verify they are correct.

16. At this point the password information has been successfully saved in the settings file. The process of saving the passwords into the settings file is complete.

Loading Passwords from a Settings File into the DGC-2020ES

1. Connect to the DGC-2020ES with BESTCOMS*Plus*.
2. Once connected, click the "Open File" button that is used to load a settings file into the DGC-2020ES.
3. You will be prompted asking if you wish to load settings and logic into the DGC-2020ES. Select *Yes* if you need to upload settings logic. Select *No* if all you need to do is update security. If you select *No*, the settings file opens into BESTCOMS*Plus* memory.
4. Whether you have loaded settings and logic to the DGC-2020ES or not, the next step is to select *Upload Security* from the *Communications* pull-down menu.
5. DO NOT try to view the passwords before performing step 4. This would download the existing passwords from the DGC-2020ES and they will overwrite the new passwords that were loaded into BESTCOMS*Plus* memory from opening the settings file.
6. If you are prompted for a password, enter a password of a level equal to that of the highest-level password you wish to modify.
7. The passwords are uploaded to the DGC-2020ES.
8. After you have uploaded the new passwords, select GENERAL SETTINGS > DEVICE SECURITY SETUP in the settings explorer of BESTCOMS*Plus.* Verify the passwords are correct.
9. This concludes loading passwords from a settings file into the DGC-2020ES.

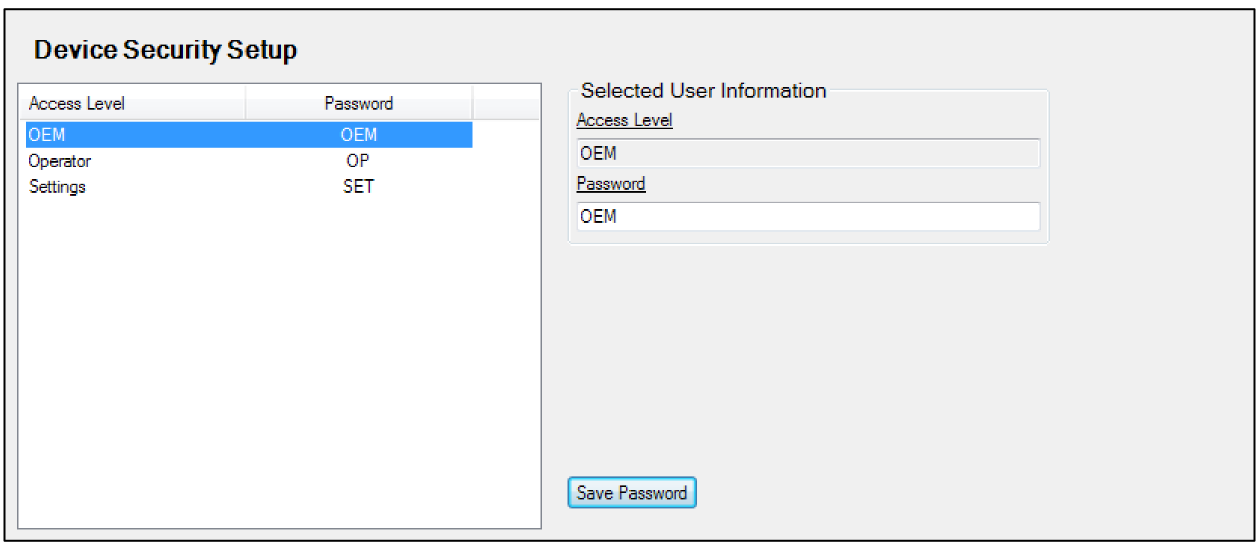


Figure 1-1. Settings Explorer, General Settings, Device Security Setup Screen

2 • Configuration through the Front Panel

This chapter provides information on configuring DGC-2020ES settings through the front panel.

Display Setup

The DGC-2020ES LCD can be customized to fit the needs of your specific application. The options can be adjusted using the front panel controls and through BESTCOMS*Plus*®. The display options are described below.

The *Front Panel HMI* screen is found in the BESTCOMS*Plus*® *Settings Explorer* under the *General Settings* category. If using the front panel, navigate to Settings > General Settings > Front Panel HMI.

Figure 2-1 shows the BESTCOMS*Plus*® Front Panel HMI settings screen.

1. LCD Contrast - Adjust this setting to reach the desired level of LCD contrast.
2. Front Panel Sleep Mode - Select *Enable* to send the DGC-2020ES into sleep mode. In sleep mode, the LEDs and LCD backlight turn off after 15 minutes of inactivity on the front panel to minimize battery drain.
3. One Line Diagram Display Enable - Select *Enable* to display one-line diagram.
4. Engine Hours Display – When Engine Hours Display is enabled, engine run-time hours are displayed on the front-panel Overview screen.
5. Overview Screen Type – The Overview Screen Type can be set for Text or Symbolic. When set to Symbolic, the parameters names are displayed as symbols.
6. Exhaust Display – When Exhaust Display is set to Inverted, the LCD background, where exhaust status is displayed, is dark with light text. When set to Normal, the LCD background is light with dark text.
7. Exhaust Status Display Screen – The Exhaust Status Display Screen setting defines where DEF level and exhaust status display are shown. Select Overview Screen to show the DEF level and exhaust status display on the Overview screen or select All Operating Screens to show the DEF level and exhaust status display on all screens that automatically appear during normal operation.
8. Battery Charger Display – When Battery Charger Display is enabled, battery charger output voltage and current are displayed on the front-panel Overview screen.
9. Display Fuel Level Below – Adjust this setting to display fuel level on the front-panel Overview screen only when the fuel level is below the desired value. When fuel level is not displayed, engine RPM is displayed in its place.
10. Language Selection - Select from Chinese, English, French, German, or Spanish.
11. Scrolling Screens - Specify the parameters which are to appear on the front-panel LCD display.
    a. Configure the *Configurable HMI Summary Settings.*
    b. Set the *Scrolling Screen Enable* to *Enable*.
    c. Set the *Scrolling Screen Scroll Delay* parameter to the desired value.
12. Phase Toggle Delay - Set the phase toggle delay to a nonzero value if automatic scrolling through the phase information in the standard overview screen on the front panel is desired. If it is left at zero, scrolling through phase information is accomplished using the up and down arrow buttons.
13. Initializing Message 1 - This parameter defines the first line of text that appears on the front panel of the DGC-2020ES as it is going through its power up and initializing sequence.
14. Initializing Message 2 - This parameter defines the second line of text that appears on the front panel of the DGC-2020ES as it is going through its power up and initializing sequence.

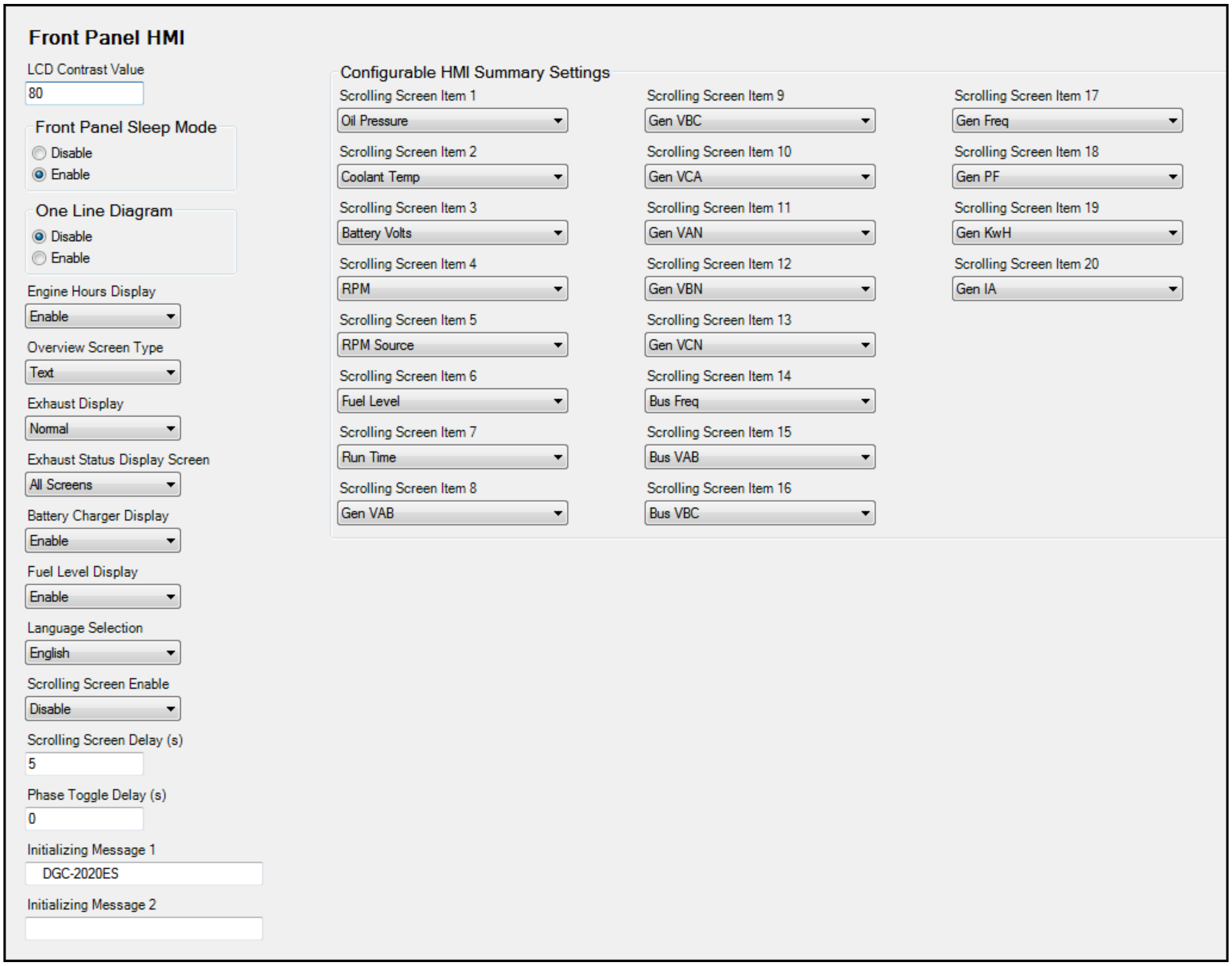


Figure 2-1. Settings Explorer, General Settings, Front Panel HMI Screen

Settings Menu

The display structure of the Settings menu on the front panel is provided below. Refer to the *Controls and Indicators* chapter in the *Operation* manual for a full description of DGC-2020ES controls and indicators.

GENERAL SETTINGS

- **FRONT PANEL HMI**
    - SUMMARY VIEW
    - SCROLL DELAY
    - PH TOG DELAY
    - LCD CONTRAST
    - SLEEP MODE
    - LANGUAGE
    - CONFIGURABLE METERING
        - ITEM X (X = 1 to 20)
    - ONE LINE DIAGRAM
    - ENG HRS DISPLAY
    - OVERVIEW
    - EXH DISPLAY
    - EXH DISPL SCRN
    - BATT CHG DISPLAY
    - FUEL LVL DISPLAY

- **CONFIGURE DATE/TIME**
  - YEAR
  - MONTH
  - DAY
  - HOURS
  - MINUTES
  - SECONDS
  - UTC OFFSET
  - DST ENABLED
  - CLK NOT SET WRN
- **VIEW DATE/TIME**
- **VERSION INFO**
  - DGC-2020ES
    - FIRMWARE VERSION
    - BOOT CODE VERSION
    - SERIAL NUMBER
    - PART NUMBER
    - MODEL NUMBER
    - LANGUAGE VERSION
    - LANGUAGE PART NUM
    - FONT VERSION
    - FONT PART NUM
    - STYLE CODE
  - CEM-2020 (Visible when CEM-2020 is enabled.)
    - FIRMWARE VERSION
    - BOOT CODE VERSION
    - SERIAL NUMBER
    - PART NUMBER
    - MODEL NUMBER
    - BUILD DATE

COMMUNICATIONS∗

∗(Visible when the optional J1939 CAN bus is enabled, style code xCx.)

- **CAN BUS SETUP**
  - CAN BUS SETUP
    - CAN BUS ENABLE
    - DTC ENABLE (Visible when CAN BUS is enabled.)
    - SPN CONV METHOD (Visible when CAN BUS is enabled.)
    - CAN BUS ADDR (Visible when CAN BUS is enabled.)
    - ENGINE ECU ADDRESS (Visible when CAN BUS is enabled.)
    - ECU OPT SLCT (Visible when CAN BUS is enabled.)
    - ECU PULSING (Visible when CAN BUS is enabled.)
    - ENG SHTDN TM (Visible when CAN BUS is enabled.)
    - PLS CYCL TM (Visible when CAN BUS is enabled.)
    - ECU SET TM (Visible when CAN BUS is enabled.)
    - RESP TIMEOUT (Visible when CAN BUS is enabled.)
    - COOL TEMP SRC (Visible when CAN BUS is enabled.)
    - OIL PRESS SRC (Visible when CAN BUS is enabled.)
    - ENGINE RUN TM SRC (Visible when CAN BUS is enabled.)
  - ECU SETUP (Visible when CAN BUS is enabled.)
    - ECU CONF
    - CUMMINS ECU SETUP
      - CUMMINS GEN CONTROL
    - ISUZU ECU SETUP
      - CLEAR ECU MEMORY
      - ESCAPE MODE
    - YANMAR ECU SETUP
      - NUMBER OF CYLINDERS
    - GEN DATA TRANSMIT
    - ENGINE PARAM XMT
    - TRIP RESET (Visible when ECU is configured for Standard, Volvo Penta, MTU ADEC, GM/Doosan, Cummins, or MTU Smart Connect.)
    - START MODE

- DPF REGENRATE SETUP (Visible when ECU is configured for Standard, Volvo Penta, MTU ADEC, GM/Doosan, Cummins, or MTU Smart Connect.)
  - DPF MANUAL REGEN
  - DPF REGEN DISABLE
- BATT CHARGER SETUP
  - CHARGER 1 TYPE
  - CHARGER 2 TYPE
- BATT CHARGR PREALARMS
  - CH1 COMMS FAIL
  - CH1 BATTERY FAIL
  - CH1 CHARGER FAIL
  - CH1 AC OFF
  - CH2 COMMS FAIL
  - CH2 BATTERY FAIL
  - CH2 CHARGER FAIL
  - CH2 AC OFF
- SENS CHARGR PREALARMS
  - CH1 THERMAL LIMIT (Visible when CHARGER 1 TYPE is set to SENS)
  - CH1 HI DC VOLTS (Visible when CHARGER 1 TYPE is set to SENS)
  - CH1 LOW DC VOLTS (Visible when CHARGER 1 TYPE is set to SENS)
  - CH1 LO CRANK V (Visible when CHARGER 1 TYPE is set to SENS)
  - CH1 INVLD SETTINGS (Visible when CHARGER 1 TYPE is set to SENS)
  - CH1 SNGL UNIT FL (Visible when CHARGER 1 TYPE is set to SENS)
  - CH2 THERMAL LIMIT (Visible when CHARGER 2 TYPE is set to SENS)
  - CH2 HI DC VOLTS (Visible when CHARGER 2 TYPE is set to SENS)
  - CH2 LOW DC VOLTS (Visible when CHARGER 2 TYPE is set to SENS)
  - CH2 LO CRANK V (Visible when CHARGER 2 TYPE is set to SENS)
  - CH2 INVLD SETTINGS (Visible when CHARGER 2 TYPE is set to SENS)
  - CH2 SNGL UNIT FL (Visible when CHARGER 2 TYPE is set to SENS)
- SPEED SELECT (Visible when ECU is configured for Volvo Penta.)
- ACCEL POSITION (Visible when ECU is configured for Volvo Penta.)
- MODULE TYPE (Visible when ECU is configured for MTU MDEC or MTU ECU7/ECU8.)
- ALIVE MSG (Visible when ECU is configured for MTU MDEC or MTU ECU7/ECU8.)
- SPEED SETUP
  - J1939 RPM ENABLE (Visible when ECU is configured for Standard, Volvo Penta, MTU ADEC, GM/Doosan, Cummins, or MTU Smart Connect.)
  - ENGINE RPM
  - SAVE RPM ADJUSTS
  - RPM BAND WIDTH
  - IDLE RPM
  - RPM CHECKSUM
  - SPEED UP (Visible when ECU is configured for MTU ADEC, MTU MDEC 304, MTU ECU7/ECU8, or MTU Smart Connect.)
  - SPEED DN (Visible when ECU is configured for MTU ADEC, MTU MDEC 304, MTU ECU7/ECU8, or MTU Smart Connect.)
  - TEST OVRSPEED (Visible when ECU is configured for MTU ADEC, MTU MDEC 304, MTU ECU7/ECU8, or MTU Smart Connect.)
  - SPD DMAND SRC (Visible when ECU is configured for MTU ADEC, MTU MDEC 304, MTU ECU7/ECU8, or MTU Smart Connect.)
  - IDLE REQUEST (Visible when ECU is configured for MTU MDEC 304, MTU ECU7/ECU8, or MTU Smart Connect.)
  - INCREASE IDLE (Visible when ECU is configured for MTU MDEC 304, or MTU ECU7/ECU8.)
- ECU SETUP (Visible when ECU is configured for MTU ADEC, MTU MDEC 304, MTU ECU7/ECU8, or MTU Smart Connect.)
  - TRIP RESET (Visible when ECU is configured for MTU MDEC 304, or MTU ECU7/ECU8.)
  - INT OIL PRIME
  - GOV PRM SW (Visible when ECU is configured for MTU ADEC or MTU Smart Connect.)
  - ENG STRT PRIME (Visible when ECU is configured for MTU MDEC 304, or MTU ECU7/ECU8.)
  - FAN OVERRIDE (Visible when ECU is configured for MTU MDEC 304, or MTU ECU7/ECU8.)

                - MODE SWITCH (Visible when ECU is configured for MTU MDEC 304, or MTU ECU7/ECU8.)
                - GOV PARAM SET (Visible when ECU is configured for MTU ECU7/ECU8.)
                - CAN RATING SW 1 (Visible when ECU is configured for MTU ECU7/ECU8.)
                - CAN RATING SW 2 (Visible when ECU is configured for MTU ECU7/ECU8.)
                - DIS CYL CUT 1 (Visible when ECU is configured for MTU MDEC 304, or MTU ECU7/ECU8.)
                - DIS CYL CUT 2 (Visible when ECU is configured for MTU MDEC 304, MTU ECU7/ECU8 or MTU Smart Connect.)
                - OPERATING MODE (Visible when ECU is configured for MTU Smart Connect.)

SYSTEM PARAMS

- **SYSTEM SETTINGS**
    - GEN CONNECT
    - BUS CONNECT
    - RATED kW
    - RATED VOLTS
    - RATED FREQ
    - ALTRNATE FRQ
    - RATED RPM
    - RATED PF
    - ROTATION
    - EPS
        - EPS THRESHLD
        - LOW LINE SF (Visible when an input is selected for the Low Line Override programmable function.)
    - FUEL LVL TYP
    - SYSTEM UNITS
    - PRESSURE UNITS (Visible when Metric is selected for System Units.)
    - BATTERY VOLT
    - FLYWHL TEETH
    - SPEED SOURCE
    - MAINT RESET
    - NFPA LEVEL
    - POWER UP DELAY
- **REMOTE MODULE SETUP**
    - CEM SETUP
        - ENABLE
        - OUTPUTS (Visible when CEM-2020 is enabled.)
        - CAN BUS ADDR (Visible when CEM-2020 is enabled.)
        - VERSION INFO (Visible when CEM-2020 is enabled.)
            - FIRMWARE VERSION
            - BOOT CODE VERSION
            - SERIAL NUMBER
            - PART NUMBER
            - MODEL NUMBER
            - BUILD DATE
        - CEM DEBUG MENU (Visible when CEM-2020 is enabled.)
            - DGC TO CEM BP
            - CEM TO DGC BP
- **CRANK SETTINGS**
    - DISCNCT LMIT
    - PRECRNK DELY
    - PRESTRT CNTCT
    - STYLE
    - # CYCLES (Visible when Cycle is selected for Cranking Style.)
    - CONT TIME (Visible when Continuous is selected for Cranking Style.)
    - CYCLE TIME
    - REST TIME
    - COOLDWN TIME
    - COOLDOWN CONFIG
    - RESTART DELAY
    - OFF MODE COOLDN

- PRESTART REST CONFIG
  - CONF
- OIL PRS CRANK DISC
  - ENABLE
  - CRANK DISC PRS

- **AUTOMATIC RESTART**
  - ENABLE
  - ATTEMPTS
  - INTERVAL
- **EXERCISE TIMER**
  - MODE
  - RUN WITH LOAD
  - START HOUR
  - START MINUTE
  - RUN HOURS
  - RUN MINUTES
- **SENSING TRANS**
  - GEN PT PRI V
  - GEN PT SEC V
  - GEN CT PRI A
  - CT LOW LINE SF (Visible when an input is selected for the Low Line Override programmable function.)
  - BUS PT PRI V
  - BUS PT SEC V
- **RELAY CONTROL**
  - START
  - RUN
  - PRESTART
- **AUTO CONFIG DETECT**
  - ENABLE
  - LOW LINE THRESH
  - 1-PH THRESH
  - 1-PH GEN CONN
- **ENGINE STATISTICS**
  - START YEAR
  - START MONTH
  - START DAY
  - # STARTS
  - HRS TO MAINT
  - kW-HRS
  - TOTAL HRS
  - LOADED HRS
  - UNLOADED HRS

PROGRAMMABLE INPUTS

- **CONFIGURABLE INPUTS**
  - INPUT X (X = 1 to 7)
    - ALARM CONFIG
    - ACTIVATN DLY
    - RECOGNITION
- **PROG FUNCTIONS**
  - EMERGENCY STOP
    - INPUT
  - AUTO XFER SWITCH
    - INPUT
    - RECOGNITION (Visible when an INPUT is selected.)
  - GRND DELTA O-RIDE
    - INPUT
    - RECOGNITION (Visible when an INPUT is selected.)
  - BATTLE OVERRIDE
    - INPUT
    - RECOGNITION (Visible when an INPUT is selected.)
  - LOW LINE OVERRIDE
    - INPUT
    - RECOGNITION (Visible when an INPUT is selected.)

- 1 PHASE O-RIDE
  - INPUT
  - RECOGNITION (Visible when an INPUT is selected.)
- BATT CHRG FAIL
  - INPUT
  - ALARM CONFIG (Visible when an INPUT is selected.)
  - ACTIVATN DLY (Visible when an INPUT is selected.)
  - RECOGNITION (Visible when an INPUT is selected.)
- LOW COOL LEVEL
  - INPUT
  - ALARM CONFIG (Visible when an INPUT is selected.)
  - ACTIVATN DLY (Visible when an INPUT is selected.)
  - RECOGNITION (Visible when an INPUT is selected.)
- LOW FUEL LEVEL
  - INPUT
  - ALARM CONFIG (Visible when an INPUT is selected.)
  - ACTIVATN DLY (Visible when an INPUT is selected.)
  - RECOGNITION (Visible when an INPUT is selected.)
- FUEL LEAK DETECT
  - INPUT
  - ALARM CONFIG (Visible when an INPUT is selected.)
  - ACTIVATN DLY (Visible when an INPUT is selected.)
  - RECOGNITION (Visible when an INPUT is selected.)

PROGRAMMABLE OUTPUTS

- **CONFIG ELEMENTS**
  - CONFIG ELEMENT X (X = 1 to 8)
    - ALARM CONFIG
    - ACTIVATN DLY
    - RECOGNITION

ALARM CONFIGURATION

- **HORN CONFIGURATION**
  - HORN
  - NOT IN AUTO HORN
- **PRE-ALARMS**
  - HIGH COOLANT TEMP
    - ENABLE
    - THRESHOLD
  - LOW COOLANT TEMP
    - ENABLE
    - THRESHOLD
  - LOW OIL PRESSURE
    - ENABLE
    - THRESHOLD
  - LOW FUEL LEVEL
    - ENABLE
    - THRESHOLD
    - HYSTERESIS
  - ENGINE OVERLOAD
    - ENG KW OVRLD-1
    - ENG KW OVRLD-2
    - ENG KW OVRLD-3
  - MAINTENANCE INTERVAL
    - ENABLE
    - THRESHOLD
  - BATTERY OVERVOLTAGE
    - ENABLE
    - THRESHOLD
  - LOW BATTERY VOLTAGE
    - ENABLE
    - THRESHOLD
    - ACTIVATN DLY

- WEAK BATTERY VOLTAGE
  - ENABLE
  - THRESHOLD
  - ACTIVATN DLY
- HIGH FUEL LEVEL
  - ENABLE
  - THRESHOLD
  - ACTIVATN DLY
  - HYSTERESIS
- ACTIVE DTC (Visible when DTC is enabled.)
  - ENABLE
- ECU COMMS FAIL (Visible when CAN BUS is enabled.)
  - ENABLE
- COOLANT LEVEL (Visible when CAN BUS is enabled.)
  - ENABLE
  - THRESHOLD
- CEM COMM FAIL (Visible when CEM-2020 is enabled.)
  - ENABLE
- CHECKSUM FAIL
  - ENABLE
- BRK CLOSE FAIL PALM
  - ENABLE
- BRK OPEN FAIL PALM
  - ENABLE
- REVERSE ROTATION
  - ENABLE

- **ALARMS**
  - HIGH COOLANT TEMP
    - ENABLE
    - THRESHOLD
    - ARMING DELAY
  - LOW OIL PRESSURE
    - ENABLE
    - THRESHOLD
    - ARMING DELAY
  - LOW FUEL LEVEL
    - ENABLE
    - THRESHOLD
    - ACTIVATN DLY
  - OVERSPEED
    - ENABLE
    - THRESHOLD
    - ACTIVATN DLY
  - COOLANT LEVEL (Visible when CAN bus is enabled.)
    - ENABLE
    - THRESHOLD
  - CAN LOW COOL LEVEL

Note
The HIGH COOLANT TEMP and LOW OIL PRESSURE alarms have an ARMING DLY setting that disables the alarm for the specified time after engine startup.

- **SENDER FAIL**
  - COOL TEMP SENDR FAIL
    - CONFIG TYPE
    - RECOGNITION
    - ACTIVATN DLY
    - MIN OHMS
    - MAX OHMS
    - SF DISPLAY
  - OIL PRESS SENDR FAIL
    - CONFIG TYPE
    - RECOGNITION

        - ACTIVATN DLY
        - MIN OHMS
        - MAX OHMS
        - SF DISPLAY
    - FUEL LEVL SENDR FAIL
        - CONFIG TYPE
        - RECOGNITION
        - ACTIVATN DLY
        - MIN OHMS
        - MAX OHMS
        - SF DISPLAY
    - VOLTAGE SENSE FAIL
        - CONFIG TYPE
        - ACTIVATN DLY
    - SPEED SENDR FAIL
        - TIME DELAY

GENERATOR PROTECTION

- **27 UNDERVOLTAGE**
    - LOW LINE SF (Visible when an input is selected for the Low Line Override programmable function.)
    - 3 / 1 PHASE SETTINGS
        - PICKUP
        - HYSTERESIS
        - TIME DELAY
        - FREQ INHIBIT
        - ALARM CONFIG
- **59 OVERVOLTAGE**
    - LOW LINE SF (Visible when an input is selected for the Low Line Override programmable function.)
    - 3 / 1 PHASE SETTINGS
        - PICKUP
        - HYSTERESIS
        - TIME DELAY
        - ALARM CONFIG
- **47 PHASE IMBALANCE**
    - PICKUP
    - HYSTERESIS
    - TIME DELAY
    - ALARM CONFIG
    - LOW LINE SF (Visible when an input is selected for the Low Line Override programmable function.)
- **81 O/U FREQUENCY**
    - UNDERFREQUENCY
        - INHIBIT VOLTS
        - PICKUP
        - HYSTERESIS
        - TIME DELAY
        - ALARM CONFIG
    - OVERFREQUENCY
        - PICKUP
        - HYSTERESIS
        - TIME DELAY
        - ALARM CONFIG
    - ALTRNT FRQ SCALE FCTR
        - ALT FREQ SF
- **50 OVERCURRENT**
    - LOW LINE SF (Visible when an input is selected for the Low Line Override programmable function.)
    - 3 / 1 PHASE SETTINGS
        - PICKUP
        - TIME DELAY
        - ALARM CONFIG

BREAKER MANAGEMENT

- **BREAKER HARDWARE**
  - MAINS FAIL TRANSFER
    - ENABLE
    - RETURN DELAY
    - TRANSFER DELAY
    - MAX TRANSFER TIME
  - CLOSE WAIT TIME
    - TIME
  - GEN BREAKER
    - CONTINUOUS
    - CLOSING TIME
    - OPEN CMD
    - CLOSE CMD
  - MAINS BREAKER
    - CONFIGURED
    - CONTINUOUS (Visible when configured.)
    - CLOSING TIME (Visible when configured.)
    - OPEN CMD (Visible when configured.)
    - CLOSE CMD (Visible when configured.)
  - BRK CLOSE FAIL PALM
  - BRK OPEN FAIL PALM
- **BUS CONDITION DETECT**
  - GEN DEAD
    - THRESHOLD
    - TIME DELAY
  - GEN STABLE
    - OV PICKUP
    - OV DROPOUT
    - UV PICKUP
    - UV DROPOUT
    - OF PICKUP
    - OF DROPOUT
    - UF PICKUP
    - UF DROPOUT
    - TIME DELAY
    - LOW LINE SF (Visible when an input is selected for the Low Line Override programmable function.)
    - ALT FREQ SF
  - GEN FAILED
    - TIME DELAY
  - BUS DEAD
    - THRESHOLD
    - TIME DELAY
  - BUS STABLE
    - OV PICKUP
    - OV DROPOUT
    - UV PICKUP
    - UV DROPOUT
    - OF PICKUP
    - OF DROPOUT
    - UF PICKUP
    - UF DROPOUT
    - TIME DELAY
    - LOW LINE SF (Visible when an input is selected for the Low Line Override programmable function.)
    - ALT FREQ SF
  - BUS FAILED
    - TIME DELAY

LOGIC TIMERS

- **TIMER X (X = 1 to 10)**
    - HOURS
    - MINUTES
    - SECONDS

ENTER PASSWORD

LOGOUT (Visible when logged in through the front panel.)

3 • BESTCOMS*Plus*®

BESTCOMS*Plus*® is a Windows®-based, PC application that provides a user-friendly, graphical user interface (GUI) for use with Basler Electric communicating products. The name BESTCOMS*Plus* is an acronym that stands for Basler Electric Software Tool for Communications, Operations, Maintenance, and Settings.

BESTCOMS*Plus* provides the user with a point-and-click means to set and monitor the DGC-2020ES. The capabilities of BESTCOMS*Plus* make the configuration of one or several DGC-2020ES controllers fast and efficient. A primary advantage of BESTCOMS*Plus* is that a settings scheme can be created, saved as a file, and then uploaded to the DGC-2020ES at the user's convenience.

BESTCOMS*Plus* uses plugins, allowing the user to manage several different Basler Electric products. The DGC-2020ES plugin must be activated before use. The plugin can be activated automatically by connecting to a DGC-2020ES, or manually by requesting an activation key from Basler Electric.

The DGC-2020ES plugin opens inside the BESTCOMS*Plus* main shell. The same default logic scheme that is shipped with the DGC-2020ES is brought into BESTCOMS*Plus* by downloading settings and logic from the DGC-2020ES. This gives the user the option of developing a custom setting file by modifying the default logic scheme or by building a unique scheme from scratch.

BESTlogic™*Plus* Programmable Logic is used to program DGC-2020ES logic for protection elements, inputs, outputs, alarms, etc. This is accomplished by drag-and-drop method. The user can drag elements, components, inputs, and outputs onto the program grid and make connections between them to create the desired logic scheme.

Figure 3-1 illustrates the typical user interface components of the DGC-2020ES plugin with BESTCOMS*Plus*.

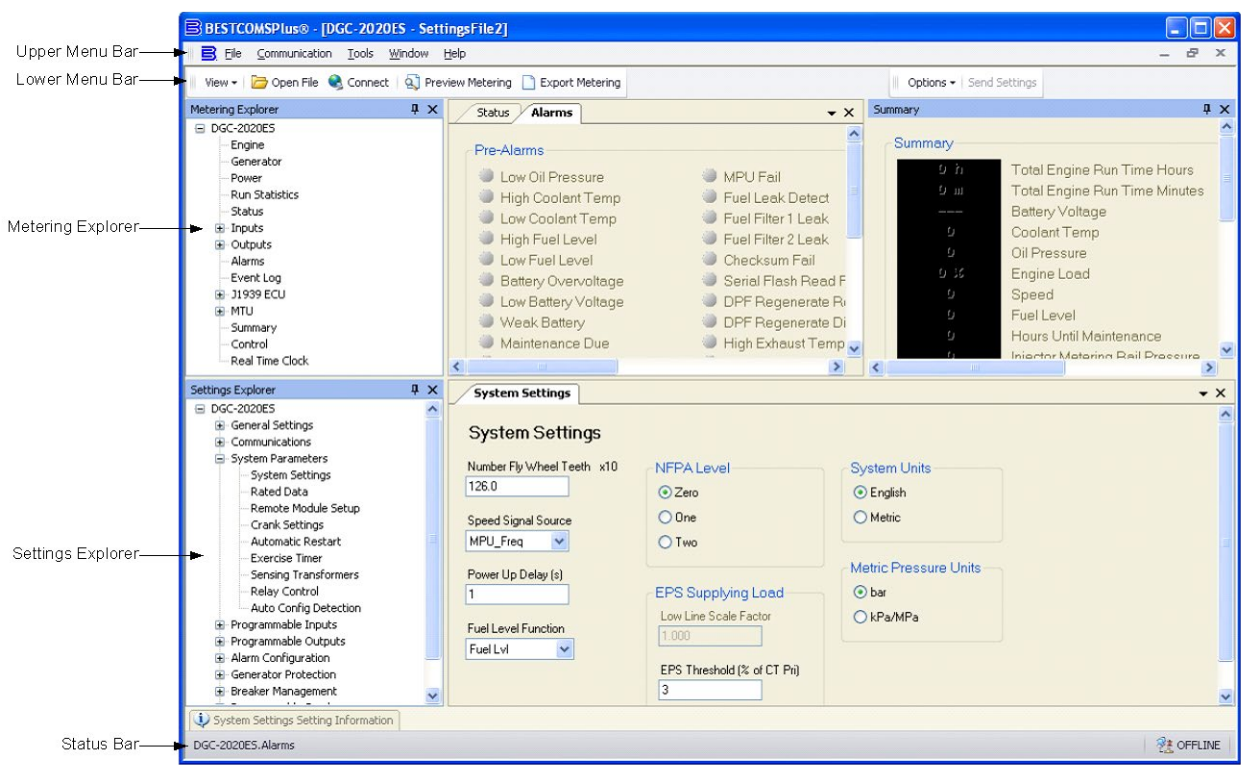


Figure 3-1. Typical User Interface Components

System Recommendations

BESTCOMS*Plus* software is built on the Microsoft® .NET Framework. The setup utility that installs BESTCOMS*Plus* on your PC also installs the DGC-2020ES plugin and the required version of .NET Framework (if not already installed). BESTCOMS*Plus* operates with systems using Windows® 7 SP1, Windows 8.1, and Windows 10 version 1607 (Anniversary Update). System recommendations for the .NET Framework and BESTCOMS*Plus* are listed in Table 3-1.

Table 3-1. System Recommendations for BESTCOMS*Plus* and the .NET Framework

System Type	Component	Recommendation
32/64 bit	Processor	2.0 GHz
32/64 bit	RAM	1 GB (minimum), 2 GB (recommended)
32 bit	Hard Drive	200 MB (if .NET Framework is already installed on PC)
		4.5 GB (if .NET Framework is not already installed on PC)
64 bit	Hard Drive	200 MB (if .NET Framework is already installed on PC)
		4.5 GB (if .NET Framework is not already installed on PC)

To install and run BESTCOMS*Plus*, a Windows user must have Administrator rights. A Windows user with limited rights might not be permitted to save files in certain folders.

Installation

Note

Do not connect a USB cable until setup completes successfully. Connecting a USB cable before setup is complete may result in errors.

Download BESTCOMS*Plus*

DGC-2020ES controllers are delivered with a CD-ROM that contains BESTCOMS*Plus* software and instruction manuals. If a CD-ROM is not available, use the following procedure to download BESTCOMS*Plus* from the Basler Electric website.

1. Navigate to https://www.basler.com/Downloads.
2. Select DGC-2020ES from the model drop down menu.
3. Under the Software heading, click the download link for BESTCOMS*Plus*.
4. Sign in or create an account to continue with the download.

Install BESTCOMS*Plus* from CD

When BESTCOMS*Plus* installation is complete, a Basler Electric folder is added to the Windows programs menu. This folder is accessed by clicking the Windows *Start* button and then accessing the Basler Electric folder in the *Programs* menu. The Basler Electric folder contains an icon that starts BESTCOMS*Plus* when clicked.

Activation of the DGC-2020ES Plugin

The DGC-2020ES plugin is a module that runs inside the BESTCOMS*Plus* shell. The DGC-2020ES plugin contains specific operational and logic settings for only the DGC-2020ES. Uploading settings to the DGC-2020ES is possible only after activating the DGC-2020ES plugin.

The DGC-2020ES plugin can be activated automatically or manually. Automatic activation is achieved by using a USB cable to establish communication between the DGC-2020ES and BESTCOMS*Plus*. Manual activation is initiated by contacting Basler Electric for an activation key and entering the key into BESTCOMS*Plus*. Manual activation is useful if you want to create a settings file prior to receiving your DGC-2020ES. Refer to *Manual Activation of DGC-2020ES Plugin.*

Connect a USB Cable

The USB driver was copied to your PC during BESTCOMS*Plus* installation and is installed automatically after powering the DGC-2020ES. USB driver installation progress is shown in the Windows taskbar area. Windows will notify you when installation is complete.

Connect a USB cable between the PC and your DGC-2020ES. Apply operating power to the DGC-2020ES. Wait until the boot sequence is complete.

Start BESTCOMS*Plus*® and Activate the DGC-2020ES Plugin Automatically

To start BESTCOMS*Plus*, click the Windows *Start* button, point to *Programs*, *Basler Electric*, and then click the *BESTCOMSPlus* icon. During initial startup, the *BESTCOMSPlus Select Language* screen is displayed (Figure 3-2). You can choose to have this screen displayed each time BESTCOMS*Plus* is started, or you can select a preferred language and this screen will be bypassed in the future. Click *OK* to continue. This screen can be accessed later by selecting *Tools* and *Select Language* from the menu bar.

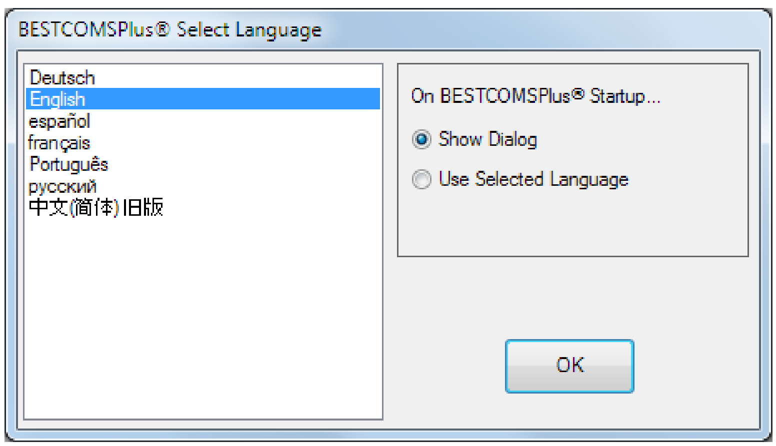


Figure 3-2. BESTCOMS*Plus* Language Selection Dialog

The BESTCOMS*Plus* platform window opens. Select *New Connection* from the *Communication* pull-down menu and select *DGC-2020ES*. See Figure 3-3. The DGC-2020ES plugin is activated automatically after connecting to a DGC-2020ES.

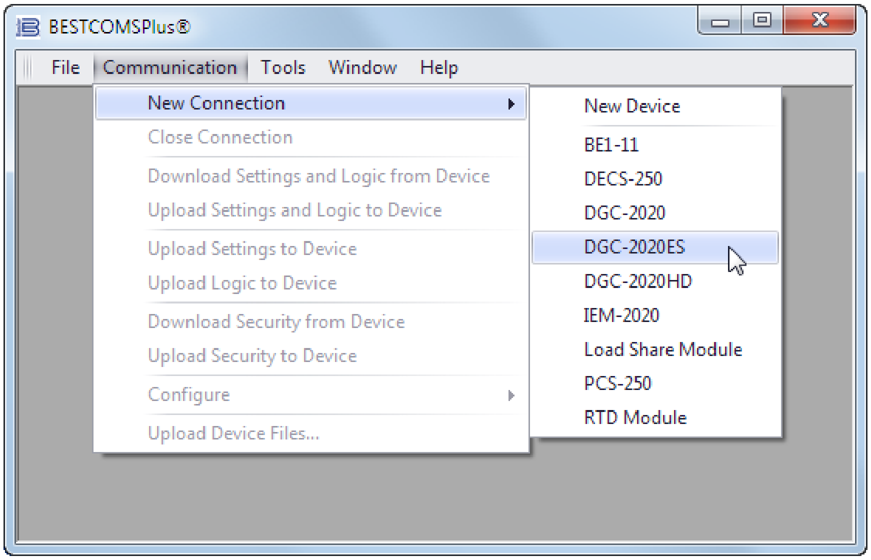


Figure 3-3. Communication Pull-Down Menu

The *DGC-2020ES Connection* screen, shown in Figure 3-4, appears.

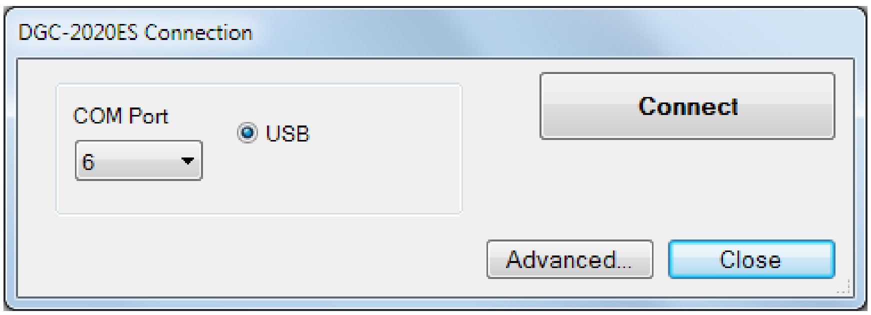


Figure 3-4. DGC-2020ES Connection Dialog

Select *COM Port.* The USB drivers are installed automatically during the BESTCOMS*Plus* installation process. To select the correct *COM Port,* open the Windows Device Manager and expand the *Ports (COM & LPT)* branch. Locate the device named *CP2101 USB to UART Bridge Controller (COMx).* The *COM Port* number will be displayed in parenthesis *(COMx).* Be sure operating power is applied to the DGC-2020ES and the USB cable is connected before opening the Device Manager. See Figure 3-5.

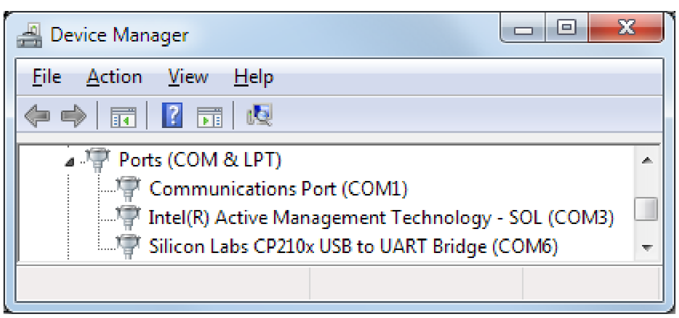


Figure 3-5. Device Manager

The DGC-2020ES plugin opens indicating that activation was successful. You can now configure the DGC-2020ES communication ports and other settings.

Installing the USB Driver if Automatic Installation Fails

To install the USB driver for the DGC-2020ES:

1. Apply operating power to the DGC-2020ES and wait for the boot sequence to complete.
2. Connect a USB cable between the PC and DGC-2020ES.

3. The *Found New Hardware Wizard* dialog box appears.
4. Select “**No, not this time**” and select *Next* to continue.
5. Choose to “**Install from a list or specific location (Advanced)**” and select *Next* to continue.
6. Insert the CD-ROM labeled BESTCOMS*Plus* into the PC CD-ROM drive.
7. Navigate to C:\Program Files\Basler Electric\BESTCOMS*Plus*\USBDeviceDrivers\ and select *Next* to continue.

When installation of the driver is complete, you may be asked to restart your computer.

Manual Activation of the DGC-2020ES Plugin

Manual activation of the DGC-2020ES plugin is required only if your initial use of BESTCOMS*Plus* will be on a PC that is not connected to a DGC-2020ES. Manual activation is described in the following paragraphs.

Requesting an Activation Key

When initially running the DGC-2020ES plugin, the *Activate Device Plugin* pop-up appears. You must contact Basler Electric for an activation key before you can activate the DGC-2020ES plugin. You can request an activation key through email or the Basler Electric website. Click either the *Website* or *Email* button. Click the *Activate* button when you are ready to enter the activation key you received from Basler Electric. The *Activate Device Plugin* pop-up appears. Refer to Figure 3-6.

Entering an Activation Key

Select DGC-2020ES from the *Device* pull-down menu. Enter your *Email Address* and *Activation Key* provided by Basler Electric. If you received an email containing the *Activation Key*, you can select all of the text in the email and copy it to the Windows clipboard using normal Windows techniques. The *Get Data* button will extract the *Device, Email Address,* and *Activation Key* from the Windows clipboard and paste it into the appropriate fields. Click the *Activate* button to continue. The *Activate Device Plugin* screen is also found by selecting *Activate Device* from the *Tools* pull-down menu of the BESTCOMS*Plus* main screen.

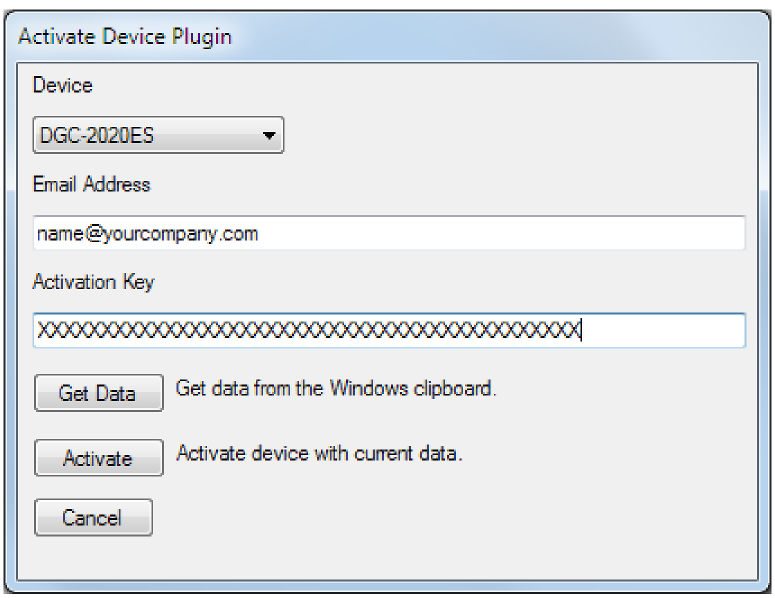


Figure 3-6. Activate Device Plugin

Establishing Communication

Communication between BESTCOMS*Plus* and the DGC-2020ES is established by clicking on the Connect button on the DGC-2020ES Connection screen (see Figure 3-4) or by clicking on the Connect button on the lower menu bar of the main BESTCOMS*Plus* screen (Figure 3-1). Download all settings and logic from the DGC-2020ES by selecting Download Settings and Logic from the Communication pull-down menu. BESTCOMS*Plus* will read all settings and logic from the DGC-2020ES and load them into BESTCOMS*Plus* memory. See Figure 3-7.

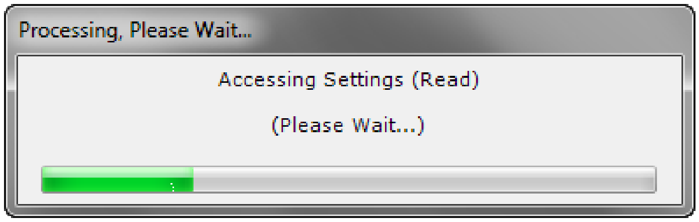


Figure 3-7. Processing, Please Wait…

Advanced Properties

Click the Advanced button on the Connection screen to display the Advanced Properties dialog. Default settings are shown in Figure 3-8.

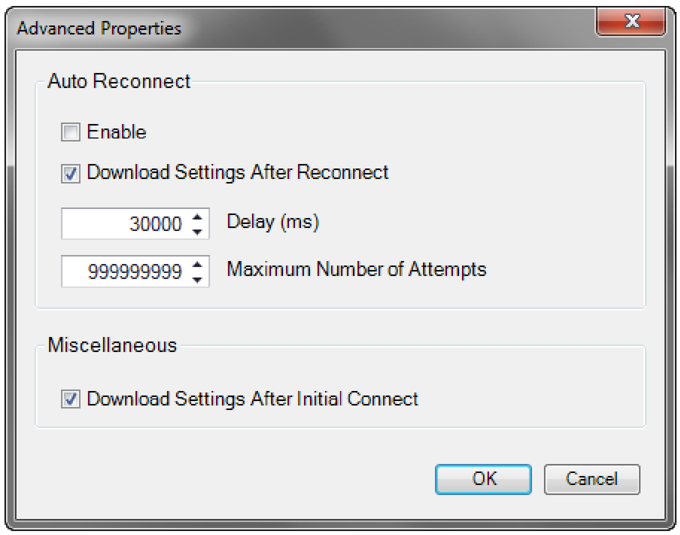


Figure 3-8. Advanced Properties Dialog

Menu Bars

The menu bars are located near the top of the BESTCOMS*Plus* window (see Figure 3-1). The upper menu bar has five pull-down menus. With the upper menu bar, it is possible to manage settings files, configure communication settings, upload and download settings/security files, and compare settings files. The lower menu bar consists of clickable icons. The lower menu bar is used to change BESTCOMS*Plus* views, save or load a BESTspace™ workspace, open a settings file, connect/disconnect, preview metering printout, export metering, switch to live mode, and send settings to the DGC-2020ES.

Upper Menu Bar (BESTCOMS*Plus*® Shell)

Upper menu bar functions are listed and described in Table 3-2.

Table 3-2. Upper Menu Bar (BESTCOMS*Plus* Shell)

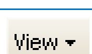
Menu Item	Description
File	
New	Create a new settings file
Open	Open an existing settings file
Open File As Text	Generic file viewer for *.csv, *,txt, etc. files
Close	Close settings file

Menu Item	Description
Save	Save settings file
Save As	Save settings file with a different name
Export To File	Save settings as a *.csv file
Print	Print, export, or send a settings file
Properties	View properties of a settings file
History	View history of a settings file
Recent Files	Open a previously opened file
Exit	Close BESTCOMS*Plus* program
Communication	
New Connection	Choose new device or DGC-2020ES
Close Connection	Close communication between BESTCOMS*Plus* and DGC-2020ES
Download Settings and Logic from Device	Download operational and logic settings from the device
Upload Settings and Logic to Device	Upload operational and logic settings to the device
Upload Settings to Device	Upload operational settings to the device
Upload Logic to Device	Upload logic settings to the device
Download Security from Device	Download security settings from the device
Upload Security to Device	Upload security settings to the device
Upload Device Files	Upload firmware to the device
Tools	
Select Language	Select BESTCOMS*Plus* language
Activate Device	Activate the DGC-2020ES plugin
Set File Password	Password protect a settings file
Compare Settings Files	Compare two settings files
Auto Export Metering	Exports metering data on a user-defined interval
Event Log - View	View the BESTCOMS*Plus* event log
Event Log - Clear	Clear the BESTCOMS*Plus* event log
Event Log - Set New File Name	Set a new file name for event log
Window	
Cascade All	Cascade all windows
Tile	Tile horizontally or vertically
Maximize All	Maximize all windows
Help	
Check for Updates	Check for BESTCOMS*Plus* updates via the internet
Check for Update Settings	Enable or change automatic checking for updates
About	View general, detailed build, and system information

Lower Menu Bar (DGC-2020ES Plugin)

The lower menu bar functions are listed and described in Table 3-3.

Table 3-3. Lower Menu Bar (DGC-2020ES Plugin)

Menu Button	Description
	Enables you to show/hide the Metering Panel, Settings Panel, or Settings Info Panel.

	Opens and saves BESTspace™ workspaces. Customized workspaces make switching between tasks easier and more efficient.
Open File	Opens a saved settings file.
Connect	Connect: Opens the *DGC-2020ES Connection* screen which enables you to connect to the DGC-2020ES via USB or a modem. This button only appears when a DGC-2020ES is not connected.
Disconnect	Disconnect: Used to disconnect a connected DGC-2020ES. This button only appears when a DGC-2020ES is connected.
Preview Metering	Displays the *Print Preview* screen where a preview of the Metering printout is shown. Click on the printer button to send to a printer.
Export Metering	Enables all metering values to be exported into a *.csv file.
Options ▾	Displays a drop-down list entitled *Live Mode Settings* which enables *Live* mode where settings are automatically sent to the device in real time as they are changed.
Send Settings	Sends settings to the DGC-2020ES when BESTCOMS*Plus* is not operating in Live Mode. Click this button after making a setting change to send the modified setting to the DGC-2020ES.

Settings Explorer

The Settings Explorer is a convenient tool within BESTCOMS*Plus* used to navigate through the various settings screens of the DGC-2020ES plugin.

These screens allow the user to edit general settings, communications, system parameters, programmable inputs, programmable outputs, alarm configuration, generator protection, breaker management, programmable senders, and BESTlogic*Plus* programmable logic.

Logic setup will be necessary after making certain setting changes. For more information, refer to the BESTlogic*Plus* chapter.

Settings Entry

When entering settings in BESTCOMS*Plus*, each setting is validated against prescribed limits. Entered settings that do not conform with the prescribed limits are accepted but flagged as noncompliant. Figure 3-9 illustrates an example of flagged, noncompliant settings (locator A) and the Setting Validation window (locator B) used to diagnose faulty settings.

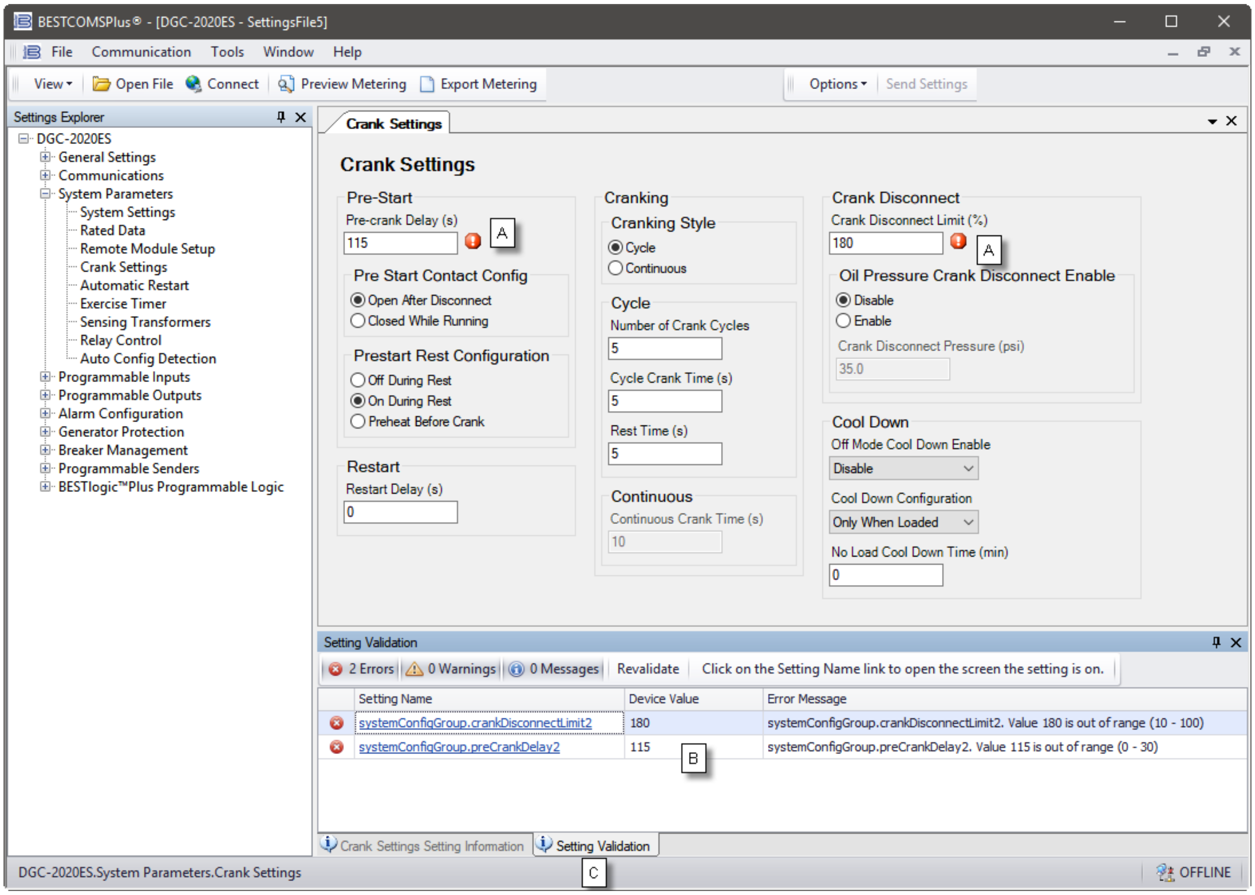


Figure 3-9. Flagged, Noncompliant Settings and the Seting Validation Window

The Setting Validation window, viewed by selecting the Setting Validation tab (locator C), displays three types of annunciations: errors, warnings, and messages. An error describes a problem such as a setting that is out of range. A warning describes a condition where supporting settings are invalid, causing other settings to be noncompliant with the prescribed limits. A message describes a minor setting issue that was automatically resolved by BESTCOMS*Plus*. An example of a condition triggering a message is entry of a settings value with a resolution that exceeds the limit imposed by BESTCOMS*Plus*. In this situation, the value is automatically rounded and a message is triggered. Each annunciation lists a hyperlinked name for the noncompliant setting and an error message describing the issue. Clicking the hyperlinked setting name takes you to the setting screen with the offending setting. Right-clicking the hyperlinked setting name will restore the setting to its default value.

Note
It is possible to save a DGC-2020ES settings file in BESTCOMS*Plus* with noncompliant settings. However, it is not possible to upload noncompliant settings to the DGC-2020ES.

Metering Explorer

The Metering Explorer is a convenient tool within BESTCOMS*Plus* used to navigate through the various metering screens of the DGC-2020ES plugin.

These screens allow the user to view real-time system data including generator voltages and currents, input/output status, alarms, reports, and other parameters. Refer to the Metering chapter in the *Operation* manual for more information on the Metering Explorer.

BESTspace™

BESTspace provides the ability to manage customized workspaces. A workspace consists of the position and size of all open screens within BESTCOMS*Plus*. Pre-saved workspaces can be quickly loaded to fit the specific task at hand. Any number of different workspaces can be saved including a default workspace which loads when the DGC-2020ES plug-in is started. The Metering Explorer screens and the Settings Explorer screens can be saved independently into the workspace file. A *Comments* box is provided for writing a description or leaving notes for each saved workspace. To access BESTspace, click *View* (on the lower menu bar) and hover over *BESTspace*. Figure 3-10 illustrates the BESTspace options found under the *View* pull-down menu. Figure 3-11 illustrates the options included in the Load/Save Workspace File screen.

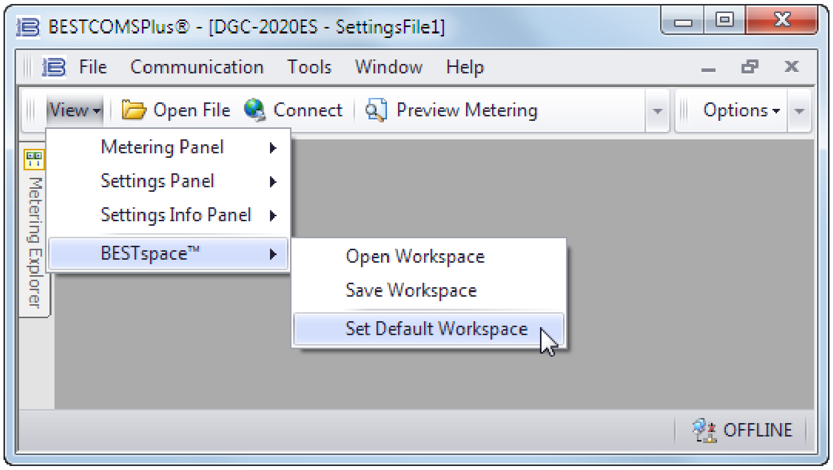


Figure 3-10. View Menu, BESTspace™ Options

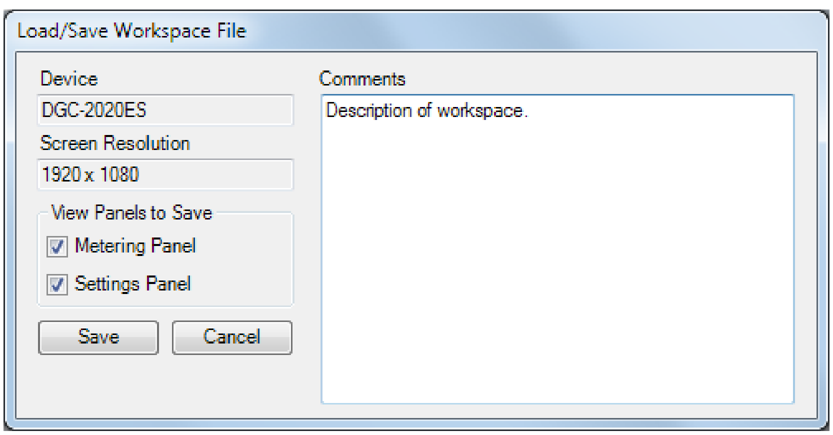


Figure 3-11. View Menu, BESTspace™, Save Workspace Screen

Settings File Management

A settings file contains all DGC-2020ES settings, including logic. A settings file assumes a file extension of "∗.bstx". It is possible to save the logic only as a separate logic library file on the BESTlogic*Plus* Programmable Logic screen. This function is helpful when similar logic is required for several devices. A logic library file assumes a file extension of "∗.bslx". It is important to note that settings and logic can be uploaded to the device together or separately, but are always downloaded together. For more information on logic files, refer to the *BESTlogicPlus* chapter.

Opening a Settings File

To open a DGC-2020ES settings file with BESTCOMS*Plus*, pull down the *File* menu and choose *Open*. The *Open* dialog box appears. This dialog box allows you to use normal Windows techniques to select the file that you want to open. Select the file and choose *Open*. You can also open a file by clicking on the *Open File* button on the lower menu bar. If connected to a device, you will be asked to upload the settings and logic from the file to the current device. If you choose *Yes*, the settings displayed in BESTCOMS*Plus* will be overwritten with the settings of the opened file.

Saving a Settings File

Select *Save* or *Save As* from the *File* pull-down menu. A dialog box appears allowing you to enter a filename and location to save the file. Select the *Save* button to complete the save.

Upload Settings and/or Logic to Device

To upload a settings file to the DGC-2020ES, open the file through BESTCOMS*Plus* or create the file using BESTCOMS*Plus*. Then pull down the *Communication* menu and select *Upload Settings and Logic to Device.* If you want to upload operational settings without logic, select *Upload Settings to Device*. If you want to upload logic without operational settings, select *Upload Logic to Device*. You are prompted to enter the password. The default password is “OEM”. If the password is correct, the upload begins and the progress bar is shown.

Download Settings and Logic from Device

To download settings and logic from the DGC-2020ES, pull down the *Communication* menu and select *Download Settings and Logic from Device*. If the settings in BESTCOMS*Plus* have changed, a dialog box will open asking if you want to save the current settings changes. You can choose *Yes* or *No*. After you have taken the required action to save or discard the current settings, downloading begins. BESTCOMS*Plus* will read all settings and logic from the DGC-2020ES and load them into BESTCOMS*Plus* memory.

Print a Settings File

To view a preview of the settings printout, select *Print Preview* from the *File* pull-down menu. To print the settings, select the printer icon in the upper left corner of the *Print Preview* screen.

You can skip the print preview and go directly to print by pulling down the *File* menu and selecting *Print*. A dialog box opens containing the typical Windows options for setting the properties of the printer. Configure these settings as necessary and then select *Print*.

Compare Settings Files

BESTCOMS*Plus* has the ability to compare two settings files. To compare files, pull down the *Tools* menu and select *Compare Settings Files*. The *BESTCOMSPlus Settings Compare Setup* dialog box appears (Figure 3-12). Select the location of the first file under *Left Settings Source* and select the location of the second file under *Right Settings Source*. If you are comparing a settings file located on your PC hard drive or portable media, click the folder button and navigate to the file. If you want to compare settings downloaded from a unit, click the *Select Unit* button to set up the communication port. Click the *Compare* button to compare the selected settings files.

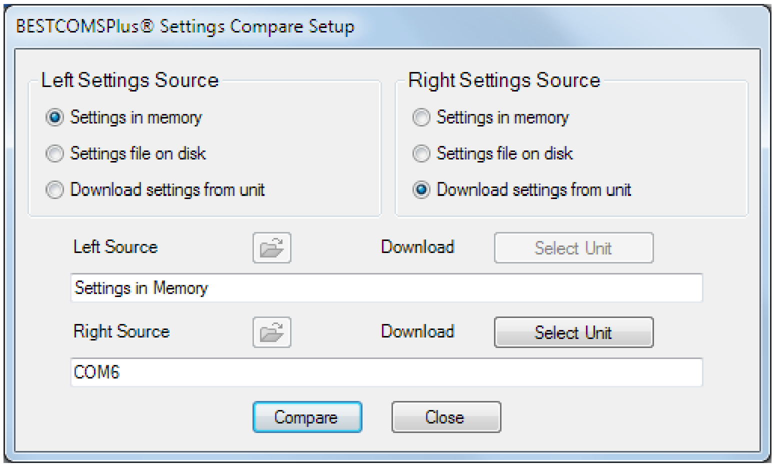


Figure 3-12. Tools, Compare Settings Files Screen

A dialog box appears, displaying the results of the comparison. The *BESTCOMSPlus Settings Compare* dialog box (Figure 3-13) is displayed where you can view all settings (*Show All Settings*), view only the differences (*Show Settings Differences*), view all logic *(Show All Logic Paths),* or view only logic differences *(Show Logic Path Differences).* Select *Close* when finished.

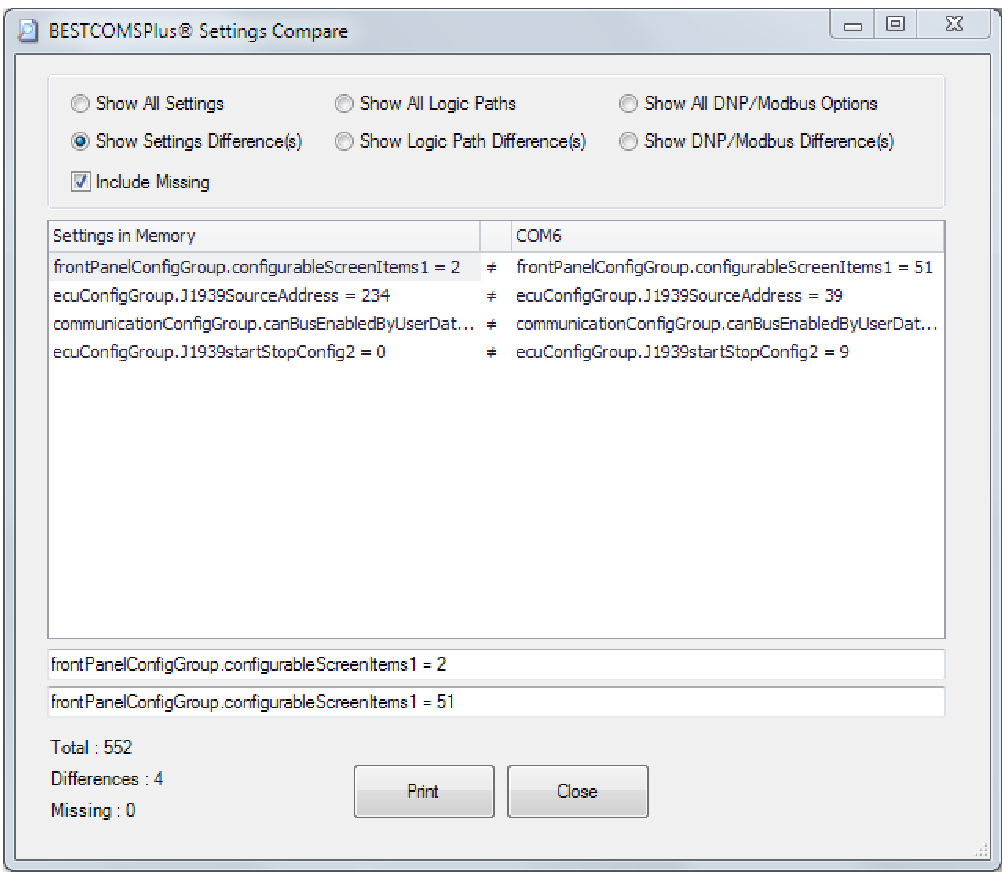


Figure 3-13. Settings Comparison Results Screen

Firmware Updates

Future enhancements to the DGC-2020ES functionality will make a firmware update desirable. Because default settings are loaded when DGC-2020ES firmware is updated, your settings should be saved in a file prior to upgrading firmware.

Note

The latest version of BESTCOMS*Plus* software should be downloaded from the Basler Electric website and installed before performing a firmware upgrade.

A device package contains firmware and a language module. Embedded firmware is the operating program that controls the actions of the DGC-2020ES. The DGC-2020ES stores firmware in nonvolatile flash memory that can be reprogrammed through the communication ports. It is not necessary to replace EPROM chips when updating the firmware with a newer version.

The language of the front panel LCD can be changed by uploading a different language module into the DGC-2020ES. The DGC-2020ES stores the language module in nonvolatile flash memory; the language module contains all language translations for the DGC-2020ES. The language module can be reprogrammed through the communications port. In general, any time a firmware upgrade is made to the DGC-2020ES, the language module should be uploaded as well.

The DGC-2020ES can be used in conjunction with the Contact Expansion Module (CEM-2020) which expands the DGC-2020ES capabilities. When upgrading the firmware in any component of this system, the firmware in ALL of the components of the system should be upgraded to ensure compatibility of communications between the components.

Caution

The order in which the components are upgraded is critical. Assuming a system of a DGC-2020ES and expansion module is in a state where the DGC-2020ES is communicating with the system expansion module, **the expansion module must be upgraded before the DGC-2020ES.** This is necessary because the DGC-2020ES must be able to communicate with the expansion module before the DGC-2020ES can send firmware to it. If the DGC-2020ES were upgraded first, and the new firmware included a change to the expansion module communication protocol, it is possible that the expansion module could no longer communicate with the upgraded DGC-2020ES. Without communications between the DGC-2020ES and the expansion module, upgrading the expansion module is not possible.

Note

If power is lost or communication is interrupted during file transfer to the DGC-2020ES, it will cease to operate and will not recover automatically. If this occurs or if the front panel HMI becomes blank and all LEDs are flashing at a two-second rate, the DGC-2020ES will not have valid firmware installed and the firmware must be uploaded again. To accomplish this, cycle power to the DGC-2020ES and activate the DGC-2020ES plugin in BESTCOMS*Plus*. Select *Upload Device Files* from the *Communication* pull-down menu and proceed normally.

Upgrading Firmware in Expansion Modules

The following procedure is used to upgrade firmware in the DGC-2020ES expansion module. This must be completed before upgrading firmware in the DGC-2020ES. If no expansion module is present, proceed to *Upgrading Firmware in the DGC-2020ES.*

1. Place the DGC-2020ES in OFF mode. This can be accomplished by clicking the *Off* button on the *Control* screen inside the Metering Explorer or by pressing the *Off* button on the DGC-2020ES front panel.
2. Enable the expansion module that is present in the system. If it has not already been enabled, enable the expansion module on the SETTINGS > SYSTEM PARAMETERS > REMOTE MODULE SETUP screen.
3. Verify that the DGC-2020ES and the associated expansion module are communicating. This can be verified by examining the pre-alarm status using the Metering Explorer in BESTCOMS*Plus* or from the front panel by navigating to METERING > ALARMS-STATUS > PRE-ALARMS. There should be no *Loss of Comms* pre-alarms in the pre-alarm status when communications are functioning properly.
4. Connect to the DGC-2020ES through the USB port if not already connected.
5. Select *Upload Device Files* from the Communication pull-down menu.
6. You will be asked to save the current settings file. Select *Yes* or *No*.
7. When the *Basler Electric Device Package Uploader* screen (Figure 3-14) appears, click on the *Open* button to browse for the device package you have received from Basler Electric. The *Package Files* along with *File Details* are listed. Place a check in the boxes next to the individual files you want to upload.

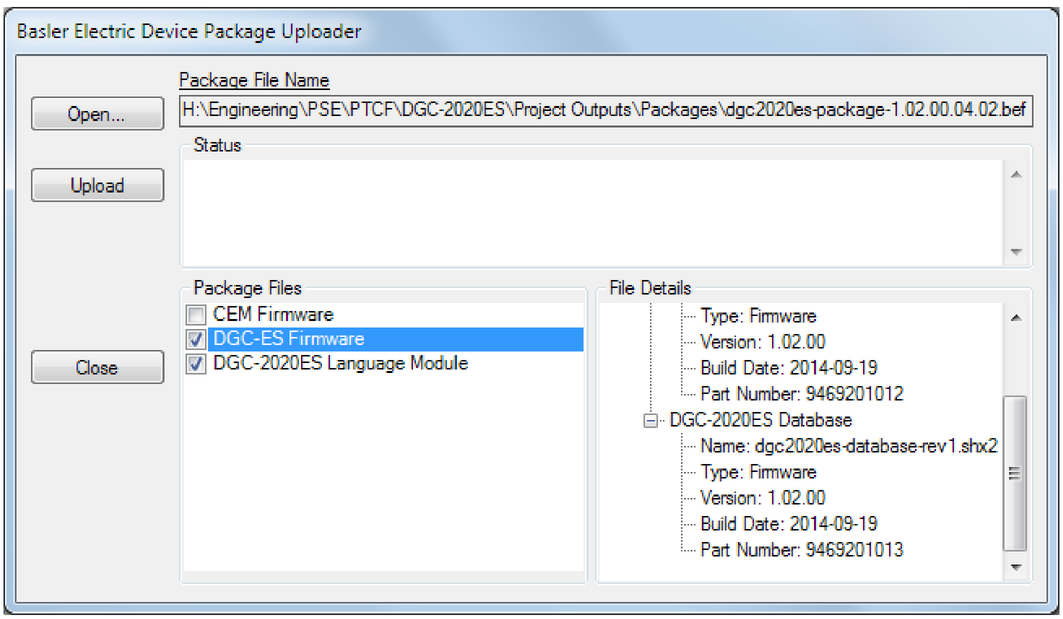


Figure 3-14. Basler Electric Device Package Uploader

8. Click on the *Upload* button and the *Proceed with Device Upload* screen will appear. Select *Yes* or *No*.
9. After selecting *Yes*, the *DGC-2020ES Selection* screen will appear. Select the communication port to begin upload. Refer to Figure 3-15.
10. After file(s) have been uploaded, click the *Close* button on the *Basler Electric Device Package Uploader* screen and disconnect communication to the DGC-2020ES.

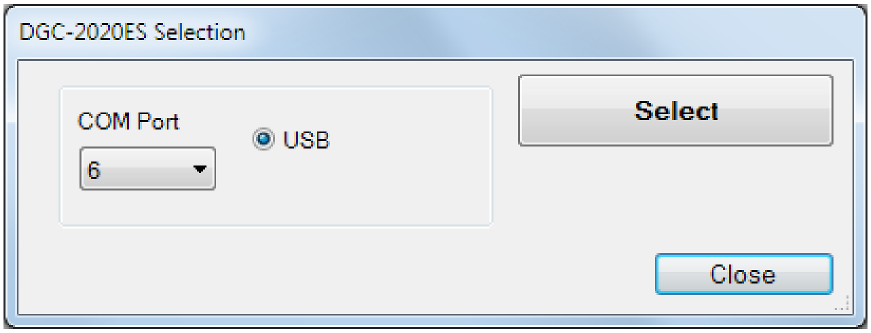


Figure 3-15. DGC-2020ES Selection

Upgrading Firmware in the DGC-2020ES

Upgrade DGC-2020ES firmware and then load a saved settings file.

1. Upgrade the DGC-2020ES firmware and language module.
    a. Connect to the DGC-2020ES with BESTCOMS*Plus*. Check the firmware Application Version on the GENERAL SETTINGS > VERSION INFO > DGC-2020ES screen.
    b. Select *Upload Device Files* from the *Communication* pull-down menu. You do not have to be connected to the DGC-2020ES at this time. Save settings when prompted, if desired.
    c. Open the desired device package file (****DGC-2020ES-*****_xxyyzz.bef, where **** may be additional descriptive text of varying length, and xx.yy.zz is the version number of the device package file.)
    d. Check the boxes for *DGC-2020ES Firmware* and *DGC-2020ES Language Module.* Note the version number of the DGC-2020ES firmware; this is the version that will be used to set the Application Version in the settings file in a later step. This is NOT the same as the version of the package file that is contained in the fields xx.yy.zz in the package file name.
    e. Click the *Upload* button and follow the instructions that appear to begin the upgrade process.
    f. After the upload is complete, disconnect communication to the DGC-2020ES.
2. Load the saved settings file into the DGC-2020ES.
    a. Close all settings files.
    b. From the *File* pull-down menu, select *New*, *DGC-2020ES*.
    c. Connect to the DGC-2020ES.
    d. Once all settings have been read from the DGC-2020ES, open the saved settings file by selecting the file with *File, Open File* in the BESTCOMS*Plus* menu.
    e. When BESTCOMS*Plus* asks if you wish to upload settings and logic to the device, click *Yes*.
    f. If you are receiving upload failures and indications that the logic is incompatible with the firmware version, check that the DGC-2020ES style number in the saved file matches that of the DGC-2020ES into which the file is being uploaded. The style number in the settings file is found under GENERAL SETTINGS > STYLE NUMBER in BESTCOMS*Plus*.
    g. If the style number of the settings file does not match that of the DGC-2020ES into which it is to be loaded, disconnect from the DGC-2020ES, then modify the style number in the settings file. Then repeat the steps titled *Load the Settings File into the DGC-2020ES.*

BESTCOMSPlus® Updates

Ongoing DGC-2020ES functionality enhancements may make future DGC-2020ES firmware updates desirable. Enhancements to DGC-2020ES firmware typically coincide with enhancements to the DGC-2020ES plugin for BESTCOMS*Plus*. When a DGC-2020ES is updated with the latest version of firmware, the latest version of BESTCOMS*Plus* should also be obtained.

- If you obtained a CD-ROM containing a firmware update from Basler Electric, then that CD-ROM will also contain the corresponding version of BESTCOMS*Plus* software.
- You can check for BESTCOMS*Plus* updates by visiting www.basler.com.
- You can use the manual "check for updates" function in BESTCOMS*Plus* to ensure that the latest version is installed by selecting Check for Updates in the Help drop-down menu. (An internet connection is required.)

4 • Communication

DGC-2020ES communication ports include a mini-B USB port, CAN terminals, and provisions for an optional Remote Display Panel. The following paragraphs describe the DGC-2020ES communication ports in detail.

Caution

This product contains one or more *nonvolatile memory* devices. Nonvolatile memory is used to store information (such as settings) that needs to be preserved when the product is power-cycled or otherwise restarted. Established nonvolatile memory technologies have a physical limit on the number of times they can be erased and written. In this product, the limit is 100,000 erase/write cycles. During product application, consideration should be given to communications, logic, and other factors that may cause frequent/repeated writes of settings or other information that is retained by the product. Applications that result in such frequent/repeated writes may reduce the useable product life and result in loss of information and/or product inoperability.

USB

The rear-panel, mini-B USB port enables local communication with a PC running BESTCOMS*Plus*® software. The DGC-2020ES is connected to a PC using a standard USB cable. BESTCOMS*Plus* is a Windows®-based communication software package that is supplied with the DGC-2020ES. A detailed description of BESTCOMS*Plus* is provided in the BESTCOMS*Plus* chapter.

CAN

A Controller Area Network (CAN) is a standard interface that enables communication between multiple controllers on a common network using a standard message protocol. DGC-2020ES controllers have a CAN interface that supports the SAE J1939 protocol and the MTU protocol.

Applications using an engine-driven generator set controlled by a DGC-2020ES may also have an Engine Control Unit (ECU). The CAN interface allows the ECU and DGC-2020ES to communicate. The ECU reports operating information to the DGC-2020ES through the CAN interface. Operating parameters and diagnostic information, if supported by the ECU, are decoded and displayed for monitoring.

The primary use of the CAN interface is to obtain engine operating parameters for monitoring speed, coolant temperature, oil pressure, coolant level, and engine hours without the need for direct connection to individual senders. Table 4-1 lists the ECU parameters and Table 4-2 lists the engine configuration parameters supported by the DGC-2020ES CAN interface. These parameters are transmitted via the CAN interface at preset intervals. See the column labeled Update Rate in Table 4-1 for transmission rates.

CAN interface connections are made at 13 (CAN H), 14 (CAN L), and 15 (SHIELD).

Table 4-1. ECU Parameters Obtained from CAN Interface

ECU Parameter	Metric Units	English Units	Update Rate	* SPN
Actual Engine Percent Torque	%	%	Engine Speed Dependent	513
Aftertreatment 1 Diesel Particulate Filter Intake Temperature (DOC Inlet Temperature)	°C	°F	500 ms	3242

ECU Parameter	Metric Units	English Units	Update Rate	* SPN
Aftertreatment 1 Diesel Particulate Filter Intermediate Temperature (DOC Outlet Temperature)	°C	°F	500 ms	3250
Aftertreatment 1 Diesel Particulate Filter Outlet Temperature	°C	°F	500 ms	3246
Air Filter Differential Pressure	kPa	psi	500 ms	107
Air Inlet Temperature	kPa	°F	1 s	172
Alarm Reset Feedback	Binary (0 or 1)		1 s	2815
Ambient Air Temperature	°C	°F	1 s	171
Auxiliary Pressure 1	kPa	psi	On Request	1387
Auxiliary Pressure 2	kPa	psi	On Request	1388
Barometric Pressure	kPa	psi	1 s	108
Battery Charger 1 State	0 = Idle (not Connected to Battery) 1 = Charging 2 = Maintaining Battery Charge 3–12 = Reserved 13 = Battery Failure 14 = Charger Failure 15 = Not Available		1 s	4990
Battery Charger 1 AC Line State	0 = Disconnected 1 = Connected 2 = Error 3 = N/A		1 s	4991
Battery Charger 1 Output Voltage	Vdc	Vdc	1 s	4992
Battery Charger 1 Output Current	Adc	Adc	1 s	4993
Battery Charger 2 State	0 = Idle (not Connected to Battery) 1 = Charging 2 = Maintaining Battery Charge 3–12 = Reserved 13 = Battery Failure 14 = Charger Failure 15 = Not Available		1 s	4994
Battery Charger 2 AC Line State	0 = Disconnected 1 = Connected 2 = Error 3 = N/A		1 s	4995
Battery Charger 2 Output Voltage	Vdc	Vdc	1 s	4996
Battery Charger 2 Output Current	Adc	Adc	1 s	4997
Battery 1 Temperature	°C	°F	1 s	1800
Battery 2 Temperature	°C	°F	1 s	1801
Battery Voltage	Vdc	Vdc	1 s	168
Boost Pressure	kPa	psi	500 ms	102
Charge Air Temperature	°C	°F	1 s	2629
Coolant Level	%	%	500 ms	111
Coolant Pressure	kPa	psi	500 ms	109
DEF Inducement Level - Level of Inducement Not to Run the Engine	%	%	1 s	5246
DEF Severity Level - Severity of Tank Low Level	%	%	1 s	5245
DEF Tank 1 Level	%	%	1 s	1761

ECU Parameter	Metric Units	English Units	Update Rate	* SPN
DEF Tank 2 Level	%	%	1 s	4367
DPF Ash Level %	%	%	On Request	3720
DPF Soot Level %	%	%	On Request	3719
ECU Temperature	°C	°F	1 s	1136
Engine Coolant Preheated State	Binary (0 or 1)		500 ms	3552
Engine Coolant Temperature	°C	°F	1 s	110
Engine Desired Operating Speed	rpm	rpm	250 ms	515
Engine Intake Manifold #1 Absolute Pressure	kPa	psi	500 ms	3563
Engine Intercooler Coolant Level	%	%	500 ms	3668
Engine Intercooler Temperature	°C	°F	1 s	52
Engine Oil Level	%	%	500 ms	98
Engine Oil Pressure	kPa	psi	500 ms	100
Engine Oil Temperature	°C	°F	1 s	175
Engine Speed	rpm	rpm	Engine Speed Dependent	190
Exhaust Gas Temperature	°C	°F	500 ms	173
Exhaust Temperature A	°C	°F	500 ms	2433
Exhaust Temperature B	°C	°F	500 ms	2434
Fuel Delivery Pressure	kPa	psi	500 ms	94
Fuel Leak Filter 1	Binary (0 or 1)		1 s	1239
Fuel Leak Filter 2	Binary (0 or 1)		1 s	1240
Fuel Rate	liter/hr	gal/hr	100 ms	183
Fuel Temperature	°C	°F	1 s	174
High Exhaust System Temp (HEST) Lamp/Indicator	—	—	500 ms	3698
Injection Control Pressure	MPa	psi	500 ms	164
Injector Metering Rail Pressure	MPa	psi	500 ms	157
Intake Manifold Temperature	°C	°F	500 ms	105
Particulate Filter (DPF) Lamp/Indicator	—	—	500 ms	3697
Percent Load at Current rpm	%	%	50 ms	92
Rated Power	watts	watts	On Request	166
Rated rpm	rpm	rpm	On Request	189
Regeneration Disabled (Inhibit) Lamp/Indicator	—	—	500 ms	3703
Shutdown from ECU	Binary (0 or 1)		1 s	1110
Switched Battery Voltage (at ECU)	Vdc	Vdc	1 s	158
Throttle (Accelerator Pedal) Position	%	%	50 ms	91
Total Engine Hours	hours	hours	Requested 1.5 s	247
Total Fuel Used	liters	gallons	Requested 1.5 s	250
Transmission Oil Pressure	kPa	psi	1 s	127
Transmission Oil Temperature	°C	°F	1 s	177
Trip Average Fuel Rate	liters	gallons	500 ms	1029

ECU Parameter	Metric Units	English Units	Update Rate	* SPN
Trip Fuel	liters	gallons	Requested 1.5 s	182
Winding 1 Temperature	°C	°F	1 s	1124
Winding 2 Temperature	°C	°F	1 s	1125
Winding 3 Temperature	°C	°F	1 s	1126

* SPN is suspect parameter number.

Table 4-2. Engine Configuration Parameters Obtained from CAN Interface

ECU Parameter	Metric Units	English Units	Update Rate	* SPN
Engine Speed at High Idle Point 6	rpm	rpm	5 s	532
Engine Speed at Idle Point 1	rpm	rpm	5 s	188
Engine Speed at Point 2	rpm	rpm	5 s	528
Engine Speed at Point 3	rpm	rpm	5 s	529
Engine Speed at Point 4	rpm	rpm	5 s	530
Engine Speed at Point 5	rpm	rpm	5 s	531
Gain (Kp) of End Speed Governor	%/rpm	%/rpm	5 s	545
Maximum Momentary Engine Override Speed Point 7	rpm	rpm	5 s	533
Maximum Momentary Engine Override Time Limit	seconds	seconds	5 s	534
Percent Torque at Idle Point 1	%	%	5 s	539
Percent Torque at Point 2	%	%	5 s	540
Percent Torque at Point 3	%	%	5 s	541
Percent Torque at Point 4	%	%	5 s	542
Percent Torque at Point 5	%	%	5 s	543
Reference Engine Torque	N•m	ft-lb	5 s	544
Requested Speed Control Range Lower Limit	rpm	rpm	5 s	535
Requested Speed Control Range Upper Limit	rpm	rpm	5 s	536
Requested Torque Control Range Lower Limit	%	%	5 s	537
Requested Torque Control Range Upper Limit	%	%	5 s	538

* SPN is suspect parameter number.

Caution

When the CAN is enabled, the DGC-2020ES ignores the following sender inputs: oil pressure, coolant temperature, and magnetic pickup.

Under certain circumstances, the following strings may be displayed on the front panel HMI and in the Metering Explorer of BESTCOMS*Plus*:

- *NC (Not Connected)* - String displayed for a J1939 parameter when the engine ECU is not connected to the DGC-2020ES.
- *SF (Sender Fail)* - String displayed for a J1939 parameter when the engine ECU sends a special code indicating a measurement failure for the parameter. For example, if oil sender is determined to be bad by the ECU, it sends a special code in place of the J1939 oil pressure data indicating a sender fail condition.
- *NS (Not Sent)* - String displayed for a J1939 parameter when the J1939 parameter has not been sent to the DGC-2020ES by the engine ECU.

- *NA (Not Applicable)* - String displayed for a J1939 parameter when the engine ECU sends a special code for the parameter indicating that the parameter is not implemented or not applicable in the ECU.
- *UF (Unknown Failure)* - String displayed when the J1939 parameter data received by the ECU is not within the valid J1939 data range for the parameter but is not one of the special codes above.

Table 4-3 lists the J1939 data transmitted from the DGC-2020ES.

Table 4-3. J1939 Data Transmitted from the DGC-2020ES

ECU Parameter	Update Rate	* SPN
Battle Override Switch	100 ms	1237
Speed Request	10 ms	898
Note: Requests from the DGC-2020 to the Engine ECU for various parameters are made by issuing the request.		
Address Claim Request	Once on power up, and any time a Global Request for Address Claim (GRAC) PGN is received.	NA
Currently Active Diagnostic Trouble Codes Request	Whenever a refresh of Currently Active Diagnostic Trouble Code Requests is received.	NA
Previously Active Diagnostic Trouble Codes Request	2 s	NA
Clear Currently Active Diagnostic Trouble Codes Request	Whenever a request to reset Currently Active Diagnostic Trouble Code Request is made.	NA
Clear Previously Active Diagnostic Trouble Codes Request	Whenever a request to reset Previously Active Diagnostic Trouble Code Request is made.	NA
Engine Hours/Revolutions Request	2 s	NA
Fuel Consumption Request	2 s	NA
Electronic Engine Controller #4 (Rated Speed and Power) Request	2 s	NA
Auxiliary Analog Information	2 s	N/A

CAN Setup

The following paragraphs describe the settings found on the CAN Setup screen. This screen is found in the BESTCOMS*Plus Settings Explorer*, under the *Communications, CAN Bus* category. If using the front panel, navigate to Settings > Communications > CAN Bus Setup > CAN Bus Setup. Figure 4-1 illustrates the BESTCOMS*Plus* CAN Bus Setup screen.

Enable ECU Support

Set to Enabled for the DGC-2020ES to communicate with the ECU.

Enable DTC (Diagnostic Trouble Code) Support

If the ECU is a J1939 ECU, enable DTC support. If the ECU does not support it, no diagnostic trouble codes will be logged by the DGC-2020ES.

SPN Conversion Method

The most common SPN conversion method is 4 and is the default for the DGC-2020ES. Refer to ECU manufacturer documentation to determine the correct SPN conversion method of the ECU and set the SPN Conversion Method setting in the DGC-2020ES accordingly.

CAN bus Address

This parameter sets a unique address number for the DGC-2020ES operating on a CAN. The CAN Address is set internally by the DGC-2020ES when certain types of ECUs are selected on the ECU Setup screen, and in this case, the user-entered value does not apply. See Table 4-4.

Table 4-4. CAN Bus Address per ECU Type

ECU Type	CAN Bus Address
Cummins	220
Daimler CPC4	User-selectable
GM/Doosan	User-selectable
Isuzu	User-selectable
John Deere	User-selectable
MTU ADEC	1
MTU ECU7/ECU8	6
MTU MDEC	6
MTU Smart Connect	234
Scania	39
Standard	User-selectable
Volvo Penta	17
Yanmar	User-selectable

Engine ECU Address

Set this parameter to the address claimed by the Engine ECU operating on the J1939 network. In certain cases, there is more than one ECU transmitting data on the J1939 network. This setting specifies the ECU on the network to which the DGC-2020ES should transmit data. For more information on J1939 address handling, see J1939 Addresses below. When GM/Doosan is selected as the ECU type, the value of this setting is ignored and the Engine ECU Address value is always 0.

Coolant Temperature Source

With From ECU selected, the DGC-2020ES accepts coolant temperature data from the ECU on CAN 2 (ECU). With From DGC Input selected, the DGC-2020ES accepts coolant temperature data from the coolant temperature engine sender input.

Oil Pressure Source

With From ECU selected, the DGC-2020ES accepts oil pressure data from the ECU on CAN 2 (ECU). With From DGC Input selected, the DGC-2020ES accepts oil pressure data from the oil pressure engine sender input.

Engine Run Time Source

With From ECU selected, the DGC-2020ES accepts Engine Run Time data from the ECU on CAN 2 (ECU). With From DGC Input selected, the DGC-2020ES uses its internally tracked Engine Run Time data.

ECU Contact Control - Output Select

Select whether the RUN output relay or the PRE (Prestart) output relay closes to give the ECU its “energize to run” signal. In some implementations, this relay may actually be providing ECU power.

ECU Contact Control - Pulsing Enable

Select if the ECU is not to be on line at all times. Often ECUs are allowed to go “off line” to conserve battery drain when the engine is not running. The DGC-2020ES will “pulse” it periodically to force it to be active to allow the DGC-2020ES to read data such as coolant temperature and coolant level. This is required if the DGC-2020ES is to report low coolant temperature conditions (which may indicate a failure of a block heater), or low coolant level conditions (if a leak occurs while the machine is not running). Pulsing is also used to check the integrity of CAN communications when the machine is not running.

ECU Related Time Values - Engine Shut Down

Set this parameter for a value longer than the duration required to stop the engine after being shut down. The ECU is pulsed after this time expires. If the time is too short, the pulse may occur while the engine is still turning which could cause a brief re-start and possibly damage the flywheel and starter system.

ECU Related Time Values - Pulse Cycle Time

Set this parameter for the desired time between ECU pulse cycles.

ECU Related Time Values - Settling Time

This parameter is the duration of the “on line” time of the pulse cycle during which the DGC-2020ES reads data from the ECU. The settling time should be set long enough so that any ECU parameters that require time to “settle down” after the ECU is on line can do so. Since the DGC-2020ES may use some of the ECU data for alarm or pre-alarm annunciation, it is important that the data have time to settle.

ECU Related Time Values - Response Timeout

This setting defines the amount of time that the DGC-2020ES will wait to receive data from the ECU during a pulse cycle or start attempt. If no data is received during this time in a pulse cycle, a LOSS OF ECU COMMS pre-alarm is annunciated. If no data is received in this time during an engine starting attempt, a LOSS OF ECU COMMS alarm is annunciated.

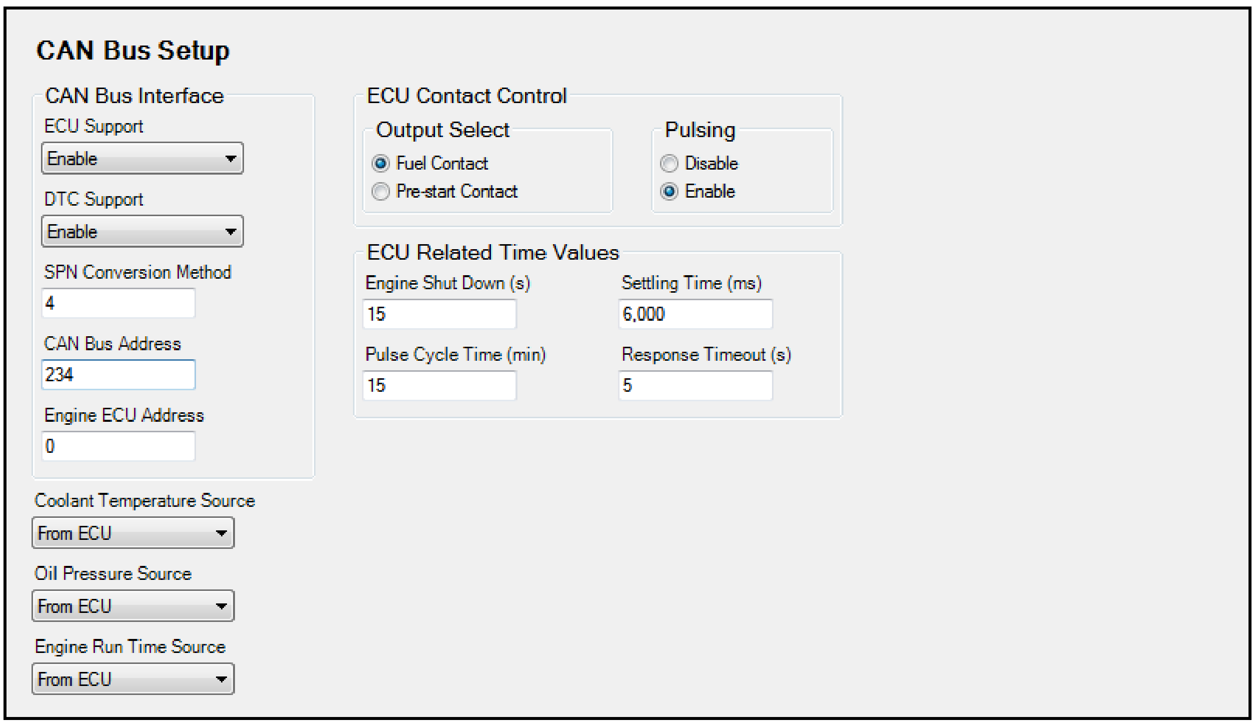


Figure 4-1. Settings Explorer, Communications, CAN Bus, CAN Bus Setup

ECU Setup

The following paragraphs describe the settings on the ECU Setup screen. This screen is found in the BESTCOMS*Plus Settings Explorer*, under the *Communications, CAN Bus* category. If using the front panel, navigate to Settings > Communications > CAN Bus Setup > ECU Setup. Refer to Figure 4-2.

ECU Type

The DGC-2020ES can be configured for Standard, Volvo Penta, MTU MDEC, MTU ADEC, MTU ECU7/ECU8, GM/Doosan, Cummins, MTU Smart Connect, Scania, or John Deere.

Generator Parameter Transmit

When the Generator Parameter Transmit setting is enabled, the DGC-2020ES broadcasts generator metered parameters over CAN as listed in Table 4-5. The Generator Parameter Transmit setting is not used when ECU Type is set for MTU MDEC, MTU ECU7/ECU8, or MTU Smart Connect.

Engine Parameter Transmit

When the Engine Parameter Transmit setting is enabled, the DGC-2020ES broadcasts engine metered parameters over CAN. When the Engine Parameter Transmit setting is disabled, transmission of J1939 commands from the DGC-2020ES to the engine are disabled, but commands from the engine to the DGC-2020ES are allowed.

Table 4-5. Generator Parameter Transmit

PGN Name	PGN	Hex	SPN	Parameter	Bytes Within PGN Data
Generator Total AC Energy	65018	FDFA	2468	Generator Total kW Hours Export	1 to 4
			2469	Generator Total kW Hours Import	5 to 8
Generator Total AC Reactive Power	65028	FE04	2456	Generator Total Reactive Power	1 to 4
			2464	Generator Overall Power Factor	5 to 6
			2518	Generator Overall Power Factor Lagging	7, bits 1 & 2
Generator Total AC Power	65029	FE05	2452	Generator Total Real Power	1 to 4
			2460	Generator Total Apparent Power	5 to 8
Generator Average Basic AC Quantities	65030	FE06	2440	Generator Average L-L AC RMS Voltage	1 to 2
			2444	Generator Average L-N AC RMS Voltage	3 to 4
			2436	Generator Average AC Frequency	5 to 6
			2448	Generator Average AC RMS Current	7 to 8
Engine Temperature	65262	FEEE	110	Engine Coolant Temperature (Not sent when CAN is enabled.)	1
Engine Fluid Level/Pressure	65263	FEEF	100	Engine Oil Pressure (Not sent when CAN is enabled.	4
Dash Display	65276	FEFC	96	Fuel Level	2

Diesel Particulate Filter (DPF)

The diesel particulate filter settings are used when the ECU is configured for Standard, Volvo Penta, MTU ADEC, GM/Doosan, Cummins, or MTU Smart Connect. The DGC-2020ES supports the CAN parameters that are related to the diesel particulate filter implemented on certain engines to meet Tier 4 emission requirements.

Two parameters are provided to initiate or disable DPF regeneration. The first, *Manual Regeneration*, is transmitted to the engine via CAN to initiate DPF regeneration. The second, *Disable Regeneration*, is transmitted to the engine via CAN to disable DPF regeneration. Extended operation with regeneration disabled is not recommended.

Speed Setup

Speed control over J1939 and ECU7/ECU8 is implemented over CAN when the CAN bus RPM Request setting is enabled. This is implemented for all ECUs.

Engine RPM: The Engine RPM setting defines the nominal requested engine rpm.

Idle RPM: The Idle RPM setting is the requested rpm when the IDLE REQUEST logic element is true.

Remember Speed Adjustments: A Remember Speed Adjustments setting is provided to establish how RPM adjustments by raise/lower commands are saved. When Yes is selected, adjustments to RPM by raise/lower commands are saved to memory and used for all subsequent run sessions. This is true even when power is cycled to the DGC- 2020ES. When No is selected, adjustments to rpm by raise/lower commands are retained for the duration of only the current run session. The adjustments are discarded the next time the engine is run or the DGC-2020ES is power cycled.

RPM Bandwidth: The RPM Bandwidth setting defines the speed adjustment range. For example, if the Engine RPM setting is 1800 and the RPM Bandwidth is set to 100, the rpm can be adjusted from 1750 to 1850 rpm.

RPM Checksum: Some newer engine ECUs will not respond to TSC1 speed request when the speed is a constant value unless a Message Counter and Checksum are implemented. This setting enables or disables the Message Counter and RPM Checksum.

Start Mode

The Start mode specifies whether the engine should start normally or as rapidly as possible. When Normal mode is selected, the engine will go through a normal start sequence when started. When Rapid mode is selected, the engine will go through a rapid start sequence if the engine ECU is programmed for a rapid start. A normal start could be employed when starting the generator is not time critical. However, if there was a power outage, a rapid start could be employed to restore power as soon as possible.

Volvo Penta

Configuring the DGC-2020ES for Volvo Penta* necessitates the configuration of two additional settings: Speed Select and Accelerator Position. The Speed Select setting configures the Volvo Penta ECU to operate the engine at the primary or secondary base speed. If the engine is configured by Volvo for 60 Hz applications, the primary base speed is 1,800 rpm and the secondary base speed is 1,500 rpm. If the engine is configured by Volvo for 50 Hz applications, the primary base speed is 1,500 rpm and the secondary base speed is 1,800 rpm. The Accelerator Position setting is expressed as a percentage and tells the Volvo Penta ECU where to set the engine speed (trim) relative to the base speed. The range of the setting is the base speed ±120 rpm. A setting of 0% will cause the engine to run at 120 rpm below the base speed, a setting of 50% will cause the engine to run at the base speed, and a setting of 100% will cause the engine to run at 120 rpm above the base speed. The Accelerator Position setting is linear with a gain of 2.4 rpm/percentage. This setting is not saved in nonvolatile memory and defaults back to 50% after DGC-2020ES control power is cycled.

The DGC-2020ES sends the following parameters to a Volvo Penta ECU through Volvo Proprietary J1939 communications:

- Start Request - sent when starting the engine.
- Stop Request - sent when shutting down the engine.
- Idle Request - sent when the Idle Request logic element is true in BESTlogic*Plus.*
- Preheat Request - sent anytime the DGC-2020ES would normally have its PRE relay closed for engines requiring a preheat contact.
- Accelerator Pedal Position - sent based on the Accelerator Position setting. If the Accelerator Pedal Position setting is left at the default 50%, this is calculated and sent based on the programmable Engine RPM setting to achieve the desired engine RPM.
- Primary/Secondary Engine Speed - sent based on the Speed Select setting and the state of the Alternate Frequency Override element in BESTlogic*Plus*. Primary speed is sent when the Speed Select setting is set for Primary and Secondary speed is sent when the Speed Select setting is set for Secondary. However, these are reversed if the Alternate Frequency Override is true. A setting of Primary results in Secondary being sent and a setting of Secondary results in Primary being sent when the Alternate Frequency Override is true.

∗ The Volvo Penta ECU configuration is applicable only to the EDC3 and EMS2 models of Volvo Penta engine controllers.

Cummins

When Cummins is selected as the ECU type, the following parameters are sent to the engine via Cummins Proprietary J1939 communications:

- Start Request - sent when starting or running the engine.
- Stop Request - sent when stopping the engine.
- Idle Request - sent when the Idle Request logic element is true in BESTlogic*Plus.*

- Rated Speed (50 or 60 Hz) - sent based on the Rated Speed setting of the DGC-2020ES. However, these are reversed if the Alternate Frequency Override is true. A setting of 60 Hz Rated Speed results in 50 Hz being sent and a setting of 50 Hz Rated Speed results in 60 Hz being sent when the Alternate Frequency Override is true.

Generator Control Communications Configuration: A parameter is provided to configure generator control communications. If the standard PGNs for Generator Control One and Generator Control Two are broadcast by the generator controller, the Cummins ECU will use those. If they are not broadcast, the ECU will expect the Cummins Engine Governing PGN (0xFF69) and Cummins Generator Control PGN (0xFF73). If the user selects Standard for the Generator Control Communications setting, the DGC-2020ES will not broadcast 0xFF69 and 0xFF73 in order to minimize loading on the CAN Bus.

MTU

If the engine is configured as MTU MDEC, the configuration of the following settings is necessary:

- MDEC Module Type - Specifies the type of MDEC module.
- Speed Demand Switch - Specifies speed demand source for the MTU engine ECU.
- NMT Alive Transmit Rate - Specifies the rate at which messages are transmitted to the MTU engine.

If the engine is configured as MTU ADEC, the configuration of the following settings is necessary:

- Speed Demand Switch - Specifies speed demand source for the MTU engine ECU.
- Overspeed Test - Temporarily drives an MTU ECU into overspeed for testing overspeed.
- Governor Param Switch Over - Specifies which governor parameters an MTU ECU should use.
- Trip Reset - Resets trip information such as trip fuel used, trip hours, trip idle time, etc.
- Int Oil Prime - Causes an MTU ECU engine to perform an internal lubrication cycle.

If the engine is configured as MTU ECU7/ECU8, the configuration of the following settings is necessary:

- Speed Demand Switch - Specifies speed demand source for the MTU engine ECU.
- Overspeed Test - Temporarily drives an MTU ECU into overspeed for testing overspeed.
- Speed Up - Increases speed of the MTU ECU.
- Speed Down - Decreases speed of the MTU ECU.
- Idle Request - Turns the idle request on or off.
- Increased Idle - Sets the MTU ECU idle.
- Trip Reset - Resets trip information such as trip fuel used, trip hours, trip idle time, etc.
- Int Oil Prime - Causes an MTU ECU engine to perform an internal lubrication cycle.
- MTU 50 Hz 60 Hz Switch Setting - Set automatically based on rated frequency of the DGC-2020ES and the state of the alternate frequency override.
- Engine Start Prime - Turns the engine start prime on or off.
- Fan Override - Turns the fan override on or off.
- Mode Switch - Turns the mode switch on or off.
- Governor Param Set Select - Sets the governor parameter set select.
- CAN Rating Switch 1 & 2 - Turns the CAN rating switch 1 & 2 on or off.
- Cylinder Cutout Disable 1 & 2 - Turns the cylinder cutout disable 1 & 2 on or off.
- MTU ECU7/ECU8 Module Type - Specifies ECU7/ECU8 Module type.
- NMT Alive Transmit Rate - Specifies the rate at which messages are transmitted to the MTU engine.

If the engine is configured as MTU Smart Connect, the configuration of the following settings is necessary:

- Speed Demand Switch - Specifies speed demand source for the MTU engine ECU.
- Overspeed Test - Temporarily drives an MTU ECU into overspeed for testing overspeed.
- Speed Up - Increases speed of the MTU ECU.
- Speed Down - Decreases speed of the MTU ECU.
- Idle Request - Turns the idle request on or off.
- Trip Reset - Resets trip information such as trip fuel used, trip hours, trip idle time, etc.
- Int Oil Prime - Causes an MTU ECU engine to perform an internal lubrication cycle.
- Governor Param Switch Over - Specifies which governor parameters an MTU ECU should use.
- Cylinder Cutout Disable 2 - Turns the cylinder cutout disable 2 on or off.
- Engine Operating Mode - Selects engine operating mode 1 or 2.

Scania

The majority of CAN Bus parameters are sent from Scania Engine ECUs via standard J1939 communications. However, some additional proprietary parameters are sent via Scania proprietary J1939 communications. Proprietary Start, Stop, and Emergency Stop commands are sent from the DGC-2020ES to the Scania ECU. The ECU communicates Diesel Exhaust Fluid (DEF) Levels, as well as DEF Fluid Low, DEF Low Severe, DEF Inducement, and DEF Severe Inducement Pre-Alarms to the DGC-2020ES through Proprietary Scania parameters. Additional information on DEF related parameters can be found in the *Exhaust Treatment* chapter.

John Deere

The Regeneration Interlock setting enables John Deere proprietary parameters to be broadcast over the J1939 CAN Bus.

The Regeneration Interlock parameter is sent via the Stationary Regeneration/Cleaning CAN Lockout Message PGN, which is PGN 61194. When the DGC Regeneration Interlock value is set to Enabled, the DGC-2020ES sends a value of 01 (binary) for the two bit “Allowed” configuration which allows regeneration to occur. When the DGC-2020ES Regeneration Interlock value is set to Disabled, the DGC-2020ES sends a value of 00 (binary) for the two bit “Not Allowed” configuration which inhibits regeneration.

The DGC-2020ES sends starter engagement requests to the ECU via the SAE J1939 Engine Start Control PGN. When the DGC-2020ES requests the starter to be engaged it sends a value of 01 (binary) for the two-bit starter engagement parameter. Otherwise the DGC-2020ES sends a value of 00 (binary) for the two-bit starter engagement parameter.

Isuzu

When the ECU type is set for Isuzu, the Clear ECU Memory and Escape Mode Request buttons are operational. When the Clear ECU Memory button is clicked, it will remain on for five seconds and then turn off, sending a five-second long memory clear request to the engine ECU. When the Escape Mode Request button is clicked, a temporary override of inducement to not operate the engine is sent to the ECU.

Daimler CPC4

When the ECU type is set for Daimler CPC4, the DGC-2020ES monitors the Torque Limit (LIM) Lamp Status broadcast via proprietary J1939 communications from the Daimler engine ECU to the DGC-2020ES. When the monitored LIM Lamp status indicates the lamp is on solid, the DGC-2020 annunciates a pre-alarm displaying the LIM symbol and text “Torque Limit”. When the monitored LIM Lamp status indicates the lamp is flashing, the DGC-2020ES annunciates a pre-alarm displaying the LIM symbol and text “Torque Limit Severe”. The DGC-2020ES also displays the LIM symbol in the exhaust status display portion of the front panel display.

Yanmar

Some DTC-FMI combinations report different Yanmar P Codes depending on whether the engine has three or four cylinders. The Number of Cylinders setting specifies how many cylinders exist in the engine.

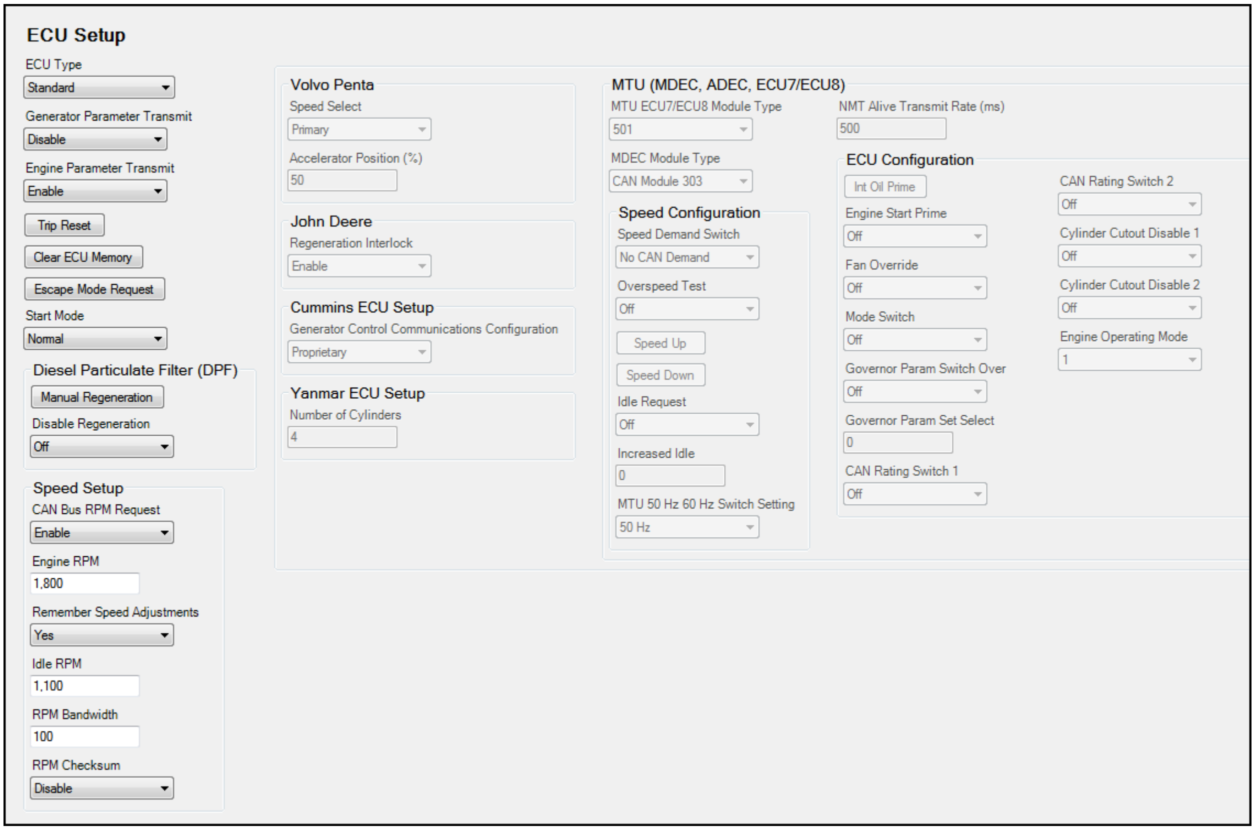


Figure 4-2. Settings Explorer, CAN Bus, ECU Setup

Remote Display Panel (optional)

Applications that require remote annunciation can use Basler Electric's Remote Display Panel. This device provides remote indication of many pre-alarm and alarm conditions.

Remote Display Panel connections are made at 10 (RDP TxD–), 11 (RDP TxD+), 17 (BATT–), and 18 (BATT+).

The following pre-alarm conditions are indicated by LEDs on the Remote Display Panel:

- High coolant temperature
- Low coolant temperature
- Low oil pressure
- Low fuel level∗
- Weak battery
- Battery overvoltage†
- Battery charger failure∗†

The following alarm conditions are indicated by LEDs and an audible alarm on the Remote Display Panel:

- Low coolant level∗
- High coolant temperature
- Low oil pressure
- Overcrank
- Overspeed
- Emergency stop activated
- Fuel leak/Sender failure∗†
- Sender failure†

∗ This can be configured in the DGC-2020ES as *None*, *Alarm*, or *Pre-alarm*. See the *Contact Inputs* chapter for more information. The LED on the Remote Display Panel illuminates when the input that is assigned to the programmable function is closed, whether the function is configured as *None*, *Alarm*, or *Pre-alarm*.

† This LED can be reprogrammed in the DGC-2020ES to suit the needs of a particular application. The condition listed above is annunciated by default.

Additionally, the Remote Display Panel indicates when the DGC-2020ES is not operating in Auto mode and when the generator is supplying load or when the DGC-2020ES is in an alarm state not listed above.

Refer to Basler Publication 9318100990 for more information on the Remote Display Panel.

See the *Terminals and Connectors* chapter in the *Installation* manual for more information on connecting the Remote Display Panel to the DGC-2020ES.

5 • Device Configuration

System parameters configure the DGC-2020ES for operation with a specific application. This chapter lists items to consider when configuring the DGC-2020ES. These items consist of system settings and rated data, remote module setup, crank settings, automatic restart settings, exercise timer settings, sensing transformer ratings, relay control settings, and system configuration detection settings.

System Settings

The System Settings parameters consist of number of fly wheel teeth, speed signal source, power-up delay, fuel level function, NFPA compliance level, EPS supplying load, system units, and metric pressure units. The System Settings screen is found in the BESTCOMS*Plus*® Settings Explorer under the System Parameters category. If using the front panel, navigate to Settings > System Parameters > System Settings.

Number Flywheel Teeth

The Number Fly Wheel Teeth setting accepts a value from 1 to 500, in increments of 0.1. This value is used when calculating engine rpm.

Speed Signal Source

The DGC-2020ES can be configured to detect engine speed from a magnetic pickup (MPU), the genset frequency, or both the MPU and genset frequency. On engines with CAN ECUs, if MPU or MPU Freq is selected as the Speed Signal Source, the DGC-2020ES uses CAN as the speed source when CAN is enabled. If Gen Freq is set as the Speed Signal Source, the DGC-2020ES uses the generator frequency.

When engine speed is obtained from the genset frequency, the DGC-2020ES uses the rated (nominal) genset frequency and nominal rpm rating when calculating engine rpm.

When engine speed is obtained from an MPU, the DGC-2020ES uses the nominal rpm rating and the number of flywheel teeth when calculating engine rpm.

The speed signal from the MPU takes priority when both the genset frequency and MPU are selected as the engine speed source. If both MPU and genset frequency are selected and the MPU fails, the DGC-2020ES automatically switches to the genset frequency as the engine speed source.

Power Up Delay

In some cases, the ECU takes longer than the DGC-2020ES to power up. The power up delay setting is used to delay the initial pulsing of the ECU for data on DGC-2020ES power up. This setting ranges from 0 to 60 seconds in 1 second increments.

Fuel Level Function

This setting determines whether the fuel level indications and the related alarm and pre-alarm are enabled or disabled. Setting selections include, Fuel Lvl (Fuel Level), Natural Gas, Liquid Propane, or Disabled. Selecting a fuel type other than Fuel Lvl disables any fuel level indication, alarm, or pre-alarm. This includes the Fuel Level value on the *Metering Explorer, Engine* screen in BESTCOMS*Plus*.

NFPA Compliance Level

The DGC-2020ES can be used in an application requiring compliance with NFPA Standard 110. Levels 1 and 2 of Standard 110 are supported. Selecting level 1 or 2 affects DGC-2020ES operation in the following ways:

- The number of crank cycles is fixed at 3
- Crank cycle time is fixed at 15 seconds
- Continuous crank time is fixed at 45 seconds
- The low coolant temperature pre-alarm setting is fixed at 70°F

EPS Supplying Load

EPS Supplying Load settings consist of Low Line Scale Factor and EPS Threshold. These settings are described in the following paragraphs.

Low Line Scale Factor

Low Line Scale Factor automatically adjusts the EPS threshold setting in applications utilizing more than one type of genset connection. The scale factor setting is implemented when the DGC-2020ES senses a contact closure at a contact input programmed to activate scaling of the settings. The value of the scale factor setting serves as a multiplier for the threshold setting. For example, if a scale factor contact input is received by the DGC-2020ES and the scale factor setting is 2.000, the threshold setting is doubled (2.000 x Threshold setting).

EPS Threshold

Indication that the emergency power system is supplying load is determined by a user-adjustable threshold setting. This setting is expressed as a percentage of the genset CT (nominal) primary rating.

This setting accepts values from 3 to 10, in increments of 1%.

System Units

Engine oil pressure and coolant temperature can be displayed in English or metric units of measure.

Metric Pressure Units

This setting allows engine oil pressure to be displayed in bar or kPa/MPa.

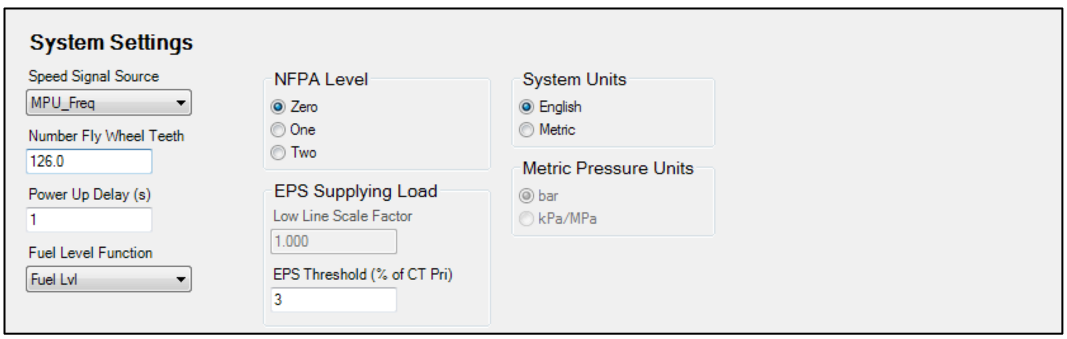


Figure 5-1. Settings Explorer, System Parameters, System Settings Screen

Rated Data

Rated Data parameters consist of sensing transformer ratings, voltage, power factor, kW, engine RPM, frequency, battery volts, generator and bus connection types, and phase rotation. The Rated Data screen is found in the BESTCOMS*Plus* Settings Explorer under the System Parameters category. If using the front panel, navigate to Settings > System Parameters > System Settings.

Click the Edit button on the BESTCOMS*Plus* Rated Data settings screen to adjust values. Click OK to accept the changes, and Cancel to discard them.

Sensing Transformers

For information on sensing transformers settings, see *Sensing Transformers*, below.

Rated Data

Genset nameplate data used by the DGC-2020ES includes the rated voltage, power factor, kW, and engine RPM.

Rated Volts (V L-L)

This setting accepts values from 1 to 99,999, in increments of 1.

Rated Power Factor (PF)

This setting accepts values from -1 to 1, in increments of 0.001.

Genset kW Rating

This setting accepts values from 5 to 9,999, in increments of 1.

Rated Engine RPM

This setting accepts values from 25 to 3,600, in increments of 1.

Calculated Rated Data

Rated Secondary Volts, Rated Phase Amps, Rated Secondary Phase Amps, Rated kVA, and Rated kvar are calculated automatically. The equations used for these calculations are listed below.

$$\text{Rated Secondary Volts} = \text{Rated Volts}\left(\frac{\text{Gen PT Secondary Volts}}{\text{Gen PT Primary Volts}}\right)$$

$$\text{Rated Phase Amps}\,(3-\text{phase machine}) = \frac{\text{Rated kVA}}{\text{Rated L}-\text{L Volts}\sqrt{3}}$$

$$\text{Rated Phase Amps}\,(1-\text{phase machine}) = \frac{\text{Rated kVA}}{\text{Rated L}-\text{L Volts}}$$

$$\text{Rated Secondary Phase Amps} = \text{Rated Phase Amps}\left(\frac{\text{CT Secondary Amps}}{\text{CT Primary Amps}}\right)$$

$$\text{Rated kVA} = \frac{\text{Rated kW}}{\text{Rated PF}}$$

$$\text{Rated kvar} = \text{Rated kVA}\sqrt{1-\text{Rated PF}^2}$$

Frequency

The frequency settings allow selection of the rated frequency of the generator and an alternate frequency.

Rated Frequency of the Unit

Rated frequency settings consist of 50 and 60 Hz.

Alternate Frequency

This setting accepts values from 10 to 450, in increments of 0.01.

Battery Volts

The nominal voltage of the starter battery is used by the DGC-2020ES to detect and annunciate battery overvoltage and low or weak battery voltage. The Battery Volts settings consist of 12 V and 24 V.

Generator Connection

Genset connection types accommodated by the DGC-2020ES include three, three-phase connections (delta, wye, and grounded delta) and a single-phase configuration (sensing across phases A and B.)

Bus Connection

Bus connection types consist of single- and three-phase. Single-phase bus voltage is sensed across phases A and B.

Phase Rotation

The Phase Rotation setting allows selection of ABC or CBA rotation according to the phase rotation connection of the machine. The DGC-2020ES calculates the power angle as the angle between the Phase AB voltage and phase B current. An angle compensation factor, determined by the phase rotation setting, is then applied. If the actual phase rotation connection of the machine does not match the phase rotation setting, calculation of the power angle will be incorrect, which may result in a miscalculation of kW, kvar, and power factor.

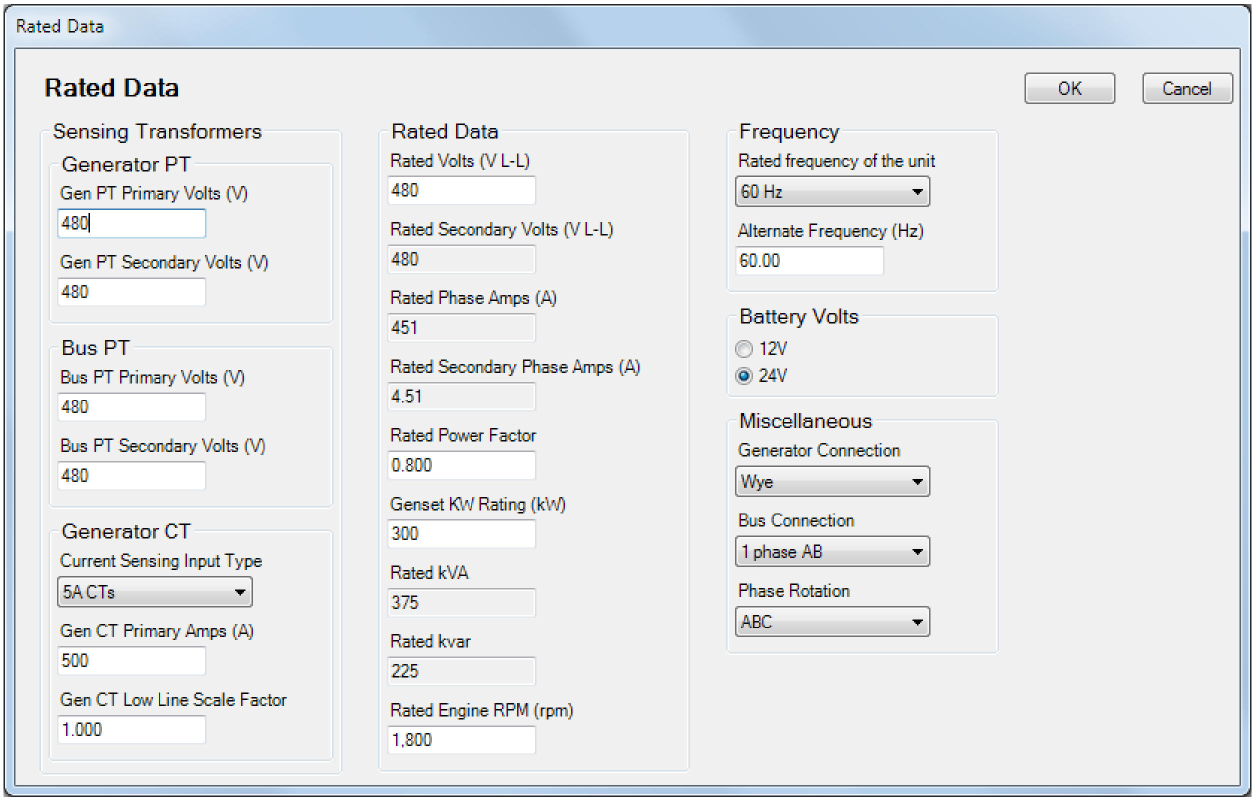


Figure 5-2. Settings Explorer, System Parameters, Rated Data Screen

Remote Module Setup

When the optional CEM-2020 is enabled, a J1939 address must be entered. Select the appropriate number of outputs available on the CEM-2020. The low current module (CEM-2020) provides 24 contact outputs and the high current module (CEM-2020H) provides 18 contact outputs.

The Remote Module Setup screen is found in the BESTCOMS*Plus* Settings Explorer under the System Parameters category. If using the front panel, navigate to Settings > System Parameters > Remote Module Setup.

The BESTCOMS*Plus* Remote Module Setup screen is illustrated in Figure 5-3.

Figure 5-3. Settings Explorer, System Parameters, Remote Module Setup Screen

Crank Settings

The Crank Settings consist of pre-start, restart, cranking, crank disconnect, and cooldown. These settings are described in the paragraphs below.

The Crank Settings screen is found in the BESTCOMS*Plus* Settings Explorer under the System Parameters category. If using the front panel, navigate to Settings > System Parameters > Crank Settings.

The BESTCOMS*Plus* Crank Settings screen is illustrated in Figure 5-4.

Pre-Start

If desired, cycle or continuous cranking can be delayed after initiating engine startup. During this delay, the Pre-Start output closes to energize glow plugs or pre-start the lubrication pump. The Pre-crank Delay setting accepts values from 0 to 30, in increments of 1 second.

The Pre-Start output can be configured to open upon the conclusion of engine cranking or remain closed as long as the engine is running.

The Pre-Start output can be configured during the resting state. If Preheat Before Crank is selected, the Pre-Start output is closed for the duration of the Pre-crank Delay time prior to re-entering the cranking state. If the Pre-crank delay setting is longer than the rest interval, the Pre-Start output is closed for the entire duration of the rest time.

Restart

Attempting to start an engine after a normal shutdown but before the engine RPM has settled to zero can stress an engine in certain situations. The Restart Delay inhibits attempts to start the engine immediately after a normal shutdown for the duration of the Restart Delay timer. This delay should allow an engine to properly spin down before attempting to restart. This setting accepts values from 0 to 120, in increments of 1 second.

Cranking

The DGC-2020ES can be programmed for either cycle or continuous cranking.

Cycle cranking provides multiple engine starting attempts. Each starting attempt consists of a fixed interval of engine cranking followed by a rest interval. The Number of Crank Cycles setting accepts values from 1 to 7, in increments of 1. The Cycle Crank Time setting accepts values from 5 to 15, in increments of 1 second.

Continuous cranking provides a single, extended engine-starting attempt. The Continuous Crank Time setting accepts values from 5 to 60, in increments of 1 second.

Crank Disconnect

Under normal operation, engine rpm is used to determine crank disconnect. The Crank Disconnect Limit setting establishes the engine rpm percentage at which the starter is disconnected. This setting accepts values from 10 to 100, in increments of 1 percent.

The Oil Pressure Crank Disconnect provides a secondary indication that the engine is running. This ensures that the starter is disconnected, even if no engine rpm sources are functioning. When enabled, oil pressure is used to determine if the engine is running. If the engine oil pressure is above the threshold, the starter is disconnected from the engine. The Crank Disconnect Pressure threshold setting accepts values from 2.9 to 150 psi, 0.2 to 10.3 bar, and 20 to 1,034.5 kPa, in increments of 0.1.

Cool Down

After the load is removed from a genset, the DGC-2020ES implements a smart cooldown function. This function ensures that the engine and turbocharger properly cool down by maintaining engine operation for a user-defined duration.

This cooldown function is initiated for any one of the following conditions:

- Genset load is removed and engine shutdown is permitted while in AUTO mode
- Auto Transfer switch (ATS) opens while operating in AUTO mode
- Remote shutdown is initiated while in AUTO mode
- Off Mode Cooldown is initiated
- The Cooldown Request logic element is initiated
- The Cool and Stop Request logic element is initiated

Settings

Off Mode Cool Down: Upon receiving a cool down request with this setting enabled, the unit will enter a cool down cycle when in Off mode.

Cool Down Configuration: Upon receiving a cool down request with Only When Loaded selected, the unit will enter a cool down cycle only if a load is currently applied. With Always selected, the unit will enter a cool down cycle upon request with or without a load applied.

No Load Cool Down Time: This setting establishes the duration of the cool down cycle when no load is applied.

Smart Cooldown Function

The smart cooldown function reduces unnecessary fuel expenditure by considering overall cooldown time through multiple requests. For example, a new cooldown request is initiated after a previous cooldown sequence has already started. The cooldown timer is not simply reset with each new request. Instead, the amount of time that the engine has spent cooling down is factored into the new request. This saves time and fuel by running the engine no longer than necessary to achieve proper cooldown.

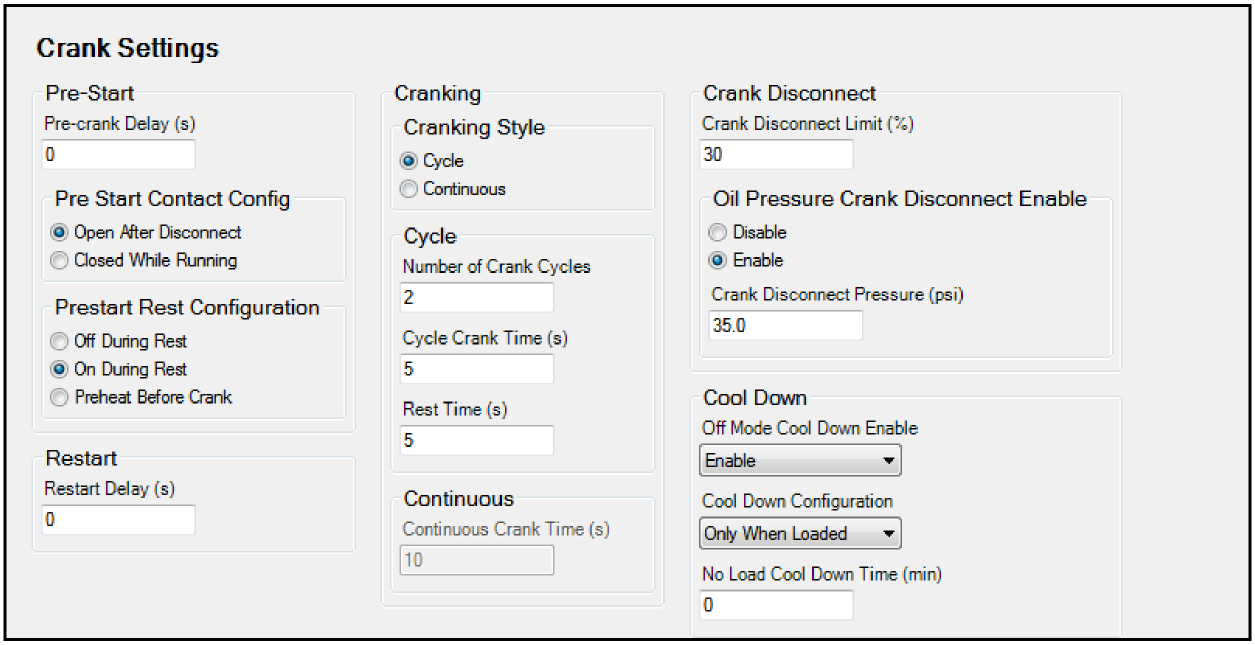


Figure 5-4. Settings Explorer, System Parameters, Crank Settings Screen

Automatic Restart

When enabled, the Automatic Restart clears all alarms automatically if the DGC-2020ES shuts down due to an alarm condition. An attempt to restart the engine is made, after a predetermined time delay, if the ATS contact input is closed. If an ATS contact is not present, the unit remains in the READY state with alarms cleared. A restart is not attempted if a low fuel alarm or emergency stop is present. The number of restart attempts is programmable. Automatic restart attempts are recorded in the event log.

The Auto Restart Interval setting accepts values from 0.5 to 30, in increments of 0.5 minutes. The Auto Restart Attempts setting accepts values from 1 to 10, in increments of 1.

The Automatic Restart screen is found in the BESTCOMS*Plus* Settings Explorer under the System Parameters category. If using the front panel, navigate to Settings > System Parameters > Automatic Restart.

The BESTCOMS*Plus* Automatic Restart screen is illustrated in Figure 5-5.

Figure 5-5. Settings Explorer, System Parameters, Automatic Restart Screen

Exercise Timer

The exercise timer function starts and runs the genset at specified intervals. Exercise timer settings are described in the following paragraphs.

Modes

The Mode setting determines how often the generator is exercised. Each mode has supporting settings that establish the start time, date, and duration of each session. When a mode is selected, only the appropriate supporting settings for that mode are available while other settings are grayed out. Start Hour, Start Minute, Run Period Hours, Run Period Minutes, and Run with Load settings are available for all modes. The exercise timer modes are described below.
Daily: The generator will run every day.

Monthly: The generator will run on the same day every month using the numeric date. For example, the fifth of every month. See Start Day of Month under *Supporting Settings* below.

N Week Intervals: On or after the specified start date, the generator will run on the same day every N weeks, where N is a value from 1 through 52. For example, every two weeks on Sundays, starting on January 1, 2020. See Start Day of Week, Week Interval, and Begin Date (Month, Day, Year) under *Supporting Settings* below.

Weekday of Month: The generator will run on the same day of the week every month. For example, the third Tuesday of every month. See Start Day of Week and Week of Month under *Supporting Settings* below.

Weekly: The generator will run on the same day every week. See Start Day of Week under *Supporting Settings* below.

Supporting Settings

Begin Date (Month, Day, Year): These three settings establish the date on which the exercise timer will start when Mode is set to N Week Intervals.
Start Day of Month: Accepts values 1 through 31. Enabled when Mode is set to Monthly.
Start Day of Week: Select Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, or Saturday. Enabled when Mode is set to Weekly, Weekday of Month, or N Week Intervals.

Start Time and Run Period: The generator will start at the time established by the Start Hour and Start Minute settings and will run for the duration established by the Run Period Hours and Run Period Minutes settings. These settings are available for all modes.

Run with Load: When enabled, the DGC-2020ES closes the generator breaker during the run time.

Week Interval: Accepts values 1 through 52. Enabled when Mode is set to N Week Intervals.

Week of Month: Select First, Second, Third, Fourth, or Last. Enabled when Mode is set to Weekday of Month.

Contact inputs and outputs can be assigned to this function. Refer to the *BESTlogicPlus* chapter for more information.

The Exercise Timer screen is found in the BESTCOMS*Plus* Settings Explorer under the System Parameters category. If using the front panel, navigate to Settings > System Parameters > Exercise Timer.

The BESTCOMS*Plus* Exercise Timer screen is illustrated in Figure 5-6.

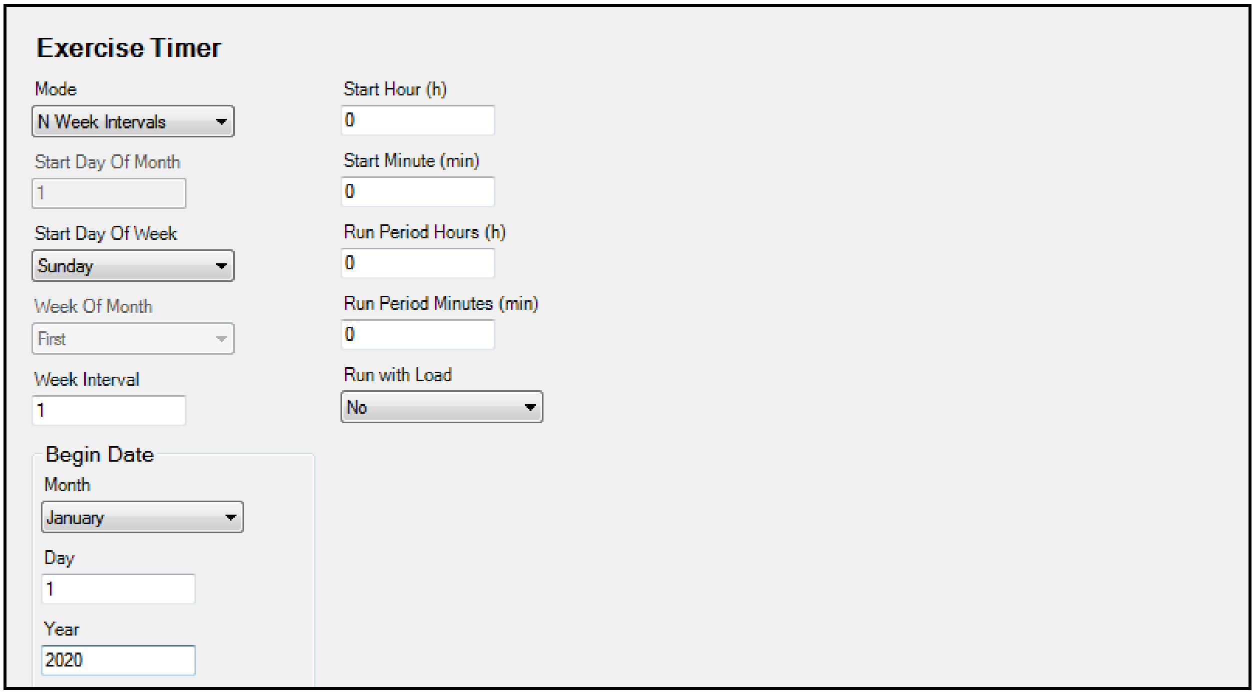


Figure 5-6. Settings Explorer, System Parameters, Exercise Timer Screen

Sensing Transformers

Three sets of transformer settings configure the DGC-2020ES for operation with a specific system. These settings, along with the generator voltage, generator current, and bus voltage detected by the DGC-2020ES, enable it to accurately meter system values and offer generator protection.

The Sensing Transformers screen is found in the BESTCOMS*Plus* Settings Explorer under the System Parameters category. If using the front panel, navigate to Settings > System Parameters > Sensing Transformers.

When adjusting these settings using BESTCOMS*Plus*, click the *Rated Data* button. See *Rated Data,* above, for more information.

Generator PT

The generator PT settings establish the nominal primary (generator side) and secondary (DGC-2020ES side) voltage levels at the generator voltage-sensing transformer. The Generator PT Primary setting accepts values from 1 to 999,999, in increments of 1. The Generator PT Secondary setting accepts values from 1 to 480, in increments of 1.

Bus PT

Primary and secondary bus transformer ratings are used by the optional automatic transfer switch function. This function monitors a three-phase bus input to detect mains failure. The primary setting establishes the nominal voltage present at phases A, B, and, C of the bus. This setting accepts values from 1 to 99,999, in increments of 1. The secondary setting establishes the nominal voltage detected at the bus voltage input of the DGC-2020ES. This setting accepts values from 1 to 480, in increments of 1.

Generator CT

The generator CT setting establishes the nominal, primary (generator side) current level at the generator current sensing transformer. This setting accepts values from 1 to 9,999, in increments of 1. The secondary value of the generator CT is dictated by the style number of the controller. A DGC-2020ES with a style number of 1xx uses a nominal CT secondary rating of 1 Aac. A DGC-2020ES with a style number of 5xx uses a nominal CT secondary rating of 5 Aac.

The Gen CT Low Line Scale Factor setting is used to automatically adjust the Gen CT Primary Amps setting in applications that may utilize more than one type of genset connection. This setting accepts a value from 0.001 to 3, in increments of 0.001. The scale factor setting is implemented when the DGC-2020ES senses a contact closure at a contact input programmed to activate scaling of the settings. The value of the scale factor setting serves as a multiplier for the Gen CT Primary Amps setting. For example, if a scale factor contact input is received by the DGC-2020ES and the scale factor setting is 2.000, the Gen CT Primary Amps setting is doubled (2.000 x Gen CT Primary Amps).

Relay Control

The default operational setting for the Start, Run, and Pre-start relays is *Predefined* or standard. Any of these relays can be logic driven by selecting the *Programmable* setting. Logic driven (programmable relays must be set up using BESTlogic*Plus*.

The Relay Control screen is found in the BESTCOMS*Plus* Settings Explorer under the System Parameters category. If using the front panel, navigate to Settings > System Parameters > Relay Control.

The BESTCOMS*Plus* Relay Control screen is illustrated in Figure 5-7.

Figure 5-7. Settings Explorer, System Parameters, Relay Control Screen

System Configuration Detection

When enabled, this feature allows the DGC-2020ES to automatically detect its sensing configuration in relation to the generator. Upon starting the genset, the configuration of the generator is automatically detected. The Single Phase Override and Low Line Override programmable function settings are then adjusted accordingly.

There is a one-second delay in the detection to prevent the DGC-2020ES from alternating between detected configurations. When the DGC-2020ES is in the *Off* mode or the engine is not running, the Automatic Configuration Detection function is disabled. The DGC-2020ES is assumed to be in the last valid automatically detected configuration.

It is recommended that the Single Phase Override and Low Line Override programmable functions are not assigned to contact inputs when Automatic Configuration Detection is enabled.

Single Phase Detect Threshold

If the difference between the maximum and minimum line-to-line voltage exceeds this threshold, the unit is determined to be in single-phase configuration. If determined to be in single-phase configuration, the Single Phase Override programmable function forces the DGC-2020ES into single-phase mode. The single-phase mode connection is determined by the *Single Phase Detect Generator Connection*, below.

If the Single Phase Override function is assigned to a contact output, the state of the contact output and the detected configuration are ORed. This means, if one or both are true, then the system is determined to be configured for single phase.

Low Line Detect Threshold

If the average of the valid line-to-line voltages for the detected configuration is above this threshold, the unit is determined to be in a high-line configuration. If the average is below this threshold, it is determined to be in a low-line configuration. If determined to be in low-line configuration, the Low-Line Override function forces the DGC-2020ES into the low-line configuration.

If the Low-Line Override function is assigned to a contact output, the state of the contact output and the detected configuration are ORed. This means, if one or both are true, then the system is determined to be configured for low-line.

Single Phase Detect Generator Connection

This setting specifies which single-phase connection to use when the system is determined to be single-phase. Single-phase AB or Single-phase AC can be selected.

The *Auto Config Detection* screen is found in the BESTCOMS*Plus* Settings Explorer under the System Parameters category. If using the front panel, navigate to Settings > System Parameters > Auto Config Detect. The BESTCOMS*Plus* Auto Config Detection screen is illustrated in Figure 5-8.

Figure 5-8. Settings Explorer, System Parameters, Auto Config Detection Screen

6 • Timekeeping

The DGC-2020ES provides a real-time clock with capacitor backup that is capable of operating the clock for up to 24 hours after power is removed from the controller. As the capacitor nears depletion, an internal backup battery takes over and maintains timekeeping. The battery will maintain the clock for approximately ten years depending on conditions. The battery is not replaceable.

The clock is used by the events recorder function to time-stamp events and the exercise timer to start and stop the genset when the exercise feature is utilized.

Clock Setup

Clock settings are made through the communication ports using BESTCOMS*Plus*® or through the front-panel interface. Write access to ports is required to program the clock. An alarm is provided to detect when the DGC-2020ES has powered up and the clock has not been set.

The clock settings are made through BESTCOMS*Plus* by selecting *Clock Setup* under *General Settings.* If using the front panel, navigate to Settings > General Settings > Configure Date/Time.

The BESTCOMS*Plus Clock Setup* screen is illustrated in Figure 6-1. Settings are listed in Table 6-1.

The local time zone is configured on this screen. The Time Zone Offset is the local offset to UTC (Coordinated Universal Time). The Time Zone Offset is required when the Start/End Time Reference is set to UTC (Coordinated Universal Time). The Start/End Time Reference is set to UTC time if required by local daylight savings time rules. The Start/End Hour/Minute settings determine the time when the DST will go into effect. The Bias setting is the amount of time that the clock moves forward or backward. The user is notified when the clock is not set when the Clock Not Set Warning is enabled.

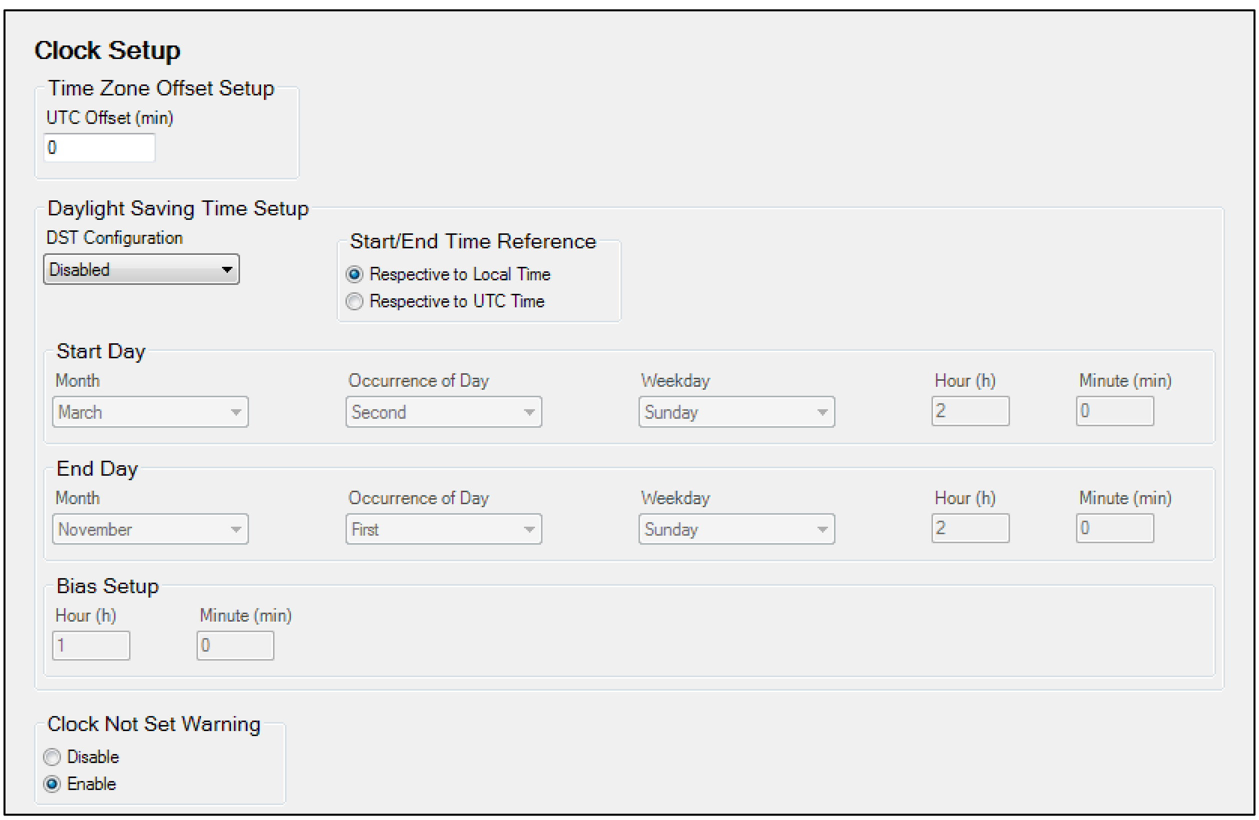


Figure 6-1. Settings Explorer, General Settings, Clock Setup Screen

Table 6-1. Settings for Clock

Setting	Range	Increment	Unit	Default
UTC Offset	–1,440 to 1,440	1	minutes	–6
DST Configuration	Floating Dates or Fixed Dates	n/a	n/a	Disabled
Start/End Time Reference	Respective to Local Time or Respective to UTC Time	n/a	n/a	Respective to Local Time
Bias Setup (Hour)	–12 to 12	1	hours	Disabled
Bias Setup (Minute)	–59 to 59	1	minutes	0
Clock Not Set Warning	Disable or Enable	n/a	n/a	Disable

Setting the Time and Date

Time and date settings are made through BESTCOMS*Plus* on the Real Time Clock screen (Figure 6-2) of the Metering Explorer. Settings can also be made through the front panel.

Figure 6-2. Metering Explorer, Real Time Clock Screen

7 • Engine Sender Inputs

The DGC-2020ES has sender inputs dedicated to monitoring the engine fuel level, oil pressure, and coolant temperature. These inputs are programmable to give the user flexibility in selecting the sender to be used in an application. Information about programming sender inputs is provided later in this chapter.

Compatible Senders

Oil pressure senders that are compatible with the DGC-2020ES include Datcon model 02505-00, Isspro model R8919, Stewart-Warner models 279BF, 279C, 411K and 411M, and VDO models 360025 and 360811. Compatible Fuel Level senders include the Isspro model R8925. Compatible Coolant Temperature senders include Datcon model 02019-00, Faria model TS4042, Isspro model, R8959, and Stewart-Warner model 334P. Other senders may also be used.

Operation

A current is provided to each sender. The developed voltage is measured and scaled for use by the internal circuitry. An open circuit or short circuit across the sender terminals will cause the DGC-2020ES to indicate a failed sender.

Sender Programmability

BESTCOMS*Plus*® software allows for the programming of sender characteristics. See *Sender Characteristic Curves* for more information.

Sender Characteristic Curves

The sender inputs of the DGC-2020ES can be customized to obtain maximum accuracy from the coolant temperature, oil pressure, and fuel level senders.

The characteristic curve of each sender input can be configured with up to 11 points. Each point can be assigned a resistance input value and a corresponding temperature (coolant temperature sender), pressure (oil pressure sender), or percentage (fuel level sender) value. A sender slope setting automatically orders the values in the resistance column according to whether the sender requires a negative or positive slope. Sender curve points are automatically plotted on a curve in BESTCOMS*Plus*, which can be printed.

Sender curve points configured in BESTCOMS*Plus* can be saved in the configuration file. The data for all three senders is automatically saved with the DGC-2020ES configuration file.

Any changes made in BESTCOMS*Plus* to the sender points, can be reverted to the factory-default values. A new settings file can also be created.

Curve Configuration

If the DGC-2020ES receives engine information from an ECU, the programmable sender parameters for coolant temperature and oil pressure do not require configuration because they have no effect. Configuration of sender parameters is appropriate for resistive senders only.

Fuel Level

Figure 7-1 illustrates the *Fuel Level* screen found in the BESTCOMS*Plus Settings Explorer* under the *Programmable Senders* category. To program the fuel level sender, perform the following procedure:

1. The percent fuel level sender is configured by selecting one of the sender types that come as a part of the BESTCOMS*Plus* sender library. Click on *Load Fuel Settings File* and select the appropriate sender.

2. If no sender file matches the sender being used, the individual points that map resistance points to fuel level may be modified by setting numeric values in the table, or dragging the points of the graph to the desired characteristic. Information on sender characteristics should be obtained from the sender manufacturer.
3. Select *Positive* or *Negative* sender slope as required for the desired sender graph.
4. Click *Save Fuel Data* to save the data in the current settings file.
5. If you want to save newly entered sender data as a sender library file, click *Create Fuel Settings File* and enter a file name and location to save the file.
6. Click the *Send Settings* button in BESTCOMS*Plus* to send the sender settings to the DGC-2020ES.

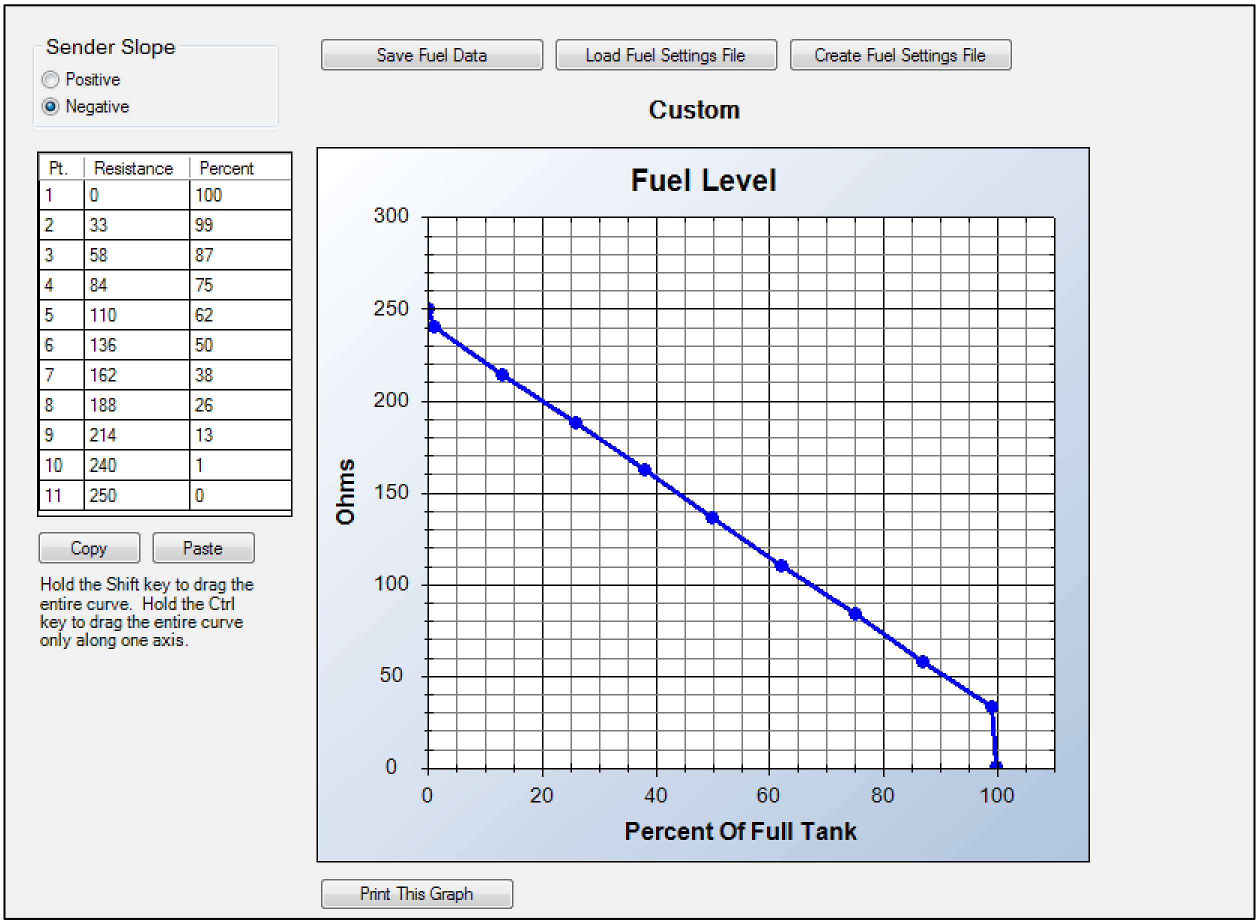


Figure 7-1. Settings Explorer, Programmable Senders, Fuel Level Screen

Oil Pressure

Figure 7-2 illustrates the *Oil Pressure* screen found in the BESTCOMS*Plus Settings Explorer* under the *Programmable Senders* category. To program the oil pressure sender, perform the following procedure:

1. The oil pressure sender can be configured by selecting one of the sender types that come as a part of the BESTCOMS*Plus* sender library. Click on *Load Oil Settings File* and select the appropriate sender.
2. If no sender file matches the sender being used, the individual points that map resistance points to oil pressure may be modified by setting numeric values in the table, or dragging the points of the graph to the desired characteristic. Information on sender characteristics should be obtained from the sender manufacturer.
3. Select *Positive* or *Negative* sender slope as required for the desired sender graph.
4. Click *Save Oil Data* to save the data in the current settings file.

5. If you want to save newly entered sender data as a sender library file, click *Create Oil Settings File* and enter a file name and location to save the file.
6. Click the *Send Settings* button in BESTCOMS*Plus* to send the sender settings to the DGC-2020ES.

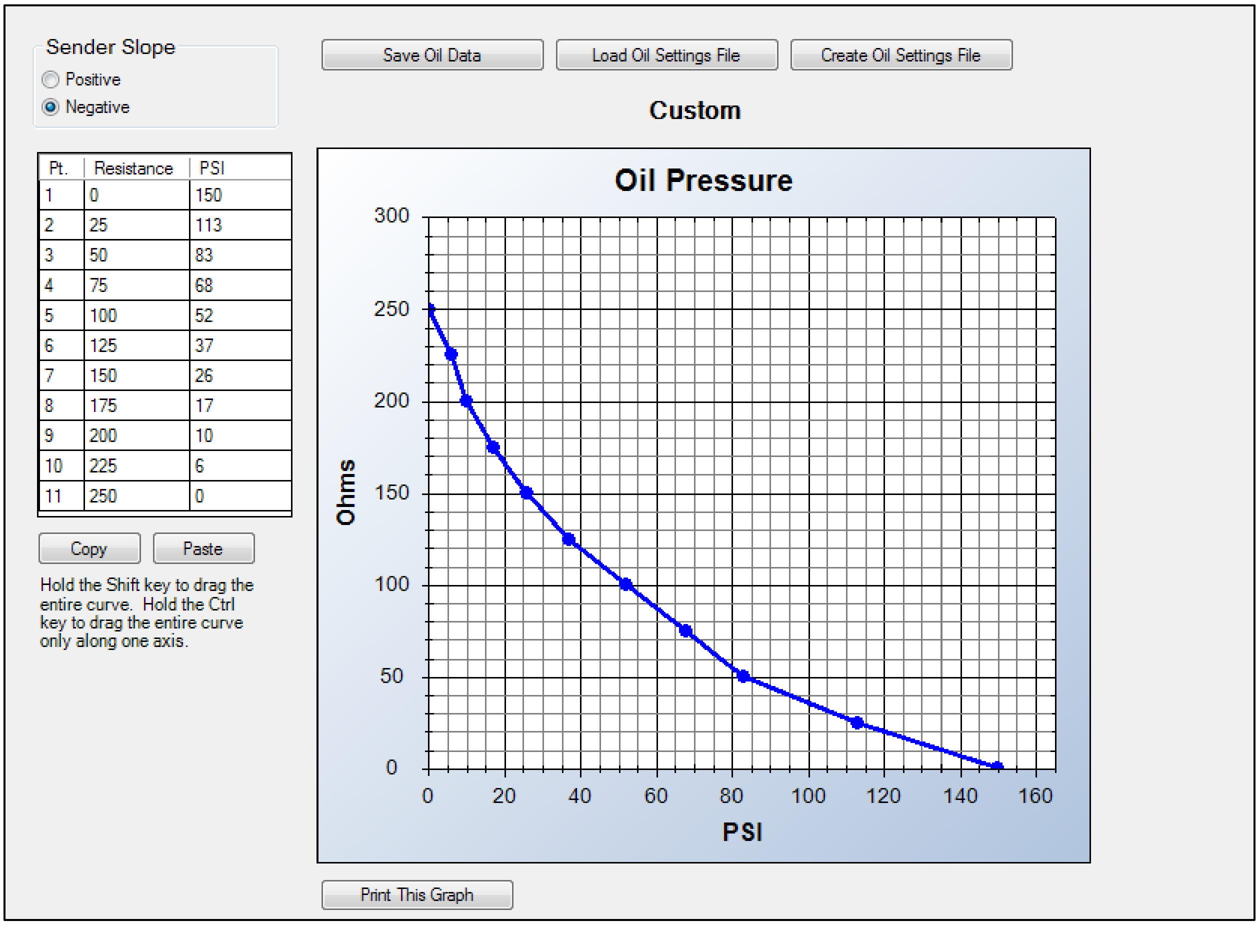


Figure 7-2. Settings Explorer, Programmable Senders, Oil Pressure Screen

Coolant Temperature

Figure 7-3 illustrates the *Coolant Temperature* screen found in the BESTCOMS*Plus Settings Explorer* under the *Programmable Senders* category. To program the fuel level sender, perform the following procedure:

1. The coolant temperature sender can be configured by selecting one of the sender types that come as a part of the BESTCOMS*Plus* sender library. Click on *Load Cool Settings File* and select the appropriate sender.
2. If no sender file matches the sender being used, the individual points that map resistance points to coolant temperature may be modified by setting numeric values in the table, or by dragging the points of the graph to the desired characteristic. Information on sender characteristics should be obtained from the sender manufacturer.
3. Select *Positive* or *Negative* sender slope as required for the desired sender graph.
4. Click *Save Cool Data* to save the data in the current settings file.
5. If you want to save newly entered sender data as a sender library file, click *Create Cool Settings File* and enter a file name and location to save the file.
6. Click the *Send Settings* button in BESTCOMS*Plus* to send the sender settings to the DGC-2020ES.

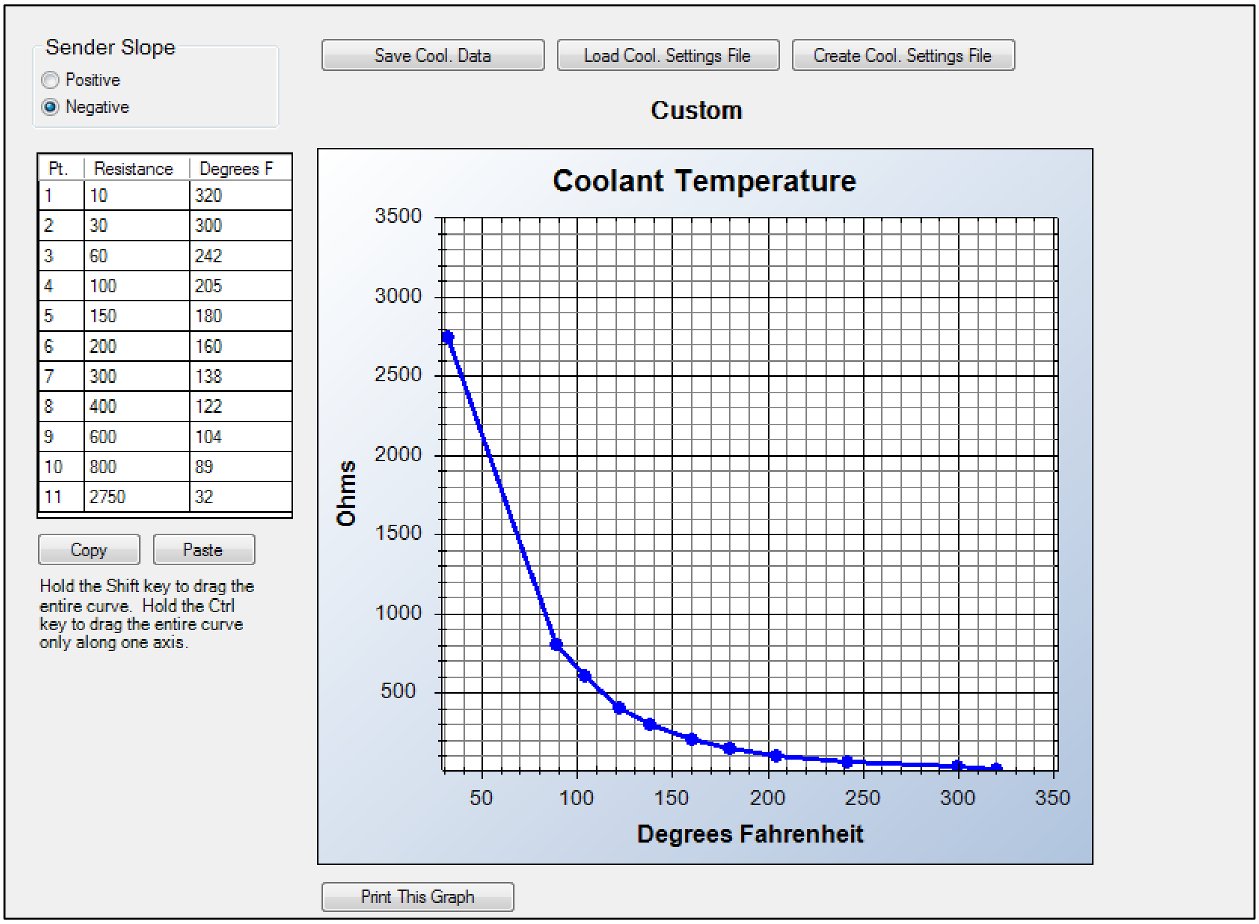


Figure 7-3. Settings Explorer, Programmable Senders, Coolant Temperature Screen

Sender Failure Detection

The DGC-2020ES can be configured to annunciate a pre-alarm or alarm when a loss of signal is detected at the coolant temperature, oil pressure, or fuel level sender input. Contact recognition can be set to Always or While Engine Running Only. Minimum and Maximum resistance values can be set. When the SF Display setting is set to Enable, “SF” is displayed instead of the measured parameter when the resistance value is outside the range specified by the Minimum and Maximum Resistance values. A loss of generator sensing voltage (when the DGC-2020ES is operating in Run or Auto mode with the ATS closed) can also be configured to trigger a pre-alarm or alarm. The speed sender fail alarm is always enabled. A user-adjustable time delay is provided for each sender/sensing alarm/pre-alarm.

Alarm and pre-alarm annunciations for loss of engine speed signals are not user-programmable and operate as follows. If the MPU (magnetic pickup) or generator frequency is programmed as the sole engine speed source and that signal source fails, an alarm (and shutdown) is triggered. If the engine speed source is configured as MPU <u>and</u> generator frequency and a loss of one of the signal sources occurs, a pre-alarm is annunciated. An alarm (and shutdown) is triggered if both speed signals are lost.

The BESTCOMS*Plus* Sender Fail screen is illustrated in Figure 7-4 and is found in the *Settings Explorer* under *Alarm Configuration*. If using the front panel, navigate to Settings > Alarm Configuration > Sender Fail.

Voltage Sensing Fail

The voltage sensing fail function monitors the generator line-to-neutral voltages. If any of the line-to-neutral voltages decreases below 2% of the CT secondary voltage for the duration of the Activation Delay, the DGC-2020ES detects a Voltage Sensing Fail condition and annunciates an alarm based on the Alarm Configuration setting.

In a Grounded Delta configuration where one phase (A, B, or C) of the delta connection is grounded, it is likely a Voltage Sensing Fail condition will occur.

In Delta connected systems where the DGC-2020ES neutral input is not connected, it is uncertain which line-to-neutral voltages will be monitored by the DGC-2020ES. Spurious Voltage Sensing Fail annunciations could occur.

It is recommended that Phase Imbalance detection be used to detect sensing issues in Delta and Grounded Delta configurations.

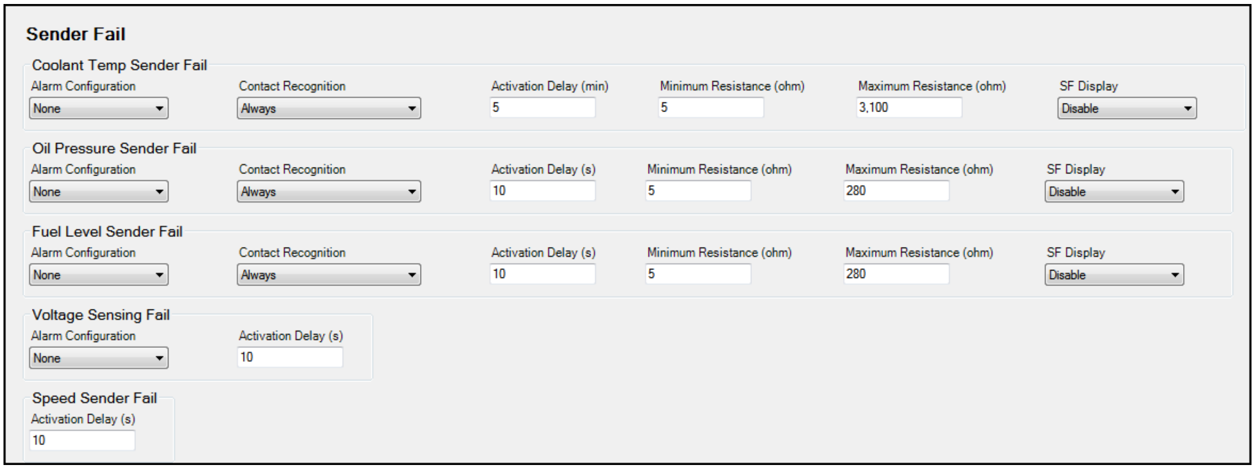


Figure 7-4. Settings Explorer, Alarm Configuration, Sender Fail Screen

8 • Contact Inputs

Contact inputs are available to initiate DGC-2020ES actions. The DGC-2020ES has seven programmable contact sensing inputs. Additional contact inputs can be accommodated with an optional CEM-2020 (Contact Expansion Module). Contact Basler Electric for availability and ordering information.

Each programmable input (Input 1 through Input 7) can be independently configured to perform the following functions. By default, each programmable input is disabled.

- Auto Transfer Switch
- Battery Charger Fail
- Battle Override
- Emergency Stop
- Fuel Leak Detect
- Grounded Delta Override
- Low Coolant Level
- Low Fuel Level
- Low Line Override
- Single-Phase Override

The programmable inputs accept dry contacts. A contact is connected between a programmable input and the negative side of the battery. Through BESTCOMS*Plus*®, each programmable contact input can be assigned a name (16 alphanumeric characters, maximum) and configured as an alarm input, a pre-alarm input, or none. The default names for the inputs are INPUT_x (where x = 1 to 7). When a programmable contact input is closed, the front panel display shows the name of the closed input if it was programmed as an alarm or pre-alarm input. Alarm inputs are annunciated through the Normal display mode screens of the front panel. Pre-alarm inputs are annunciated through the pre-alarm metering screen of the front panel. If neither alarm nor pre-alarm is programmed, no indication is given. Programming an input as *None* is useful when a programmable input is used as an input to programmable logic.

Connections for the programmable inputs are provided at terminals 3 (Input 1) through 9 (Input 7). The negative side of the battery voltage (terminal 17) serves as the return connection for the programmable inputs.

Contact Input Configuration

Figure 8-1 illustrates the *Contact Inputs* screen found in the BESTCOMS*Plus Settings Explorer* under the *Programmable Inputs* category. If using the front panel, navigate to Settings > Programmable Inputs > Configurable Inputs.

For each contact input, configure the following parameters:

1. Alarm Configuration - Select *None, Alarm,* or *Pre-Alarm*. When an alarm occurs, the horn output closes and the engine shuts down. When a pre-alarm occurs, the horn output toggles between open and closed while the engine remains running. If *None* is selected, the input is status only. The status is available to BESTlogic™*Plus* Programmable Logic regardless of *Alarm Configuration* setting.
2. Activation Delay - This parameter defines the duration that the input remains on before any annunciation occurs.
3. Label Text - Enter descriptive text that signifies the use of the input. This text appears next to the input in BESTlogic™*Plus* Programmable Logic and in the event log if the input is configured as an alarm or pre-alarm.
4. Contact Recognition - Select whether the contact input should be recognized always, or only while the engine is running. For example, a switch closes when oil pressure is low. Such a switch would be closed when the engine is not running but a low oil pressure alarm or pre-alarm should not be annunciated unless the switch is closed while the engine is running. A selection of *While Engine Running Only* prevents spurious annunciation when the engine is not running.

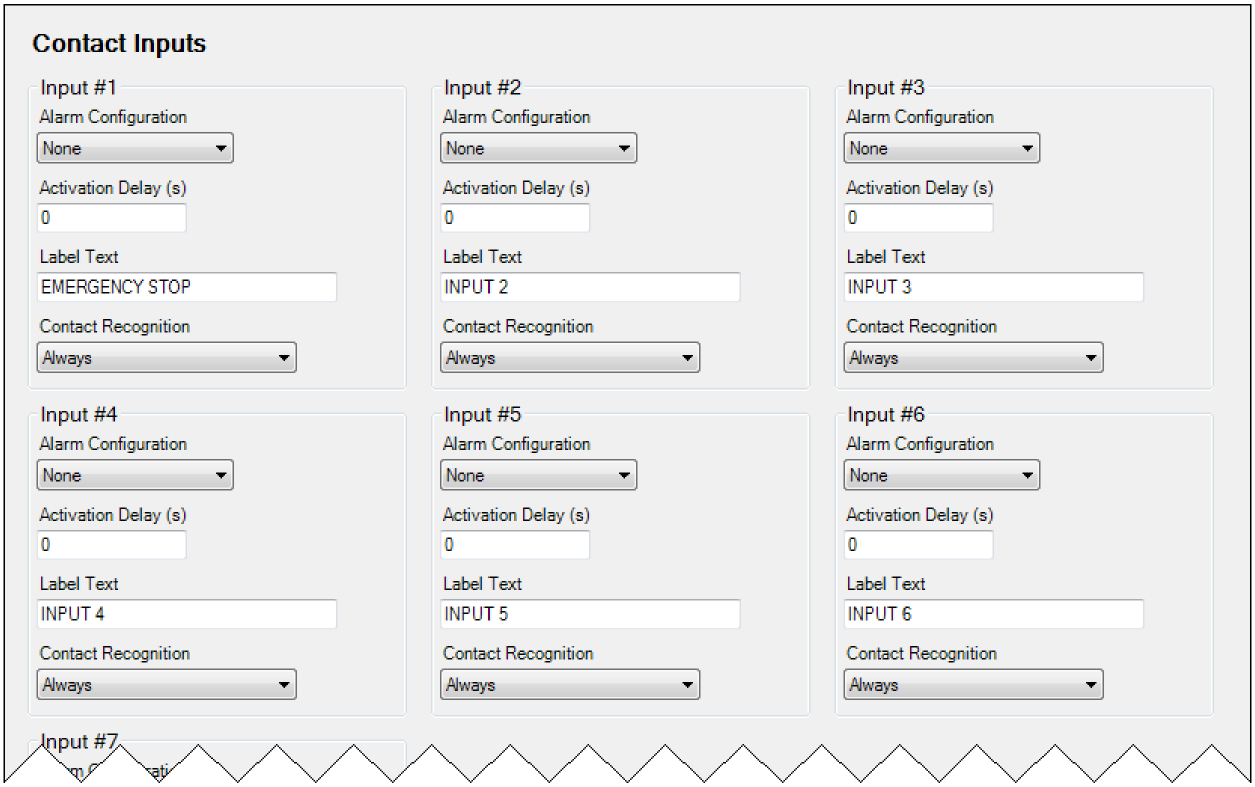


Figure 8-1. Settings Explorer, Programmable Inputs, Contact Inputs Screen

Programmable Functions

Any of the seven contact inputs can be programmed to recognize any one of 10 function types:

- Automatic Transfer Switch (ATS) - Start and run the generator while the ATS input is true and the DGC-2020ES is in Auto mode.
- Grounded Delta Override - Uses Grounded Delta sensing if the generator connection is set for Delta.
- Battle Override - The alarms programmed to shut down the unit will be overridden and ignored. When a Battle Override condition is true the DGC annunciates a Battle Override Pre-alarm that is recorded in the event log. If an alarm occurs while a Battle Override condition is true, the alarm annunciates on the DGC front panel and is recorded in the event log, but the engine will not stop.
- The DGC monitors engine RPM during battle override. If the engine RPM drops to zero while an alarm is active during a Battle Override condition, the DGC will proceed to issue a normal shutdown to prevent fuel flow while the engine is not running.
- Low-Line Override - The 51, 27, and 59 settings are scaled by the low-line scale factor setting.
- Single-Phase Override - The unit switches to single-phase sensing configuration and uses the 1 Phase Override Sensing setting (A-B or A-C).
- Emergency Stop – When an input is assigned to the Emergency Stop Programmable Function, the input functions in a normally-closed manner. When the input is closed, no alarm is annunciated. When the input is open, the DGC-2020ES will open the Start, Run, and Prestart relays and annunciate an Emergency Stop Alarm.

  Once an input is assigned to this programmable input, navigate to Settings Explorer > Programmable Inputs > Contact Inputs and configure the following settings:
    - Alarm Configuration: Status Only
    - Activation Delay: 0
    - Label Text: Any text is acceptable.
    - Contact Recognition: Always

- Battery Charger Fail - When the selected input is invoked, a user selectable pre-alarm or alarm is annunciated after the activation delay.
- Low Coolant Level - When the selected input is invoked, a Low Coolant Level pre-alarm or alarm is annunciated after the activation delay.
- Low Fuel Level - When the selected input is invoked, a Low Fuel Level pre-alarm or alarm is annunciated after the activation delay.
- Fuel Leak Detect - When the selected input is invoked, a Fuel Leak pre-alarm or alarm is annunciated after the activation delay.

An Alarm Configuration setting of “None” prevents a function from being triggered by a contact input. Programmable function status is available in BESTlogic™*Plus* Programmable Logic when the “None” alarm configuration setting is selected.

The *Programmable Functions* screen is found in the BESTCOMS*Plus Settings Explorer* under the *Programmable Inputs* category. If using the front panel, navigate to Settings > Programmable Inputs > Programmable Functions.

The BESTCOMS*Plus* Programmable Functions screen is illustrated in Figure 8-2.

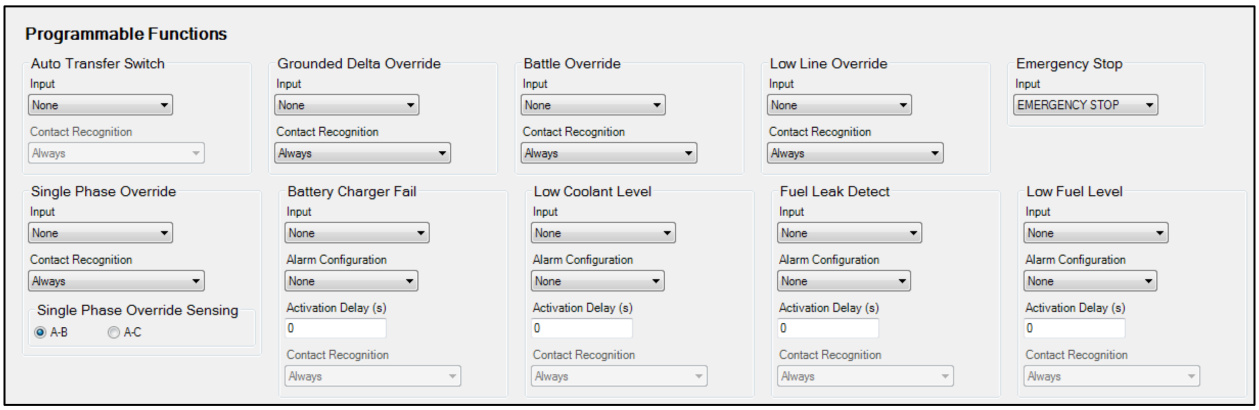


Figure 8-2. Settings Explorer, Programmable Inputs, Programmable Functions

9 • Contact Outputs

Output contact operation is controlled by the operating mode of the DGC-2020ES. The state of the Emergency Stop contact input also affects output contact operation. When the Emergency Stop contact input is open (emergency stop condition), the PRESTART, START, and RUN outputs open and an emergency stop alarm is annunciated. When the Emergency Stop input is closed, all output contacts operate normally.

DGC-2020ES output contacts include PRESTART, START, RUN, and four programmable outputs. Additional output contacts can be accommodated with an optional CEM-2020 (Contact Expansion Module).

Prestart

This output closes to energize the engine glow plugs or run pre-lubrication pumps. The PRESTART output can be programmed to close up to 30 seconds prior to engine cranking. The PRESTART output can also be programmed to open upon engine startup or remain closed as long as the engine is operating.

During the resting state, the PRESTART output can be set to Off, On, or Preheat Before Crank. If Preheat Before Crank is selected, the PRESTART output will be closed for a time equal to the Pre-crank delay time prior to re-entering the cranking state. If the Pre-crank delay setting is longer than the rest interval, the PRESTART output will be closed for the entire rest time.

PRESTART output connections are made through terminals located on the PRESTART relay.

Start

This output closes when engine cranking is initiated by the DGC-2020ES and opens when the magnetic pickup (MPU) or generator frequency indicates that the engine has started. Prior to engine starting, the duration of cranking is determined by the cranking style (cycle or continuous) selected. Cycle cranking permits up to seven crank cycles with crank cycle duration of 5 to 15 seconds. The continuous crank time is adjustable from 5 to 60 seconds.

START output connections are made through terminals located on the START relay.

Run

This output closes when engine cranking is initiated by the DGC-2020ES. The RUN output remains closed until it receives a command to stop the engine.

RUN output connections are made through terminals located on the RUN relay.

Relay Control

In some applications, it may be beneficial to modify the standard operation of the DGC-2020ES Run, Pre-Start, or Start relays. If desired, these relays can be configured to operate outside their predefined functionality. For example, if your genset does not require starting assistance from glow plugs, the Pre-Start relay may be assigned for another purpose. Configuring these relays as programmable makes them available in BESTlogic™*Plus* programmable logic to be used in the same manner as the other programmable relay outputs. Predefined or programmable operation of the Run, Pre-Start, and Start relays is selected on the Relay Control screen (Figure 9-1). See the BESTlogic*Plus* chapter for more information about DGC-2020ES programmable logic.
The Relay Control screen is found in the BESTCOMS*Plus*® Settings Explorer under the System Parameters category. If using the front panel, navigate to Settings > System Parameters > Relay Control.

Figure 9-1. Settings Explorer, System Parameters, Relay Control Screen

For each relay (Start, Run, and Pre-Start), select whether it should use its predefined functionality or be made programmable.

When *Programmable* is selected for a relay, it becomes available to BESTlogic*Plus* Programmable Logic as a logic element. The elements are titled *Start Output, Prestart Out,* and *Run Output*. The predefined functionality is available as an input to the logic. If *Programmable* is selected as the relay control mode, connecting the corresponding predefined input function to the relay causes it to function as if *Predefined* were selected as its relay control type. However, other logic can be combined with it to create operation that is more versatile. If *Programmable* is selected for a relay, but it is not used in the logic, that relay will never close.

An example logic scheme connecting the predefined inputs directly to the "programmable" relay outputs for all three relays is shown in Figure 9-2.

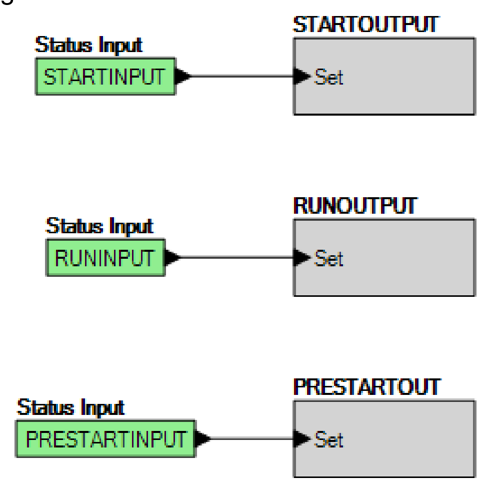


Figure 9-2. Example Logic Scheme of Programmable Relays

Programmable

DGC-2020ES controllers have four programmable output contacts (OUT 1 through 4). An additional 24 contact outputs are provided with an optional CEM-2020 (Contact Expansion Module). An optional CEM-2020H (Contact Expansion Module - High Current) provides 18 contact outputs.

Programmable Output Configuration

Figure 9-3 illustrates the *Contact Outputs* screen found in the BESTCOMS*Plus Settings Explorer* under the *Programmable Outputs* category. If using the front panel, navigate to Settings > Programmable Outputs > Contact Outputs.

Each output can be programmed with a text label describing its use. This label appears in BESTlogic*Plus* Programmable Logic where the output is used to aid in program clarity and ease of programming.

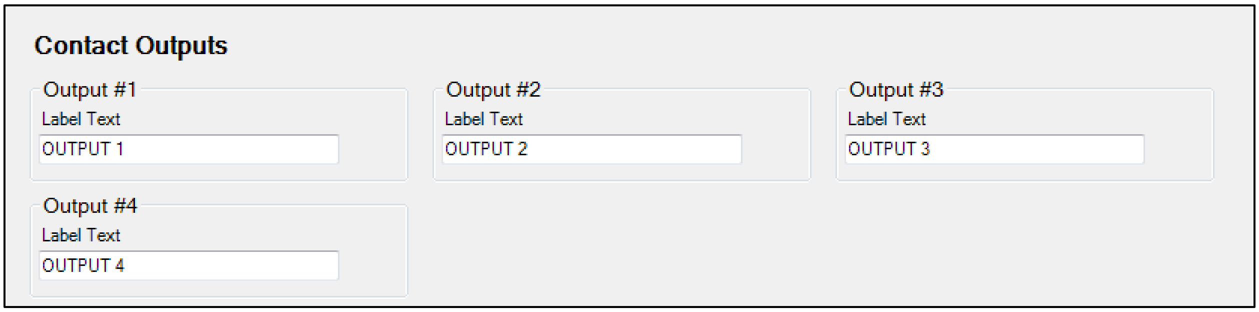


Figure 9-3. Settings Explorer, Programmable Outputs, Contact Outputs

Configurable Elements

Configurable elements are connected to the logic scheme as outputs. The configurable elements are incorporated into a BESTlogic*Plus* programmable logic scheme by selecting them from the *Elements* group in BESTlogic*Plus*. For more details, refer to the BESTlogic*Plus* chapter. Each of the eight elements can be independently configured to annunciate an alarm or pre-alarm. A user-adjustable time delay can be set to delay recognition of an element. By default, all elements are configured so that they do not trigger an alarm or pre-alarm. To make identifying an element easier, each of the elements can be given a user-assigned name. If used for an alarm or pre-alarm, the user-assigned name appears in the alarm or pre-alarm annunciation and in the DGC-2020ES event log. Elements can be recognized always or only while the engine is running. A user-adjustable arming delay disables the configurable element during engine startup. If the arming delay is set to zero, the configurable element is active at all times, including when the engine is not running. If the arming delay is set to a non-zero value, the configurable element is inactive when the engine is not running, and does not become active until after the engine is started and the arming delay has elapsed. Configurable element status is available in BESTlogic*Plus* Programmable Logic when “None” is selected for Alarm Configuration. Configurable element status can be used as logic inputs to drive other logic in the program, similar to logic control relays.

The BESTCOMS*Plus Configurable Elements* screen is illustrated in Figure 9-4 and found in the *Settings Explorer* under the *Programmable Outputs* category. If using the front panel, navigate to Settings > Programmable Outputs > Configurable Elements.

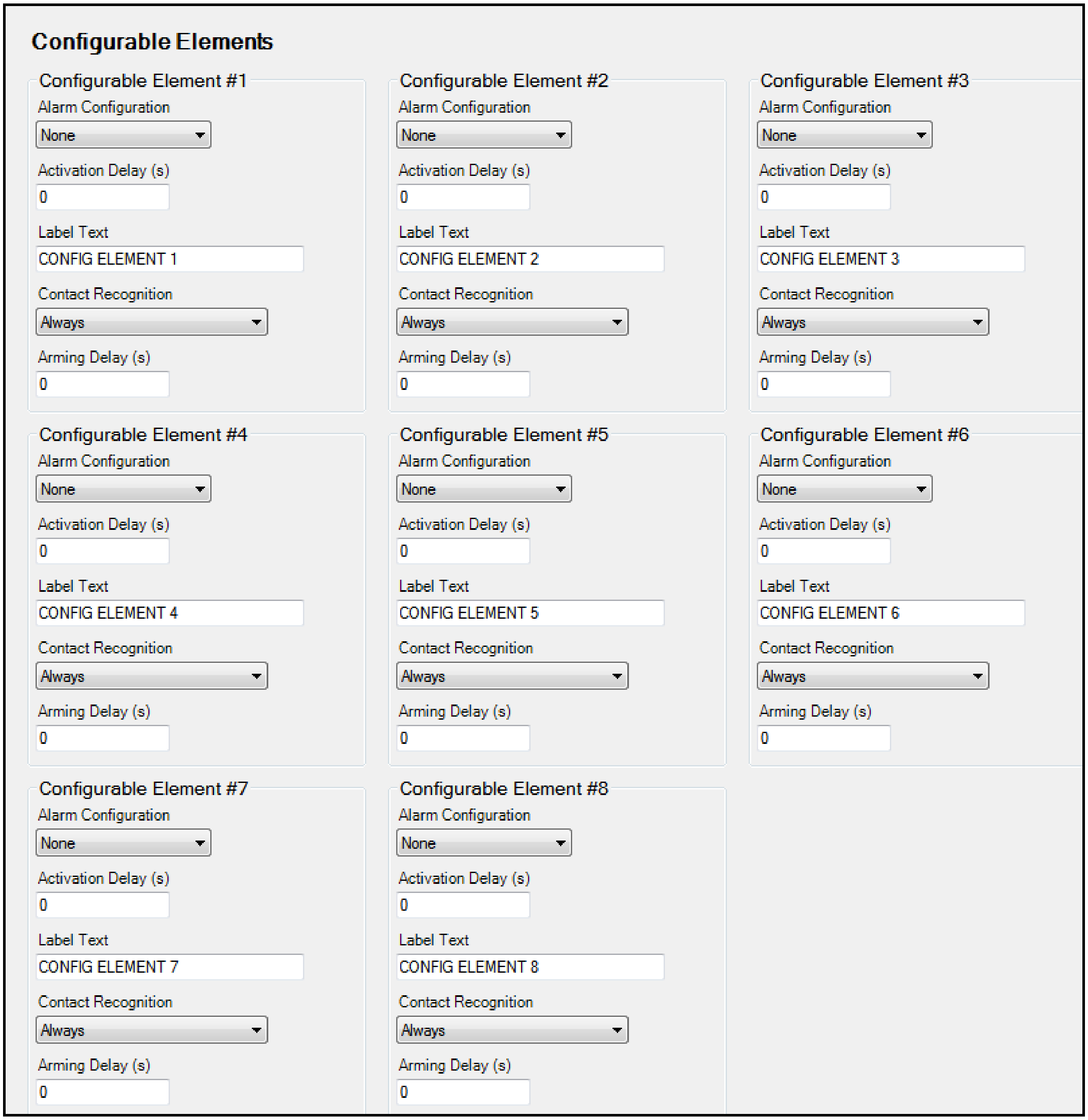


Figure 9-4. Settings Explorer, Programmable Outputs, Configurable Elements

10 • Breaker Management

The DGC-2020ES is capable of controlling the generator breaker and the mains breaker. Once it is determined that a valid breaker request is available, the DGC-2020ES will attempt to operate the breaker if possible. The user can choose to control only the generator breaker, the generator and mains breakers, or none. BESTCOMS*Plus*® is used to configure breaker management. Refer to the BESTCOMS*Plus* chapter for setting information.

Breaker Status

The status of the breakers is determined by using BESTlogic™*Plus* programmable logic and sent to the GENBRK and MAINSBRK logic blocks. These logic blocks have outputs that can be configured to energize an output contact and control a breaker as well as inputs for breaker control and status. See *Breaker Configuration*, below, for details on configuring the logic.

Breaker Operation

The DGC-2020ES will attempt to close a breaker only after verifying that it can be closed. If the breaker cannot be closed, the close request will be ignored. Only one breaker can be closed at a time. Closure to a dead bus can be performed after meeting dead bus threshold and timing requirements set by the user.

Breaker Operation Requests

Types of breaker operation requests include:

- Local Request - initiated by internal functions and based on operating modes.
- Com Request - initiated through a communication port using BESTCOMS*Plus* or the front panel.
- Logic Request - initiated from BESTlogic*Plus*.

The type of response given for a local request depends on the operating mode of the DGC-2020ES.

RUN Mode

When in RUN mode, the generator and mains breakers can be closed manually using contact inputs or the breaker operation settings on the BESTCOMS*Plus Control* screen.

OFF or AUTO Mode (Not Running)

If operating in the OFF mode or AUTO and not running, the generator breaker can be closed if the bus is determined to be dead.

AUTO Mode (Running)

When in AUTO mode and running, the mains fail transfer feature will automatically control the mains breaker and the generator breaker. Or, the external ATS (automatic transfer switch) will start the generator and control the breakers itself. In addition, the generator breaker can be automatically controlled by the exercise timer function or a RUNWLOAD (run with load) start through BESTlogic*Plus*. The generator breaker can be manually controlled using contact inputs and outputs or the breaker operation settings on the BESTCOMS*Plus Control* screen.

Breaker Closure Conditions

The conditions under which the DGC-2020ES will close a breaker are described in the following paragraphs.

Breaker Status and Voltage Stability

Before the generator breaker can be closed, it must be configured in BESTCOMS*Plus*. If only the generator breaker is configured (mains breaker not configured) the DGC-2020ES reads user settings to determine if the generator side of the breaker is stable or dead and the bus side is dead. If both the generator and the mains breakers are configured and open, the DGC-2020ES closes the generator breaker if the generator side of the breaker is stable or dead. If both breakers are configured and the mains breaker is closed, the DGC-2020ES will not close the generator breaker.

Before the mains breaker can be closed, it must be configured in BESTCOMS*Plus*. If both the mains and the generator breakers are configured and open, the DGC-2020ES will close the mains breaker if the mains side of the breaker is stable. If both breakers are configured and the generator breaker is closed, the DGC-2020ES will not close the mains breaker.

Command Agreement

A breaker will not change state if it receives conflicting commands. In other words, if an input is indicating an open command at the same time another input is indicating a close command, the breaker will not change state.

Breaker Configuration

The following paragraphs describe how to properly configure a DGC-2020ES for generator breaker control.

Initial System Setup

Connect the DGC-2020ES according to the appropriate figure in the *Typical Connections* chapter in the *Installation* manual for the type of generator connection desired (wye, delta, etc.). Set up the basic system parameters that will govern engine operation and alarm and pre-alarm annunciation. Details can be found in the *Device Configuration* and *Alarm Configuration* chapters.

Breaker Hardware

Configure the generator breaker parameters on the BESTCOMS*Plus Settings Explorer, Breaker Management, Breaker Hardware* screen. If using the front panel, navigate to Settings > Breaker Management > Breaker Hardware. Figure 10-1 illustrates the BESTCOMS*Plus* Breaker Hardware screen.

1. *Mains Fail*: When two breakers are configured (enabled), the DGC-2020ES can be enabled to automatically transfer load power from the mains to the genset during a mains failure. This feature also enables the DGC-2020ES to transfer the load back to the mains once mains power is restored. Settings include a transfer delay, return delay, max transfer time, and max return time.
    a. When enabled, Reverse Rotation Inhibit prevents automatic load transfer due to a mains failure when the machine is determined to have reverse phase rotation.
    b. If the in-phase monitor is enabled and the Mains Fail Return Delay time has expired, the generator waits until it detects that the phases are aligned between the generator and the mains before performing the open transition from the generator back to the utility.
2. *Breaker Close Wait Time*: This is a time interval in which it is expected that the breaker will transition from open to closed or closed to open. If the generator breaker does not change state within that time, either a Gen Breaker Close Fail alarm or Gen Breaker Open Fail alarm is annunciated. If the mains breaker does not change state within that time, either a Mains Breaker Close Fail alarm or Mains Breaker Open Fail alarm is annunciated.
3. *Generator Breaker*
    a. Set the *Contact Type* and *Open/Close Pulse Times* if pulsed contacts are used.
    b. Set the *Breaker Closing Time*.
4. *Mains Breaker*
    a. Set the Mains Breaker as Configured if it is used, otherwise do not configure these settings.
    b. If the mains breaker is configured, set the contact type and pulse times if pulsed contacts are used.
    c. If the mains breaker is configured, set the breaker close time.

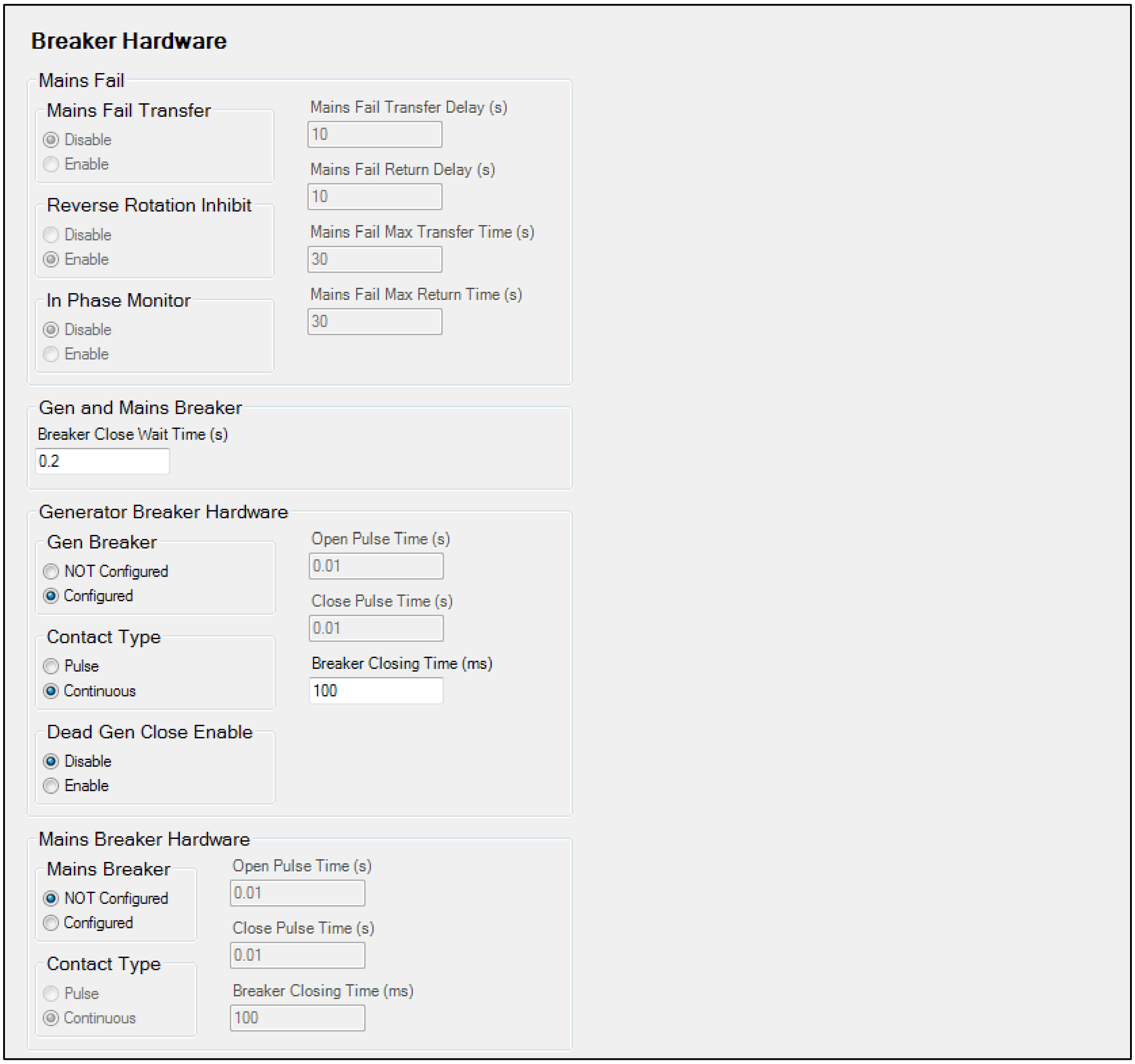


Figure 10-1. Settings Explorer, Breaker Management, Breaker Hardware Screen

Breaker Setup in BESTlogic™*Plus*

Set up the Gen Breaker in BESTlogic*Plus* Programmable Logic under the BESTCOMS*Plus Settings Explorer,* BESTlogic*Plus Programmable Logic* screen. BESTlogic*Plus* is not available through the front panel interface. Figure 10-2 illustrates the Gen breaker logic scheme in BESTlogic*Plus*.

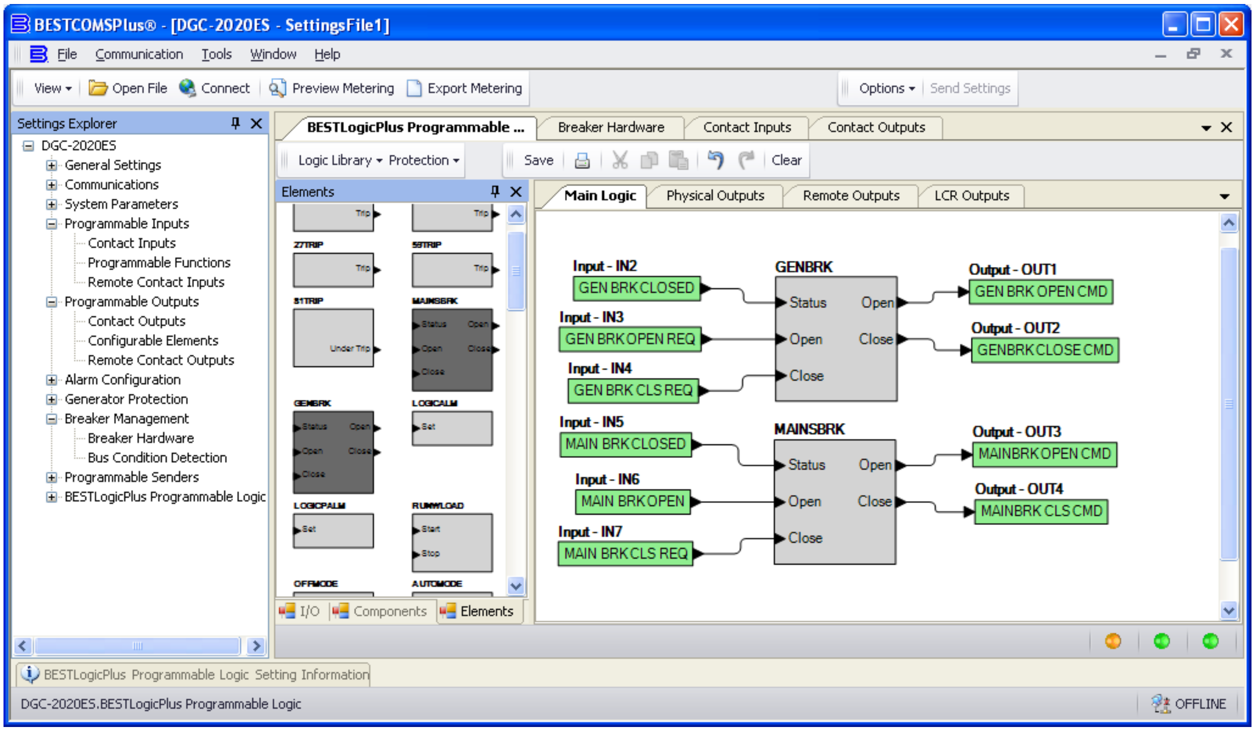


Figure 10-2. Settings Explorer, BESTlogic*Plus* Programmable Logic Screen

1. Generator Breaker
    a. Drag the Gen Breaker element into the logic diagram.
    b. Connect the breaker element open and close outputs to the contact outputs that will drive the breaker.
    c. Connect the physical input or remote input that has the breaker status (closed if breaker is closed, open when the breaker is open) to the *Status* input of the breaker element. This is the only way to indicate breaker status to the DGC-2020ES.
    d. If it is desired to have physical inputs that can request breaker open and close commands, connect the desired inputs to the open and close command inputs of the breaker element. These inputs should be pulsed. If both inputs close at the same time, the breaker will not change state. If it is not desired to have inputs for breaker commands, connect a “Logic 0” input object to the open and close command inputs of the breaker block.
2. Mains Breaker (if configured)
    a. Drag the Mains Breaker element into the logic diagram.
    b. Connect the breaker element open and close outputs to the contact outputs that will drive the breaker.
    c. Connect the physical input or remote input that has the breaker status (closed if breaker is closed, open if the breaker is open) to the *Status* input of the breaker element. This is the only way to indicate breaker status to the DGC-2020ES.
    d. If it is desired to have physical inputs that can request breaker open and close commands, connect the desired inputs to the open and close command inputs of the breaker element. These inputs should be pulsed. If both inputs close at the same time, the breaker will not change state. If it is not desired to have inputs for breaker commands, connect a “Logic 0” input object to the open and close command inputs of the breaker block.
3. Click the *Save* button when the logic setup is complete.
4. From the Communication pull-down menu, select *Upload Logic to Device* to load the logic into the DGC-2020ES if connected, or save the settings file if working off line.

Bus Condition Detection

(These thresholds determine when the generator and bus are considered to be stable or dead.)

Set the parameters for detecting stable and failed bus and generator under the BESTCOMS*Plus Settings Explorer, Breaker Management, Bus Condition Detection*. If using the front panel, navigate to Settings > Breaker Management > Bus Condition Detection.

Figure 10-3 illustrates the BESTCOMS*Plus Bus Condition Detection* screen.

1. Generator Sensing
    a. Dead Bus Voltage Threshold and Activation Delay. When the generator voltage is below this threshold for the duration of the activation delay, the generator is deemed “Dead”.
    b. Gen Stable Overvoltage and Undervoltage thresholds and Overfrequency and Underfrequency thresholds and the Bus Stable and Bus Failed Activation Delay times. When the generator voltage frequency is within the specified range for the duration of the Bus Stable Activation Delay, the generator is deemed “Stable”. Otherwise, it is deemed “Failed”.
2. Bus Sensing
    a. Dead Bus Voltage Threshold and Activation Delay. When the voltage of the bus is below this threshold for the duration of the activation delay, the bus is deemed “Dead”.
    b. Bus Stable Overvoltage and Undervoltage thresholds and Overfrequency and Underfrequency thresholds and the Bus Stable and Bus Failed Activation Delay times. When the bus voltage and frequencies are within the specified ranges for the duration of the Bus Stable Activation Delay, the bus is deemed “Stable”. Otherwise, it is deemed “Failed”.

Caution

The bus condition parameters are critical because they determine when a breaker can be closed. The generator breaker can be closed when any one of the following is true:

- The generator is stable, the bus is dead, and both breakers are open.
- The generator is dead, the bus is dead, and both breakers are open.

The mains breaker can be closed only when the bus is stable and both breakers are open.

Place the unit in AUTO. The unit is now configured for generator breaker control. It can be tested by driving the RUN WITH LOAD logic element true, setting up the exercise timer for a loaded test, or by starting the unit in RUN or AUTO mode and giving it CLOSE and OPEN commands from the physical inputs if they are available for breaker control.

Refer to the *Troubleshooting* chapter if the breaker does not seem to operate properly.

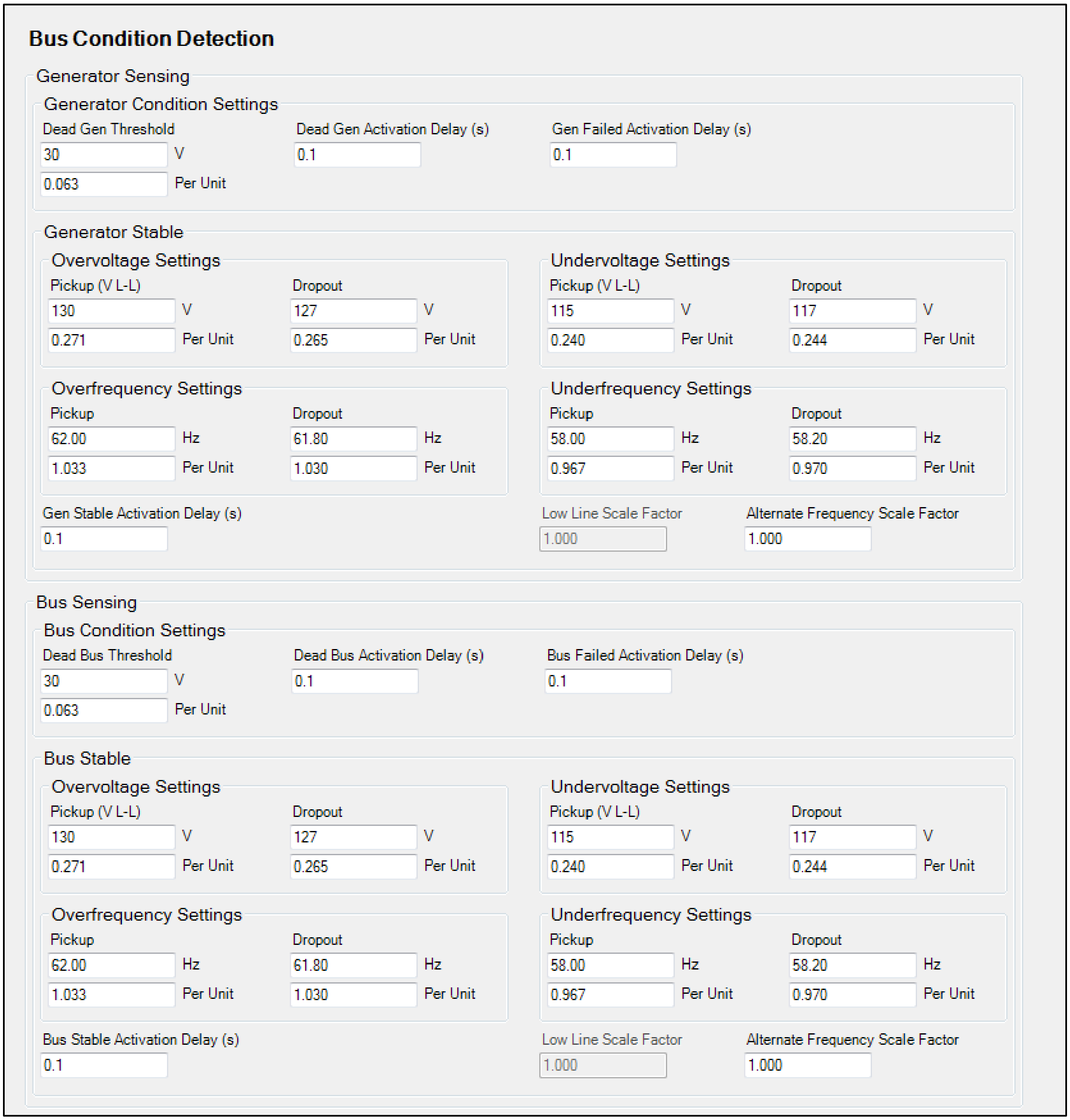


Figure 10-3. Settings Explorer, Breaker Management, Bus Condition Detection

11 • Alarm Configuration

Configuration of DGC-2020ES alarms, pre-alarms, sender failure alarms, and the audible horn is described in the following paragraphs.

Alarms

To configure alarms using BESTCOMS*Plus*, open the *Alarm* screen (Figure 11-1). This screen is found in the *Settings Explorer* under the *Alarm Configuration* category. If using the front panel, navigate to Settings > Alarm Configuration > Alarms.

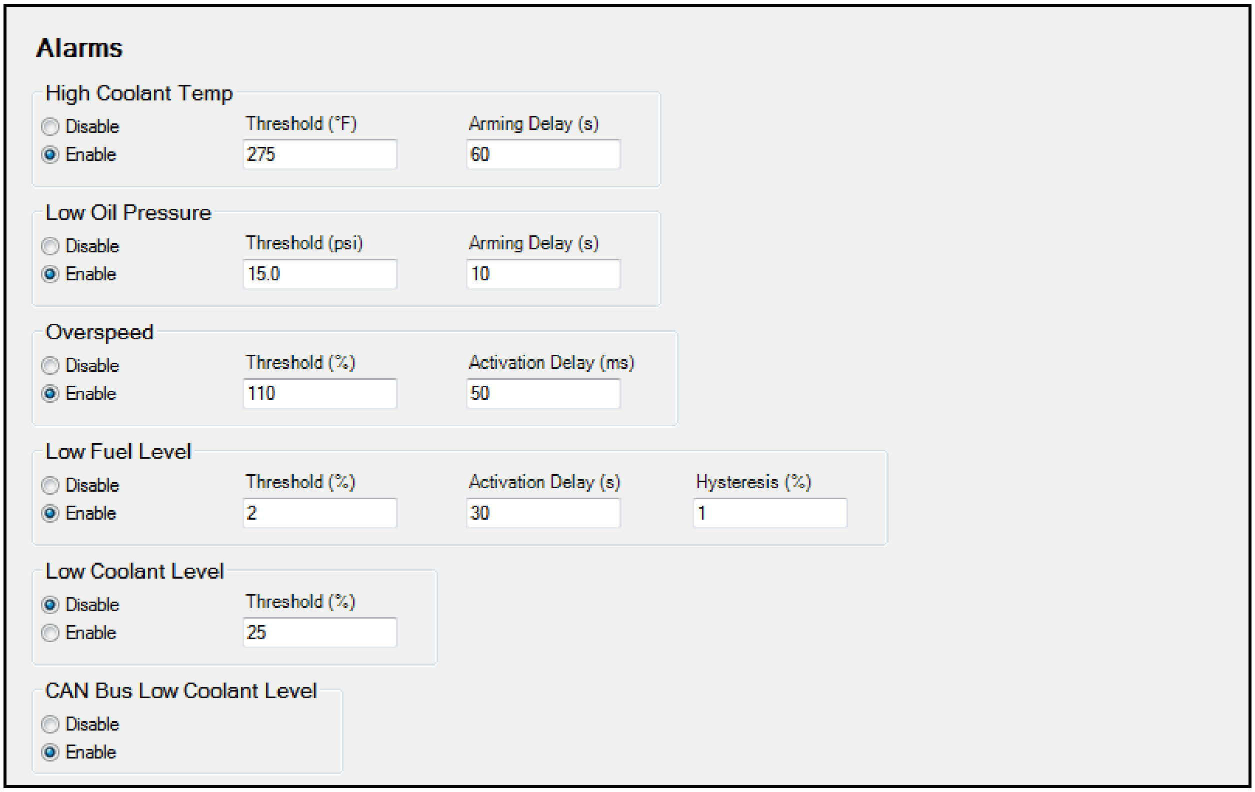


Figure 11-1. Settings Explorer, Alarm Configuration, Alarms Screen

The alarm settings are described below.

High Coolant Temp

High coolant temperature alarm settings consist of an enable/disable setting, a threshold setting, and an arming delay. If enabled, a high coolant temperature alarm is triggered after a four second delay when the engine coolant temperature exceeds the threshold setting. The arming delay disables the high coolant temperature alarm function for a user-adjustable period after engine startup. System units are configured on the System Settings screen.

Low Oil Pressure

Low oil pressure alarm settings consist of an enable/disable setting, a threshold setting, and an arming delay. If enabled, a low oil pressure alarm is triggered after a two second delay when the engine oil pressure decreases below the threshold setting. The arming delay disables the low oil pressure alarm function for a user-adjustable period after engine startup. System units and metric pressure units are configured on the System Settings screen.

Overspeed

Overspeed alarm settings include an enable/disable setting, a threshold setting, and an activation delay. If enabled, an overspeed alarm occurs when the engine speed (in rpm) exceeds the threshold setting for the duration of the activation time delay.

Low Fuel Level

Low fuel level alarm settings consist of an enable/disable setting, a threshold setting, an activation delay setting, and a hysteresis setting. If enabled, a low fuel level alarm is triggered when the metered fuel level drops below the threshold setting for the duration of the activation time delay. The hysteresis setting functions as an alarm dropout by preventing rapid switching of the alarm annunciation. Once the Low Fuel Level alarm has activated, it will not turn off until the fuel is increased to a level equal to the threshold plus the hysteresis setting.

Low Coolant Level

Low coolant level alarm settings consist of an enable/disable setting and a threshold setting. If enabled, a low coolant level alarm is triggered when the metered coolant level drops below the threshold setting. ECU Support must be enabled on the *Communications, CAN Bus, CAN Bus Setup* screen before this alarm can be configured.

CAN Bus Low Coolant Level

When enabled, any Low Coolant Level indication received over the J1939 CAN Bus it treated as an alarm. When disabled, Low Coolant Level indications received over the J1939 CAN Bus are treated as pre-alarms.

Pre-alarms

To configure pre-alarms using BESTCOMS*Plus*, open the *Pre-Alarms* screen (Figure 11-2). This screen is found in the *Settings Explorer* under the *Alarm Configuration* category. If using the front panel, navigate to Settings > Alarm Configuration > Pre-alarms.

The pre-alarm settings are described below.

High Fuel Level

High fuel level pre-alarm settings consist of an enable/disable setting, a threshold setting, an activation delay setting, and a hysteresis setting. If enabled, a high fuel level pre-alarm is triggered when the metered fuel level increases above the threshold setting for the duration of the activation delay. The hysteresis setting functions as a pre-alarm dropout by preventing rapid switching of the alarm annunciation. Once the High Fuel Level pre-alarm has activated, it will not turn off until the fuel is decreased to a level equal to the threshold minus the hysteresis setting.

Low Fuel Level

Low fuel level pre-alarm settings consist of an enable/disable setting, a threshold setting, and a hysteresis setting. If enabled, a low fuel level pre-alarm is triggered when the metered fuel level decreases below the threshold setting. The hysteresis setting functions as a pre-alarm dropout by preventing rapid switching of the alarm annunciation. Once the Low Fuel Level pre-alarm has activated, it will not turn off until the fuel is increased to a level equal to the threshold plus the hysteresis setting.

Low Battery Voltage

Low battery voltage pre-alarm settings consist of an enable/disable setting, a threshold setting, and an activation delay. If enabled, a low battery voltage pre-alarm is triggered when the battery voltage decreases below the threshold setting for the duration of the activation time delay. The threshold can be entered in actual volts or a per-unit value. The per-unit threshold value is based on the nominal battery voltage setting found on the *System Parameters, Rated Data* screen.

High Coolant Temp

High coolant temperature pre-alarm settings consist of an enable/disable setting and a threshold setting. If enabled, a high coolant temperature pre-alarm is annunciated when the engine coolant temperature exceeds the threshold setting for a fixed duration of four seconds. The arming delay disables the High Coolant Temp pre-alarm function for a user-adjustable time during engine startup. Delay duration is determined by the High Coolant Temp Alarm Arming Delay setting. System units are configured on the System Settings screen.

Weak Battery Voltage

Weak battery voltage pre-alarm settings consist of an enable/disable setting, a threshold setting, and an activation time delay. If enabled, a weak battery voltage pre-alarm latches during engine cranking when the battery voltage decreases below the threshold setting for the duration of the activation delay. The threshold can be entered in actual volts or a per-unit value. The per-unit threshold value is based on the nominal battery voltage setting found on the *System Parameters, Rated Data* screen.

Low Coolant Temp

Low coolant temperature pre-alarm settings consist of an enable/disable setting and a threshold setting. If enabled, a low coolant temperature pre-alarm occurs when the engine coolant temperature decreases below the threshold setting. System units are configured on the System Settings screen.

Battery Overvoltage

Battery overvoltage pre-alarm settings consist of an enable/disable setting and a threshold setting. If enabled, a battery overvoltage pre-alarm occurs when the battery voltage increases above the threshold setting. The threshold can be entered in actual volts or a per-unit value. The per-unit threshold value is based on the nominal battery voltage setting found on the *System Parameters, Rated Data* screen.

ECU Coms Fail

ECU communication failure pre-alarm settings consist of a single enable/disable setting. If enabled, this pre-alarm is triggered when the DGC-2020ES detects a problem in its J1939 CAN connection to the ECU.

Coolant Level

Low coolant level pre-alarm settings consist of an enable/disable setting and a threshold setting. If enabled, a low coolant level pre-alarm is triggered when the metered coolant level decreases below the threshold setting.

Maintenance Interval

Maintenance interval pre-alarm settings consist of an enable/disable setting and a threshold setting. If enabled, a maintenance interval pre-alarm is annunciated when the DGC-2020ES maintenance timer counts down to zero from the threshold time setting.

Active DTC

Active DTC (diagnostic trouble code) pre-alarm settings consist of a single enable/disable setting. If J1939 CAN and DTC support are both enabled, an “active DTC” pre-alarm can be enabled. This pre-alarm is triggered when a DTC is sent from the ECU to the DGC-2020ES.

Low Oil Pressure

Low oil pressure pre-alarm settings consist of an enable/disable setting and a threshold setting. If enabled, a low oil pressure pre-alarm is triggered after a two second delay when the engine oil pressure decreases below the threshold setting. The arming delay disables the low oil pressure pre-alarm function for a user-adjustable time during engine startup. Delay duration is determined by the Low Oil Pressure Alarm Arming Delay setting. System units and metric pressure units are configured on the *System Settings* screen.

CEM Comm Failure

CEM-2020 communication failure pre-alarm settings consist of a single enable/disable setting. If enabled, this pre-alarm is triggered when communication between the optional CEM-2020 and DGC-2020ES is lost.

Checksum Failure

When one of the internal checksum calculations, used for data integrity purposes, has failed, the checksum failure pre-alarm is triggered. This indicates that some of the user settings or firmware code has been corrupted.

After upgrading firmware through BESTCOMS*Plus*, the checksum failure pre-alarm may trigger. This pre-alarm is not indicative of an error in this case. It can be cleared by cycling power to the DGC-2020ES. If the pre-alarm reoccurs, then it is indicative of an error and corrective action should be taken. See *Resetting Alarms, Checksum Failure*, below, for more information.

Breaker Close Failure

If enabled, this pre-alarm is triggered when the DGC-2020ES has issued a "breaker close" output and has not received "breaker closed" feedback from the breaker within the allowed closing time. The Monitor setting determines whether this condition is monitored only during transitions or always.

Breaker Open Failure

If enabled, this pre-alarm is triggered when the DGC-2020ES has issued a "breaker open" output and has not received "breaker opened" feedback from the breaker within the allowed closing time. The Monitor setting determines whether this condition is monitored only during transitions or always.

Reverse Rotation

If enabled, this pre-alarm is triggered when the Generator or Bus rotation is opposite of the Phase Rotation setting defined on the Rated Data screen.

Engine kW Overload

By comparing the genset power output with the rated genset output, the level of engine loading can be determined. Three engine overload pre-alarms are available that monitor three-phase real power when three-phase sensing is active or single-phase real power if single-phase sensing is active. Settings for each pre-alarm consist of an enable/disable setting, three-phase threshold setting, three-phase hysteresis setting, single-phase threshold setting, single-phase hysteresis setting, and low-line scale factor setting. If enabled, an engine overload pre-alarm occurs when the metered power level exceeds the threshold setting. The threshold setting is expressed as a percentage of the genset kW rating on the BESTCOMS*Plus* Rated Data screen (DGC-2020ES, System Parameters, Rated Data). The hysteresis setting functions as a pre-alarm dropout by preventing rapid switching of the alarm annunciation. When the low-line override is active, the thresholds for three-phase and single-phase detection are multiplied by the low-line scale factor. The effect is that low-line threshold = three-phase or single-phase threshold setting x low-line scale factor.

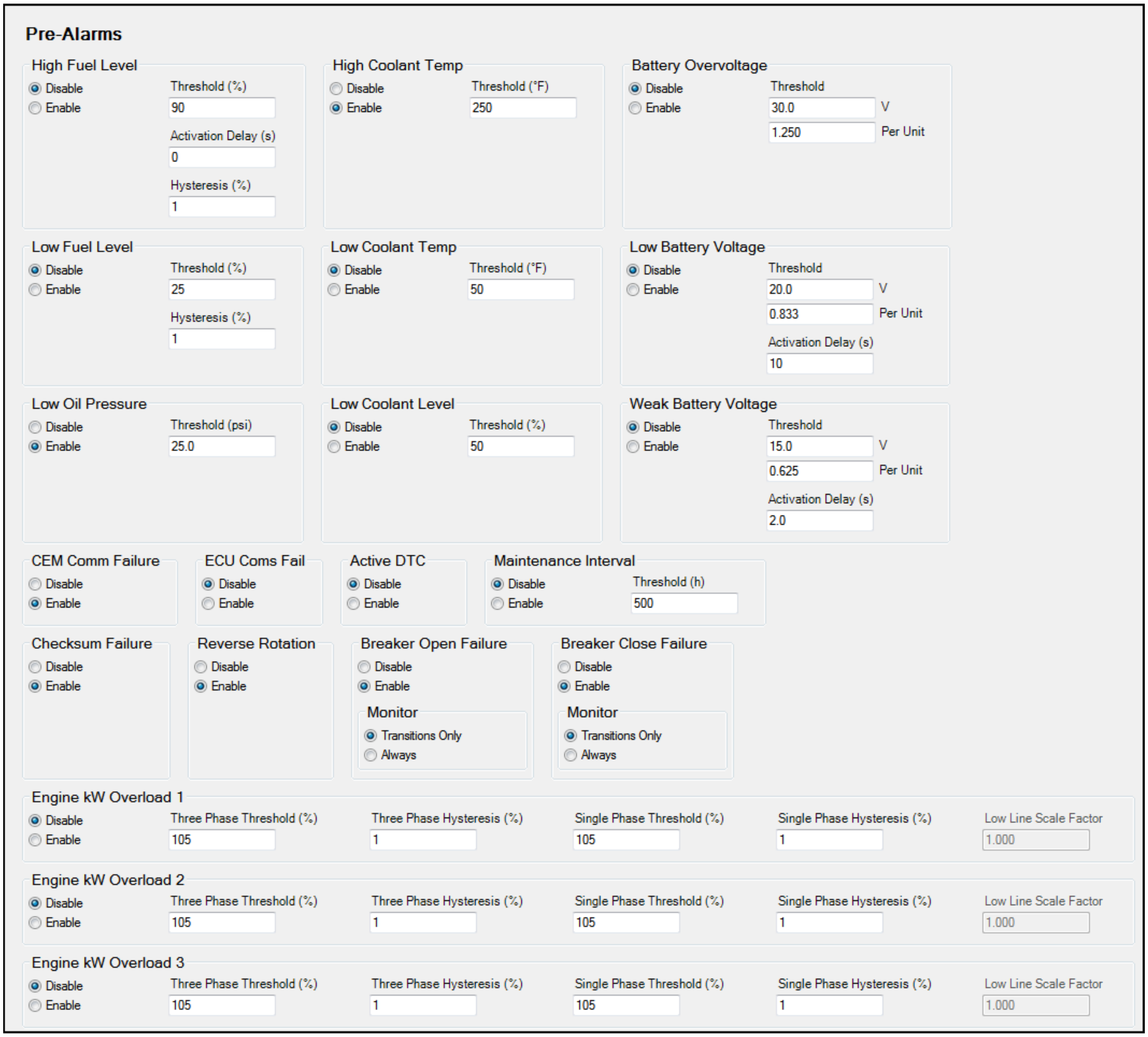


Figure 11-2. Settings Explorer, Alarm Configuration, Pre-Alarms Screen

Horn Configuration

To configure the audible horn using BESTCOMS*Plus*, open the *Horn Configuration* screen (Figure 11-3). This screen is found in the *Settings Explorer* under the *Alarm Configuration* category. If using the front panel, navigate to Settings > Alarm Configuration > Horn Configuration.

An output contact is configured through programmable logic to energize an audible horn when an alarm or pre-alarm condition exists. The horn settings consist of an enable/disable setting and a Not in Auto enable/disable setting. If enabled, the contact output is closed when an alarm condition exists. The contact output is toggled between open and closed when a pre-alarm condition exists. If the Not in Auto setting is enabled, the horn is disabled when the DGC-2020ES is not operating in Auto mode.

Figure 11-3. Settings Explorer, Alarm Configuration, Horn Configuration Screen

Sender Failure

To configure sender failure alarms using BESTCOMS*Plus*, open the *Sender Fail* screen (Figure 11-4). This screen is found in the *Settings Explorer* under the *Alarm Configuration* category. If using the front panel, navigate to Settings > Alarm Configuration > Sender Fail.

Coolant temperature, oil pressure, fuel level, and voltage sensing sender failure settings consist of an alarm configuration setting and an activation delay. The alarm configuration setting allows selection of the type of alarm to be annunciated when a sender fail condition exists. None, Alarm, and Pre-alarm can be selected. The selected alarm type is triggered when a sender failure exists for the duration of the activation time delay.

Speed sender failure settings consist of a single activation delay. An alarm is triggered when a speed sender failure exists for the duration of the activation time delay.

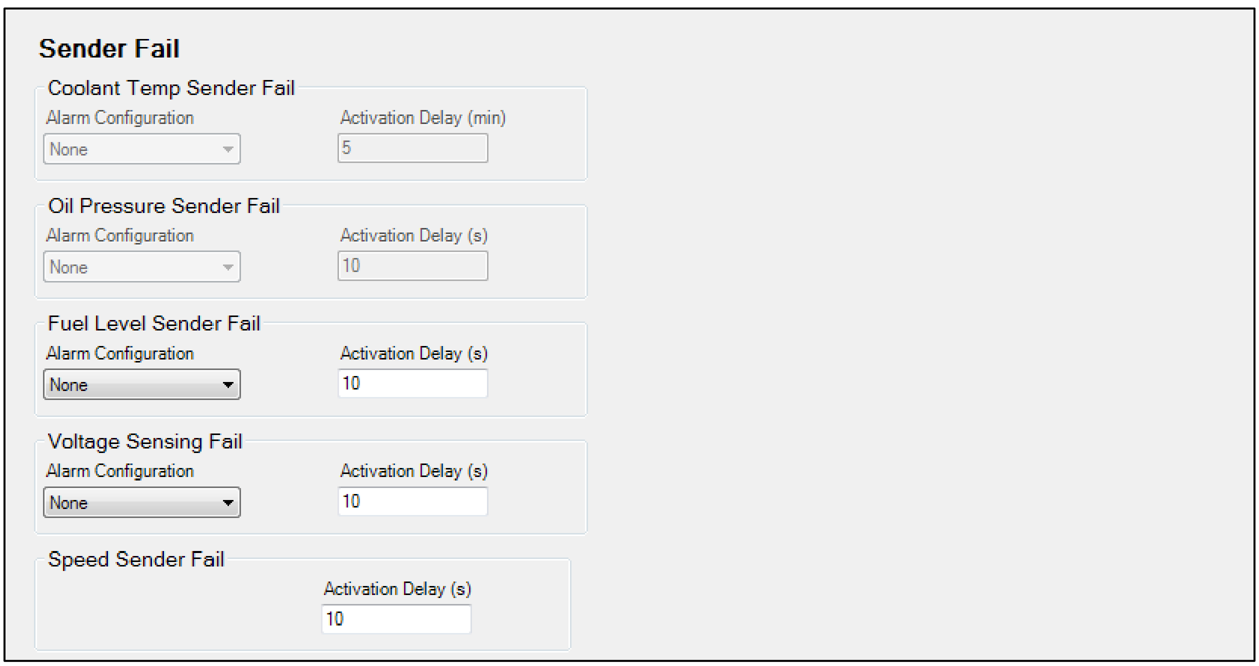


Figure 11-4. Settings Explorer, Alarm Configuration, Sender Fail Screen

12 • Generator Protection

DGC-2020ES controllers offer standard protection consisting of undervoltage (27), overvoltage (59), overcurrent (50), overfrequency (81O), underfrequency (81U), and phase-imbalance voltage (47) elements.

The description of generator protection is organized as follows:

- Voltage (27, 59, 47)
- Frequency (81)
- Overcurrent (50)

Voltage

Voltage protection consists of an undervoltage element, an overvoltage element, and a phase-sequence voltage element.

Undervoltage (27)

Two sets of undervoltage settings are provided for this element: one for three-phase generator connections and one for single-phase generator connections. The pickup setting entered is based on the PT secondary side. When a single-phase override contact input is received, the DGC-2020ES automatically switches from the three-phase undervoltage settings to the single-phase undervoltage settings.

An undervoltage condition is annunciated when the average of the three-phase (three-phase mode) or the line-to-line voltage (single-phase mode) decreases below the corresponding 27 pickup setting for the duration of the corresponding 27 activation delay. An undervoltage annunciation can be user-selected to trigger a pre-alarm (warning) or alarm (shutdown). An undervoltage annunciation can also be user-configured to close a programmable output.

The hysteresis setting functions as an undervoltage dropout by preventing rapid switching of the pickup output.

A frequency-based inhibit setting prevents a 27 trip from occurring during an undervoltage condition associated with system startup.

A low-line scale factor setting is used to automatically adjust the undervoltage pickup settings in applications that may utilize more than one type of genset connection. The scale factor setting is implemented when the DGC-2020ES senses a contact closure at a contact input programmed to activate low-line override. This triggers scaling of the protection settings. The value of the scale factor setting serves as a multiplier for the pickup settings. For example, if a scale factor contact input is received by the DGC-2020ES and the scale factor setting is 2.000, the pickup setting will be doubled (2.000 × PU).

The element is disabled when Alarm Configuration is set to “None”. Element status is available in BESTlogic™*Plus* Programmable Logic when “Status Only” is selected.

Settings which are related to machine ratings can be set in either actual units of voltage or in per unit values. When a native unit is edited, BESTCOMS*Plus*® automatically recalculates the per unit value based on the native unit setting and the rated data parameter (on the *System Parameters, Rated Data* screen) associated with it. When a per unit value is edited, BESTCOMS*Plus* automatically recalculates the native value based on the per unit setting and the rated data parameter associated with it.

Once all per unit values are assigned, if the rated data parameters are changed, BESTCOMS*Plus* automatically recalculates all native unit settings based on the modified rated data parameters.

The following settings have native units of *Secondary Volts*, and the rated data associated with them is *Rated Secondary Volts* (on the *System Parameters, Rated Data* screen).

- Undervoltage 27 Three-Phase Pickup
- Undervoltage 27 Single-Phase Pickup

The *Undervoltage* screen is found in the BESTCOMS*Plus Settings Explorer* under the *Generator Protection, Voltage* category. If using the front panel, navigate to Settings > Generator Protection > 27 Undervoltage. The BESTCOMS*Plus* Undervoltage screen is illustrated in Figure 12-1.

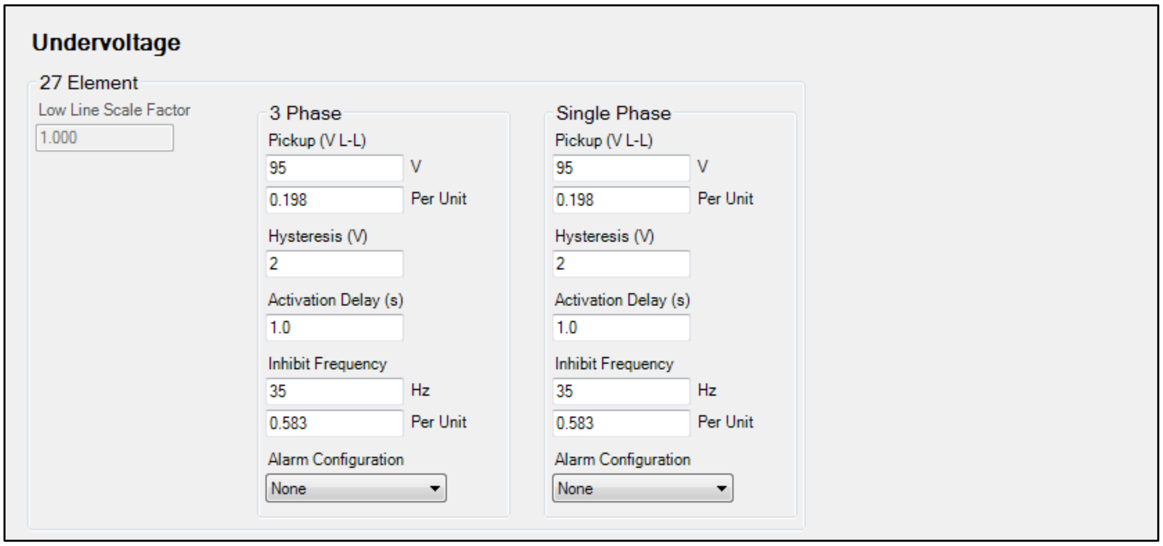


Figure 12-1. Settings Explorer, Generator Protection, Voltage, Undervoltage (27) Screen

Overvoltage (59)

Two sets of overvoltage settings are provided for this element: one for three-phase generator connections and one for single-phase generator connections. The pickup setting entered is based on the PT secondary side (DGC-2020ES). When a single-phase override contact input is received, the DGC-2020ES automatically switches from the three-phase overvoltage settings to the single-phase overvoltage settings.

An overvoltage condition is annunciated when the average of the three-phase (three-phase mode) or the line-to-line voltage (single-phase mode) increases above the corresponding 59 pickup setting for the duration of the corresponding 59 activation delay. An overvoltage annunciation can be user-selected to trigger a pre-alarm (warning) or alarm (shutdown). An overvoltage annunciation can also be user-configured to close a programmable output.

The hysteresis setting functions as an undervoltage dropout by preventing rapid switching of the pickup output.

A low-line scale factor setting is used to automatically adjust the overvoltage pickup settings in applications that may utilize more than one type of genset connection. The scale factor setting is implemented when the DGC-2020ES senses a contact closure at a contact input programmed to activate low-line override. This triggers scaling of the protection settings. The value of the scale factor setting serves as a multiplier for the pickup settings. For example, if a scale factor contact input is received by the DGC-2020ES and the scale factor setting is 2.000, the pickup setting will be doubled (2.000 × PU).

The element is disabled when Alarm Configuration is set to “None”. Element status is available in BESTlogic*Plus* Programmable Logic when “Status Only” is selected.

Settings which are related to machine ratings can be set in either actual units of voltage or in per unit values. When a native unit is edited, BESTCOMS*Plus* automatically recalculates the per unit value based on the native unit setting and the rated data parameter (on the *System Parameters, Rated Data* screen) associated with it. When a per unit value is edited, BESTCOMS*Plus* automatically recalculates the native value based on the per unit setting and the rated data parameter associated with it.

Once all per unit values are assigned, if the rated data parameters are changed, BESTCOMS*Plus* automatically recalculates all native unit settings based on the modified rated data parameters.

The following settings have native units of *Secondary Volts*, and the rated data associated with them is *Rated Secondary Volts* (on the *System Parameters, Rated Data* screen).

- Overvoltage 59 Three-Phase Pickup

- Overvoltage 59 Single-Phase Pickup

The *Overvoltage* screen is found in the BESTCOMS*Plus Settings Explorer* under the *Generator Protection, Voltage* category. If using the front panel, navigate to Settings > Generator Protection > 59 Overvoltage. The BESTCOMS*Plus* Overvoltage screen is illustrated in Figure 12-2.

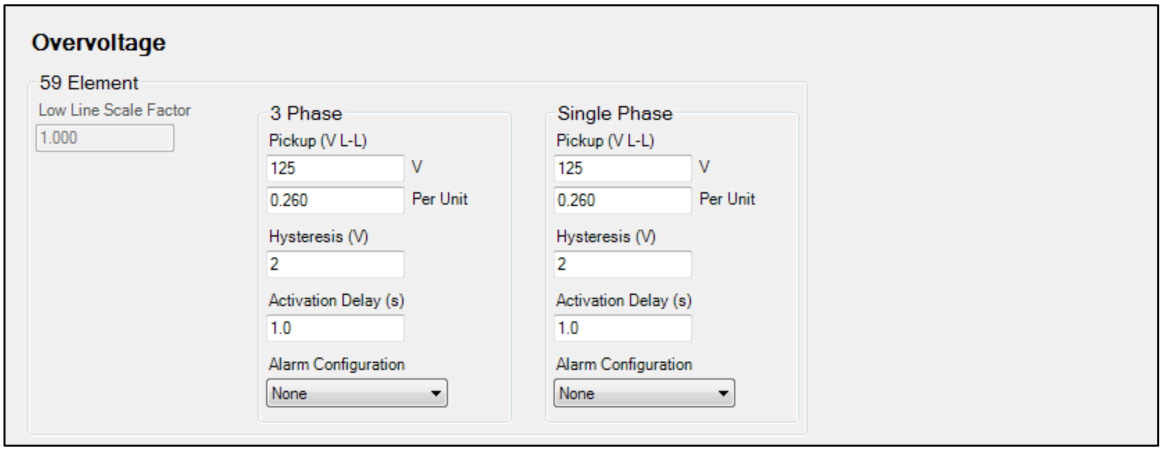


Figure 12-2. Settings Explorer, Generator Protection, Voltage, Overvoltage (59) Screen

Phase Imbalance (47)

DGC-2020ES controllers are capable of protecting against voltage imbalances between any of the three phases. The pickup setting entered is based on the PT secondary side. A phase imbalance condition is annunciated when the difference between any of the three phases of generator voltage increases above the 47 pickup setting for the duration of the 47 activation delay setting. A phase imbalance annunciation can be user-selected to trigger a pre-alarm (warning) or alarm (shutdown). A phase imbalance annunciation can also be user-configured to close a programmable output.

The hysteresis setting functions as a phase imbalance dropout by preventing rapid switching of the pickup output.

A low-line scale factor setting is used to automatically adjust the phase imbalance pickup setting in applications that may utilize more than one type of genset connection. The scale factor setting is implemented when the DGC-2020ES senses a contact closure at a contact input programmed to activate the low-line override. This triggers scaling of the protection settings. The value of the scale factor setting serves as a multiplier for the pickup setting. For example, if a scale factor contact input is received by the DGC-2020ES and the scale factor setting is 2.000, the pickup setting will be doubled (2.000 × PU).

The element is disabled when Alarm Configuration is set to “None”. Element status is available in BESTlogic*Plus* Programmable Logic when “Status Only” is selected.

Settings which are related to machine ratings can be set in either actual units of voltage or in per unit values. When a native unit is edited, BESTCOMS*Plus* automatically recalculates the per unit value based on the native unit setting and the rated data parameter (on the *System Parameters, Rated Data* screen) associated with it. When a per unit value is edited, BESTCOMS*Plus* automatically recalculates the native value based on the per unit setting and the rated data parameter associated with it.

Once all per unit values are assigned, if the rated data parameters are changed, BESTCOMS*Plus* automatically recalculates all native unit settings based on the modified rated data parameters.

The following setting has native units of *Secondary Volts*, and the rated data associated with it is *Rated Secondary Volts* (on the *System Parameters, Rated Data* screen).

- Phase Imbalance 47 Pickup

The *Phase Imbalance* screen is found in the BESTCOMS*Plus Settings Explorer* under the *Generator Protection, Voltage* category. If using the front panel, navigate to Settings > Generator Protection > 47 Phase Imbalance. The BESTCOMS*Plus* Phase Imbalance screen is illustrated in Figure 12-3.

Figure 12-3. Settings Explorer, Generator Protection, Voltage, Phase Imbalance (47) Screen

Frequency

Two sets of frequency protection settings are provided: one for underfrequency (81U) and one for overfrequency (81O).

Underfrequency (81U)

An underfrequency condition is annunciated when the generator frequency decreases below the 81U pickup setting for the duration of the 81U activation delay setting. An underfrequency annunciation can be user-selected to trigger a pre-alarm (warning) or alarm (shutdown). An underfrequency annunciation can also be user-configured to close a programmable output.

A voltage-based inhibit setting prevents an 81U trip from occurring during an underfrequency condition associated with system startup.

The hysteresis setting functions as an underfrequency dropout by preventing rapid switching of the pickup output.

Overfrequency (81O)

When the generator frequency increases above the 81O pickup setting for the duration of the 81O activation delay setting, an overfrequency condition is annunciated. An overfrequency annunciation can be user-selected to trigger a pre-alarm (warning) or alarm (shutdown). An overfrequency condition can also be user configured to close a programmable output.

The hysteresis setting functions as an overfrequency dropout by preventing rapid switching of the pickup output.

The element is disabled when Alarm Configuration is set to “None”. Element status is available in BESTlogic*Plus* Programmable Logic when “Status Only” is selected.

Alternate Frequency Scale Factor

An alternate frequency scale factor setting is used for automatic adjustment of the frequency pickup settings in applications that may utilize more than one operating frequency. For example, a machine that is configurable between 50 or 60 Hz operation. The scale factor setting is implemented when the DGC-2020ES senses a contact closure at a contact input that is connected to the Alternate Frequency Override logic element in BESTlogic*Plus* Programmable Logic. When the Alternate Frequency Override is true, the scale factor setting serves as a multiplier for the pickup settings. For example, if an alternate frequency scale factor contact input is received by the DGC-2020ES and the scale factor setting is 2.000, the pickup setting is doubled (2.000 x PU).

Per Unit

Settings which are related to machine ratings can be set in either actual units of hertz or in per unit values. Per unit settings are available for Pickup (81O/81U) and Inhibit Volts (81U). When a native unit is edited, BESTCOMS*Plus* automatically recalculates the per unit value based on the native unit setting and the rated data parameter (on the *System Parameters, Rated Data* screen) associated with it. When a per unit value is edited, BESTCOMS*Plus* automatically recalculates the native value based on the per unit setting and the rated data parameter associated with it.

Once all per unit values are assigned, if the rated data parameters are changed, BESTCOMS*Plus* automatically recalculates all native unit settings based on the modified rated data parameters.

The following settings have native units of *Frequency in Hz*, and the rated data associated with them is *Rated Frequency* (on the *System Parameters, Rated Data* screen).

- 81 U Pickup
- 81 O Pickup

The following setting has native units of *Secondary Volts*, and the rated data associated with it is *Rated Secondary Volts* (on the *System Parameters, Rated Data* screen).

- 81 U Inhibit Voltage

The *Frequency* screen is found in the BESTCOMS*Plus Settings Explorer* under the *Generator Protection, Frequency* category. If using the front panel, navigate to Settings > Generator Protection > 81 O/U Frequency. The BESTCOMS*Plus* Frequency screen is illustrated in Figure 12-4.

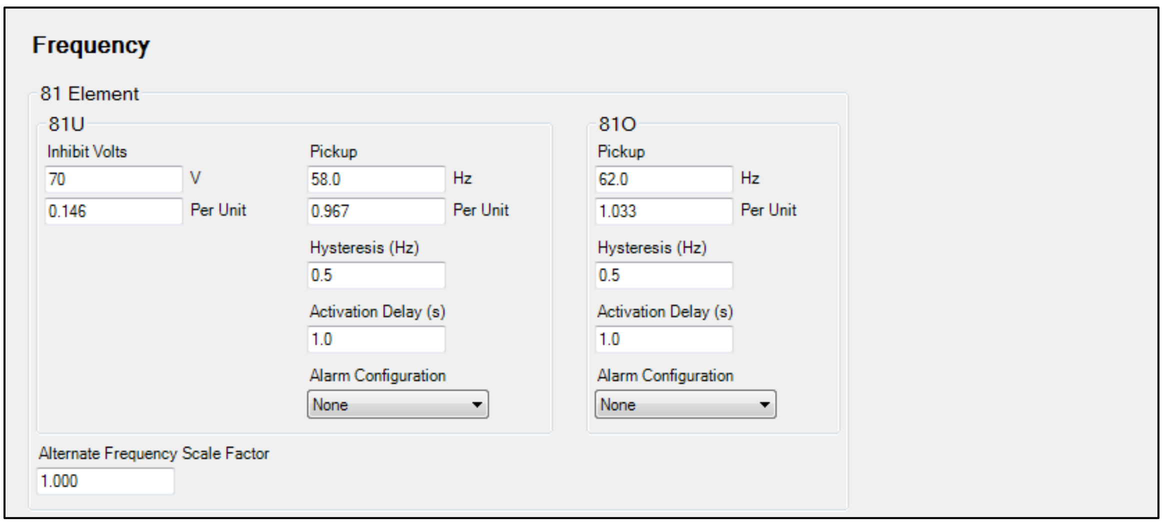


Figure 12-4. Settings Explorer, Generator Protection, Frequency, Frequency (81) Screen

Overcurrent

Two sets of overcurrent settings are provided for this element: one for three-phase generator connections and one for single-phase generator connections. The pickup setting entered is based on the CT secondary side. When a single-phase override contact input is received by the DGC-2020ES, the overcurrent protection settings automatically switch from the three-phase settings to the single-phase overcurrent protection settings.

When any of the phase currents increase above the pickup setting for the duration of the overcurrent time delay, an overcurrent condition is annunciated. An overcurrent annunciation can be user-selected to trigger a pre-alarm (warning) or alarm (shutdown). An overcurrent annunciation can also be user-configured to close a programmable output.

A low-line scale factor setting is used for automatic adjustment of the overcurrent pickup settings in applications that may utilize more than one type of genset connection. The scale factor setting is implemented when the DGC-2020ES senses a contact closure at a contact input programmed to activate low-line override. This triggers scaling of the protection settings. The value of the scale factor setting serves as a multiplier for the pickup settings. For example, if a scale factor contact input is received by the DGC-2020ES and the scale factor setting is 2.000, the pickup setting will be doubled (2.000 × PU).

The element is disabled when Alarm Configuration is set to "None". Element status is available in BESTlogic*Plus* Programmable Logic when "Status Only" is selected.

Settings which are related to machine ratings can be set in either actual units of current or in per unit values. When a native unit is edited, BESTCOMS*Plus* automatically recalculates the per unit value based on the native unit setting and the rated data parameter (on the *System Parameters, Rated Data* screen) associated with it. When a per unit value is edited, BESTCOMS*Plus* automatically recalculates the native value based on the per unit setting and the rated data parameter associated with it.

Once all per unit values are assigned, if the rated data parameters are changed, BESTCOMS*Plus* automatically recalculates all native unit settings based on the modified rated data parameters.

The following settings have native units of *Secondary Amps*, and the rated data associated with them is *Rated Secondary Phase Amps* (on the *System Parameters, Rated Data* screen).

- Overcurrent 50 Three-Phase Pickup
- Overcurrent 50 Single-Phase Pickup

The *Overcurrent* screen is found in the BESTCOMS*Plus Settings Explorer* under the *Generator Protection, Current* category. If using the front panel, navigate to Settings > Generator Protection > 50 Overcurrent. The BESTCOMS*Plus* Overcurrent screen is illustrated in Figure 12-5.

Figure 12-5. Settings Explorer, Generator Protection, Current, Overcurrent

13 • BESTlogic™*Plus*

BESTlogic*Plus* Programmable Logic is a programming method used for managing the input, output, protection, control, monitoring, and reporting capabilities of Basler Electric's DGC-2020ES Digital Genset Controller. Each DGC-2020ES has multiple, self-contained logic blocks that have all of the inputs and outputs of its discrete component counterpart. Each independent logic block interacts with control inputs and hardware outputs based on logic variables defined in equation form with BESTlogic*Plus*. BESTlogic*Plus* equations entered and saved in the DGC-2020ES system's nonvolatile memory integrate (electronically wire) the selected or enabled protection and control blocks with control inputs and hardware outputs. A group of logic equations defining the logic of the DGC-2020ES is called a logic scheme.

One default active logic scheme is preloaded into the DGC-2020ES. This scheme is configured for a typical protection and control application and virtually eliminates the need for "start-from-scratch" programming. BESTCOMS*Plus*® can be used to open a logic scheme that was previously saved as a file and upload it to the DGC-2020ES. The default logic scheme can also be customized to suit your application. Detailed information about logic schemes is provided later in this section.

BESTlogic*Plus* is not used to define the operating settings (modes, pickup thresholds, and time delays) of the individual protection and control functions. Operating settings and logic settings are interdependent but separately programmed functions. Changing logic settings is similar to rewiring a panel and is separate and distinct from making the operating settings that control the pickup thresholds and time delays of a DGC-2020ES. Detailed information about operating settings is provided in the *BESTCOMSPlus* chapter.

Caution

This product contains one or more *nonvolatile memory* devices. Nonvolatile memory is used to store information (such as settings) that needs to be preserved when the product is power-cycled or otherwise restarted. Established nonvolatile memory technologies have a physical limit on the number of times they can be erased and written. In this product, the limit is 100,000 erase/write cycles. During product application, consideration should be given to communications, logic, and other factors that may cause frequent/repeated writes of settings or other information that is retained by the product. Applications that result in such frequent/repeated writes may reduce the useable product life and result in loss of information and/or product inoperability.

Overview of BESTlogic™Plus

Use BESTCOMS*Plus* to change BESTlogic*Plus* settings. Use the Settings Explorer to open the *BESTlogicPlus Programmable Logic* tree branch as shown in Figure 13-1.

The *BESTlogicPlus Programmable Logic* screen contains a logic library for opening and saving logic files, tools for creating and editing logic documents, and protection settings.

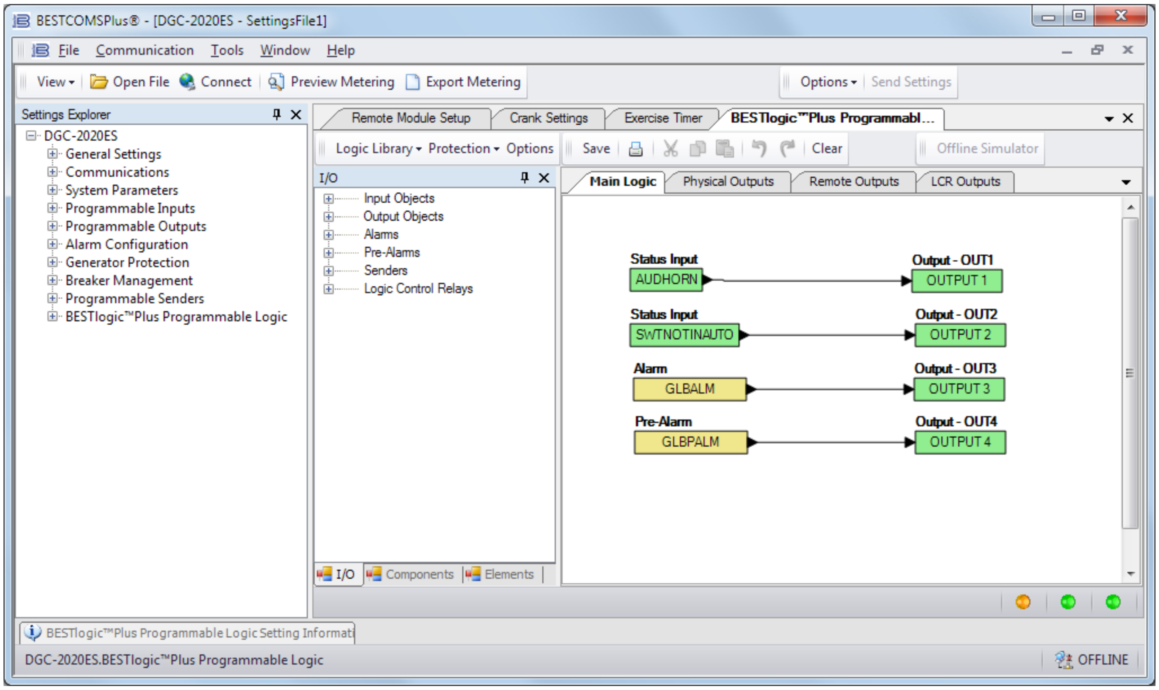


Figure 13-1. Settings Explorer, BESTlogic*Plus* Programmable Logic Screen

BESTlogic™Plus Composition

There are three main groups of objects used for programming BESTlogic*Plus*. These groups are *I/O, Components,* and *Elements.* For details on how these objects are used to program BESTlogic*Plus*, see the paragraphs on *Programming BESTlogicPlus,* later in this chapter.

I/O

This group contains Input Objects, Output Objects, Alarms, Pre-Alarms, Senders, and Logic Control Relays. Table 13-1 lists the names and descriptions of the objects in the *I/O* group.

Table 13-1. I/O Group, Names and Descriptions

Name	Description	Symbol
Input Objects		
Logic 0	Always false (Low).	Fixed 0
Logic 1	Always true (High).	Fixed 1
Physical Inputs IN1 – IN7	True when Physical Input x is active.	Input - IN1 INPUT 1
Remote Inputs IN8 – IN17	True when Remote Input x is active. (Available when an optional CEM-2020 is connected.)	Input - IN8 INPUT 8
Virtual Inputs VIN1 – VIN4	True when Virtual Input x is active.	Input - VIN1 VIN1
Status Input Active DTC's Present	True when Diagnostic Trouble Codes are present.	Status Input ACTIVEDTCSPRESENT

Name	Description	Symbol
Status Input Alarm Silence	True when the Alarm Silence logic element is true or the Alarm Silence button is pressed on the front panel.	Status Input ALARMSILENCEIN
Status Input Alternate Frequency Override	True when the Alternate Frequency Override logic element is true.	Status Input ALTFREQOVERIN
Status Input ATS Input	True when the ATS (Auto Transfer Switch) input is true or the ATS logic element is true.	Status Input ATSINSTATUS
Status Input Audible Horn	True when the Audible Horn is active.	Status Input AUDHORN
Status Input Auto Mode	True when the DGC-2020ES is in Auto Mode or the Auto Mode logic element is true.	Status Input AUTOMODE
Status Input Auto Restart	True when the Automatic Restart function is active.	Status Input AUTORESTART
Status Input Battery Charger AC Off	True when the ac power to the battery charger is off. (Battery Charger 1 shown.)	Status Input BCH1ACOFFSTATUS
Status Input Battery Charger Battery Failure	True when the battery charger has detected that the battery has failed. (Battery Charger 1 shown.)	Status Input BCH1BATTERYFAILURESTATUS
Status Input Battery Charger Comms Fail	True when the battery charger has detected a J1939 communications failure. (Battery Charger 1 shown.)	Status Input BCH1COMMSFAILSTATUS
Status Input Battery Charger Fail	True when the battery charger has failed. (Battery Charger 1 shown.)	Status Input BCH1CHARGERFAILSTATUS
Status Input Battery Charger High Output Volts	True when the battery charger output voltage is too high. (Battery Charger 1 shown.)	Status Input BCH1HIOUTPUTVOLTSSTATUS
Status Input Battery Charger Invalid Settings	True when the battery charger has detected settings that are not valid. (Battery Charger 1 shown.)	Status Input BCH1INVALIDSETTINGSSTATUS
Status Input Battery Charger Low Cranking Volts	True when the battery charger has detected that the voltage while the engine is cranking has dipped too low. (Battery Charger 1 shown.)	Status Input BCH1LOCRANKINGVOLTSSTATUS
Status Input Battery Charger Low Output Volts	True when the battery charger output voltage is too low. (Battery Charger 1 shown.)	Status Input BCH1LOOUTPUTVOLTSSTATUS
Status Input Battery Charger Single Unit Fail	True when the battery charger has detected one or more charging output stages in a charger with multiple charging output stages has failed. (Battery Charger 1 shown.)	Status Input BCH1SINGLEUNITFAILSTATUS

Name	Description	Symbol
Status Input Battery Charger Thermal Limit	True when the battery charger temperature is beyond the thermal limit. (Battery Charger 1 shown.)	Status Input BCH1THERMALLIMITSTATUS
Status Input Battery Charger Fail	True when the Battery Charger Fail input is true.	Status Input BATTCHRGFAIL
Status Input Battle Override	True when the Battle Override input is true.	Status Input BATTLORIDE
Status Input Bus Dead	True when the Bus Dead condition settings have been exceeded.	Status Input BUSDEAD
Status Input Bus Fail	True when the Bus Fail condition settings have been exceeded.	Status Input BUSFAIL
Status Input Bus Forward Rotation	True when the bus rotation matches the Phase Rotation setting.	Status Input BUSFORWARDROTATION
Status Input Bus Reverse Rotation	True when the bus rotation is opposite of the Phase Rotation setting.	Status Input BUSREVERSEROTATION
Status Input Bus Stable	True when the Bus Stable condition settings have been exceeded.	Status Input BUSSTABLE
Status Input *CAN Bus - Bus Off*	True when the CAN Bus - bus is off.	Status Input CANBUSBUSOFF
Status Input *CAN Bus Error Passive*	True when a passive error is annunciated by the CAN Bus.	Status Input CANBUSERRORPASSIVE
Status Input Configurable Elements 1-8	True when the Configurable Element x logic element is true.	Status Input CONFIGELEMENT1
Status Input Contact Expansion Module	Contact Expansion Module Connected. True when an optional CEM-2020 is connected to the DGC-2020ES.	Status Input CEMCONNECTED
Status Input Cool Down Timer Active	True when the Cool Down Timer is timing out. The Cool Down Timer is true under two circumstances: 1. The unit is in auto and ATS is removed, causing the DGC-2020ES to go into a cooldown state. 2. The engine is running (in RUN or AUTO mode with ATS applied) and the load has been removed (i.e. the EPSSUPLOAD status input is false due to small load). If the load is reapplied, the Cool Down Timer stops and resets, and it will restart when the load is removed the next time.	Status Input CDOWNTMRACT
Status Input DPF Lamp Command	True when DPF lamp is lit. This status input mimics the state of the DPF lamp. It remains true when the DPF lamp is constantly lit and toggles true and false at a rate of 1 Hz when DPF lamp is blinking.	Status Input DPFLAMPCOMMAND
Status Input DPF Manual Regen Request	True when a Diesel Particulate Filter (DPF) manual regen request has been initiated through the front panel, BESTCOMS*Plus*, or the Manual Regen Request logic element.	Status Input DPFMANUALREGENREQ

Name	Description	Symbol
Status Input DPF Regen Inhibit Request	True when the Diesel Particulate Filter (DPF) regeneration inhibit setting is turned on through the front panel, BESTCOMS*Plus*, or logic.	Status Input DPFREGENINHIBITREQ
Status Input ECU Amber Lamp	True when the engine ECU sends ECU Amber Lamp (Warning Lamp) status as part of J1939 Diagnostic Trouble Code (DTC) communications. It may be off, on, or flashing. If the installation requires annunciation of engine warning and fault lamps, this may be connected to an output in logic to drive an amber lamp.	Status Input ECUAMBERLAMP
Status Input ECU Red Lamp	True when the engine ECU sends ECU Red Lamp (Fault Lamp) status as part of J1939 Diagnostic Trouble Code (DTC) communications. It may be off, on, or flashing. If the installation requires annunciation of engine warning and fault lamps, this may be connected to an output in logic to drive a red lamp.	Status Input ECUREDLAMP
Status Input Emergency Stop	True when the Emergency Stop button has been pressed.	Status Input EMERGSTOP
Status Input Engine Running	True while the Engine is Running.	Status Input ENGRUNNING
Status Input Engine Running 15 Minutes	True when the engine is presently running and has been running 15 minutes or more since the most recent start.	Status Input ENGRUNNING15MINS
Status Input EPS Supplying Load	True while the EPS is supplying load.	Status Input EPSSUPLOAD
Status Input Front Panel Buttons	True while the *Auto* front panel button is pressed.	Status Input AUTOBUTTON
Status Input Front Panel Buttons	True while the *Back* front panel button is pressed.	Status Input BACKBUTTON
Status Input Front Panel Buttons	True while the *Down* front panel button is pressed.	Status Input DOWNBUTTON
Status Input Front Panel Buttons	True while the *Edit* front panel button is pressed.	Status Input EDITBUTTON
Status Input Front Panel Buttons	True while the *Up and Down* front panel buttons are simultaneously pressed.	Status Input LAMPBUTTON
Status Input Front Panel Buttons	True while the *Off* front panel button is pressed.	Status Input OFFBUTTON
Status Input Restart Delay Active	True when the restart delay is currently active.	Status Input RESTARTDELAYACTIVE
Status Input Front Panel Buttons	True while the *Run* front panel button is pressed.	Status Input RUNBUTTON

Name	Description	Symbol
Status Input Front Panel Buttons	True while the *Back and Edit* front panel buttons are simultaneously pressed.	**Status Input** SILENCEBUTTON
Status Input Front Panel Buttons	True while the *Up* front panel button is pressed.	**Status Input** UPBUTTON
Status Input Fuel Leak	True when the Fuel Leak Detect input is true.	**Status Input** FUELLEAK
Status Input Generator Breaker Status	True when the generator breaker is closed.	**Status Input** GENBREAKERSTATUS
Status Input Generator Dead	True when the Gen Dead condition settings have been exceeded.	**Status Input** GENDEAD
Status Input Generator Fail	True when the Gen Fail condition settings have been exceeded.	**Status Input** GENFAIL
Status Input Generator Forward Rotation	True when the generator rotation matches the Phase Rotation setting.	**Status Input** GENFORWARDROTATION
Status Input Generator Protection	True when the 27 element is tripped.	**Status Input** 27UNDRVLTTRIPSTATUS
Status Input Generator Protection	True when the 59 element is tripped.	**Status Input** 59OVOLTTRIPSTATUS
Status Input Generator Protection	True when the 47 element is tripped.	**Status Input** 47PH_IMBTRIPSTATUS
Status Input Generator Protection	True when the 50 element is tripped.	**Status Input** 50OCURRTRIPSTATUS
Status Input Generator Protection	True when the 81 Over element is tripped.	**Status Input** 81OFRQTRIPSTATUS
Status Input Generator Protection	True when the 81 Under element is tripped.	**Status Input** 81UFRQTRIPSTATUS
Status Input Generator Reverse Rotation	True when the generator rotation is opposite of the Phase Rotation setting.	**Status Input** GENREVERSEROTATION
Status Input Generator Stable	True when the Gen Stable condition settings have been exceeded.	**Status Input** GENSTABLE
Status Input Generator Test Loaded	True when the Exercise Timer has started the generator and run with load is selected.	**Status Input** GENTESTLOADED
Status Input Generator Test	True when the Exercise Timer has started the generator.	**Status Input** GENTEST

Name	Description	Symbol
Status Input Global Low Coolant Level	True when the Low Coolant Level input is true.	Status Input GLBLOWCOOLLVL
Status Input Ground Delta Override	True when the Grounded Delta Override input is true.	Status Input GNDDLTAORIDE
Status Input Idle Request	True when the Idle Request logic element is true.	Status Input IDLEREQUESTIN
Status Input In Alarm State	True when the DGC-2020ES is in the alarm state.	Status Input INALARMSTATE
Status Input In Connecting State	True when the DGC-2020ES is in the connecting state.	Status Input INCONNECTINGSTATE
Status Input In Cooling State	True when the DGC-2020ES is in the cooling state.	Status Input INCOOLINGSTATE
Status Input In Cranking State	True when the DGC-2020ES is in the cranking state.	Status Input INCRANKINGSTATE
Status Input In Disconnect State	True when the DGC-2020ES is in the disconnect state.	Status Input INDISCONNECTSTATE
Status Input In Prestart State	True when the DGC-2020ES is in the pre-start state.	Status Input INPRESTARTSTATE
Status Input In Pulsing State	True when the DGC-2020ES is in the pulsing state.	Status Input INPULSINGSTATE
Status Input In Ready State	True when the DGC-2020ES is in the ready state.	Status Input INREADYSTATE
Status Input In Resting State	True when the DGC-2020ES is in the resting state.	Status Input INRESTINGSTATE
Status Input In Running State	True when the DGC-2020ES is in the running state.	Status Input INRUNNINGSTATE
Status Input Lamp Test	True when the Lamp Test logic element is true or the Lamp Test button is pressed on the front panel.	Status Input LAMPTESTIN
Status Input Load Take Over	True when the Load Take Over logic element is true.	Status Input LOADTAKEOVERIN
Status Input Low Line Override	True when the Low Line Override input is true.	Status Input LOWLINEORIDE
Status Input Mains Breaker Status	True when the mains breaker is closed.	Status Input MAINSBREAKERSTATUS
Status Input Mains Fail Test	True when the Mains Fail Test logic element is true.	Status Input MAINSFAILIN

Name	Description	Symbol
Status Input Mains Fail Transfer Complete	True when the DGC-2020ES is configured for mains fail transfers and has successfully transferred to the generator from the utility. It remains true until the utility power is deemed good and the DGC-2020ES transfers the load back to utility power.	Status Input MAINSFLTRCOMPLETE
Status Input Mains Fail Transfer Disabled	True when the Mains Fail Transfer Functionality is not enabled or when the DGC-2020ES is operating in the Off or Run modes or in the alarm state.	Status Input MFXFRDISABLED
Status Input Mains Fail Transfer Power from Gens	True when mains fail transfer function detects the load is powered from the generator bus.	Status Input MFXFRPOWERFROMGENS
Status Input Mains Fail Transfer Power from Mains	True when mains fail transfer function detects the load is powered from the mains bus.	Status Input MFXFRPOWERFROMMAINS
Status Input Mains Fail Transfer Return Timer Active	True when mains fail transfer return delay timer is actively counting.	Status Input MFXFRRETURNTIMERACTIVE
Status Input Mains Fail Transfer Transfer Timer Active	True when the mains fail transfer delay timer is actively counting.	Status Input MFXFRTRANSFERTIMERACTIVE
Status Input Mains Fail Transfer Transferring to Gens	True when mains fail transfer is transferring load to the generator bus.	Status Input MFXFRTRANSFERRINGTOGENS
Status Input Mains Fail Transfer Transferring to Mains	True when mains fail transfer is transferring load to the mains bus.	Status Input MFXFRTRANSFERRINGTOMAINS
Status Input Off Mode	True when the DGC-2020ES is in Off Mode or the Off Mode logic element is true.	Status Input OFFMODE
Status Input Off Mode Cooldown	True when the DGC-2020ES is in Off Mode and cooling down.	Status Input OFFMODECOOL
Status Input Open Transition Delay	True when the open transition delay is actively counting.	Status Input OPENTRANSITIONDELAY
Status Input Pre Start Condition in Effect	True while in the Pre Start state.	Status Input PRESTCONDINEFFECT

Name	Description	Symbol
Status Input Pre Start Input	True when the DGC-2020ES is indicating that the Pre Start relay should be closed.	Status Input PRESTARTINPUT
Status Input Regen Completed	True for 30 seconds after a Yanmar ECU goes back into passive mode when the status of the DPF Active Regeneration Forced Status is “Regen Successful”.	Status Input REGENCOMPLETED
Status Input Regen Confirmation Requested	True after a manual exhaust regeneration has been requested on a Yanmar ECU. Once in this state, another regen request must be issued to confirm manual regeneration.	Status Input REGENCONFIRMREQ
Status Input Regen Interlock from ECU	True when John Deere proprietary parameters are broadcast over the J1939 CAN Bus.	Status Input REGENINTERLOCKFROMECU
Status Input Regen Stopped	True for 30 seconds after a Yanmar ECU goes back into passive mode when the status of the DPF Active Regeneration Forced Status is “Regen Not Successful”.	Status Input REGENSTOPPED
Status Input Reset Active	True when the Reset logic element is true or when the Reset key on the front panel is pressed.	Status Input RESETACTIVE
Status Input Restart Delay Active	True when the Restart Delay timer is timing out.	Status Input RESTARTDELAYACTIVE
Status Input Run Input	True when the DGC-2020ES is indicating that the Run relay should be closed.	Status Input RUNINPUT
Status Input Run Mode	True when the DGC-2020ES is in Run Mode or the Run Mode logic element is true.	Status Input RUNMODE
Status Input Single Phase Connection Override	True when the Single Phase Override input is true.	Status Input SPORIDE
Status Input Switch not in Auto	True when the DGC-2020ES is not in Auto Mode.	Status Input SWTNOTINAUTO
Status Input Start Input	True when the DGC-2020ES is indicating that the Start relay should be closed to start the engine.	Status Input STARTINPUT
Output Objects		
Physical Outputs OUT1 – OUT4	Physical Outputs 1 through 4.	Output - OUT1 OUTPUT 1
Remote Outputs OUT5 – OUT28	Remote Outputs 5 through 28. (Available when an optional CEM-2020 is connected.)	Output - OUT5 OUTPUT 5
Alarms		
Auto Restart Fail	True after the Automatic Restart function fails to restart the generator.	Alarm AUTORSTRTFAILALM
Battery Charger Fail	True when the Battery Charger Fail function is configured as an alarm and the activation delay has expired.	Alarm BATTCHRGFAILALM

Name	Description	Symbol
Coolant Level Sender Fail	True when a low coolant level error status code is received from the ECU. CAN Bus must be enabled.	Alarm COOLLVLSENDFAILALM
Coolant Temp Sender Fail	True when the Coolant Temp Sender Fail is configured as an alarm and the activation delay has expired.	Alarm COOLTEMPSENDFAILALM
DEF Severe Inducement	This alarm indicates the highest level of inducement not to operate the engine due to low or poor quality Diesel Exhaust Fluid (DEF), or a malfunction in the Exhaust After Treatment System (EATS). The engine may operate in a reduced power mode, or for a limited time, or may be prevented from starting by the ECU until the problem is corrected. A service tool may be required to restart the engine.	Alarm DEFSEVERINDUCEMENTALM
Diagnostic Trouble Code	True when a Diagnostic Trouble Code alarm exists.	Alarm DIAGNOSTICTROUBLECODE
ECU Comm Loss	True when communication to ECU has been lost.	Alarm LOSSECUCOMMALM
ECU Shutdown	True when ECU has shut down the engine.	Alarm ECUSHUTDOWNALM
Emergency Stop	True when the Emergency Stop button has been pressed.	Alarm EMERGSTOPALM
Exhaust System Error	This alarm annunciates when the DEF Inducement Level is greater than or equal to 3, the Isuzu Exhaust System lamp is on, and the Isuzu No Power lamp is on. The Exhaust System Error alarm appears in conjunction with a DEF Severe Inducement alarm to indicate why the machine has entered the severe inducement state due to SCR system malfunction.	Alarm EXHAUSTSYSERRORALM
Fuel Leak	True when the Fuel Leak Detect function is configured as an alarm and the activation delay has expired.	Alarm FUELLEAKALM
Fuel Level Sender Fail	True when the Fuel Level Sender Fail is configured as an alarm and the activation delay has expired.	Alarm FUELLSENDFAILALM
Generator Protection 27	True when the 27 element is configured as an alarm and has tripped.	Alarm 27UNDRVLTALM
Generator Protection 59	True when the 59 element is configured as an alarm and has tripped.	Alarm 59OVOLTALM
Generator Protection 47	True when the 47 element is configured as an alarm and has tripped.	Alarm 47PH_IMBLALM
Generator Protection 50	True when the 50 element is configured as an alarm and has tripped.	Alarm 50OCURRALM
Generator Protection 81 Over	True when the 81 Over element is configured as an alarm and has tripped.	Alarm 81OFRQALM

Name	Description	Symbol
Generator Protection 81 Under	True when the 81 Under element is configured as an alarm and has tripped.	Alarm 81UFRQALM
Global Alarm	True when one or more alarms are set.	Alarm GLBALM
Global Sender Fail	True when one or more of the Sender Fails are configured as alarms and are true.	Sender Fail GLBSENDFALM
Hi Coolant Temp	True when the High Coolant Temp Alarm settings have been exceeded.	Alarm HITEMPALM
Isuzu DEF Low Refill DEF	True when an Isuzu engine ECU has detected low DEF level and indicated the DEF symbol should be displayed, and the Isuzu No Power Lamp is active indicating that the engine has been shut down.	Alarm ISUZUDEFLOWREFILLALM
Low Coolant Level	True when the Low Coolant Level function is configured as an alarm and the activation delay has expired. In addition, true when CAN Bus is enabled and the Low Coolant Level Alarm threshold has been exceeded.	Alarm LOWCOOLLVLALM
Low Fuel Level	True when the Low Fuel Level Alarm settings have been exceeded.	Alarm LOWFUELLALM
Low Oil Pressure	True when the Low Oil Pressure Alarm settings have been exceeded.	Alarm LOWOILPRALM
Mains Fail Transfer Failed	True when a mains fail transfer fail pre-alarm occurs. The pre-alarm occurs when the DGC-2020ES is configured for mains fail transfers, but has not transferred to the generator from the utility before the Mains Fail Max Transfer Time has expired. It remains true until the pre-alarm is cleared by pressing the *Reset* button on the front panel.	Alarm MAINSFLTRFAIL
MTU Combined Red	This is an indication from the MTU Engine ECU that a Red Alarm has occurred. If any Red Alarm occurs, a Combined Red Alarm occurs.	Alarm MTUCOMBINEDRED
Oil Pressure Sender Fail	True when the Oil Pressure Sender Fail is configured as an alarm and the activation delay has expired.	Alarm OILPRESSENDFAILALM
Overcrank	True when an Overcrank condition exists.	Alarm OCRANKALM
Overspeed	True when the Overspeed Alarm settings have been exceeded.	Alarm OVERSPDALM
Speed Sender Fail	True when the Speed Sender Fail activation delay has expired.	Alarm SPDSENDFAILALM
Unexpected Shutdown Alarm	True when the metered engine speed (RPM) unexpectedly drops to 0 while the engine is running.	Alarm UNEXPECTEDSHUTDNALM
Voltage Sensing Fail	True when the Voltage Sensing Fail is configured as an alarm and the activation delay has expired.	Alarm VOLTSENSFAILALM

Name	Description	Symbol
Pre-Alarms		
Battery Charger Fail	True when the Battery Charger Fail function is configured as a pre-alarm and the activation delay has expired.	Pre-Alarm BATTCHRGFAILPALM
Battery Charger AC Off	True when the ac power to the battery charger is off. (Battery Charger 1 shown.)	Pre-Alarm BCH1ACOFFPREALARM
Battery Charger Battery Failure	True when the battery charger has detected that the battery has failed. (Battery Charger 1 shown.)	Pre-Alarm BCH1BATTERYFAILEPREALARM
Battery Charger Comms Fail	True when the battery charger has detected a J1939 communications failure. (Battery Charger 1 shown.)	Pre-Alarm BCH1COMMSFAILPREALARM
Battery Charger Fail	True when the battery charger has failed. (Battery Charger 1 shown.)	Pre-Alarm BCH1FAILPREALARM
Battery Charger High Output Volts	True when the battery charger output voltage is too high. (Battery Charger 1 shown.)	Pre-Alarm BCH1HIOUTPUTVOLTSPREALARM
Battery Charger Invalid Settings	True when the battery charger has detected invalid settings. (Battery Charger 1 shown.)	Pre-Alarm BCH1INVALIDSETPREALARM
Battery Charger Low Cranking Volts	True when the battery charger has detected that the voltage while the engine is cranking has dipped too low. (Battery Charger 1 shown.)	Pre-Alarm BCH1LOCRANKVOLTSPREALARM
Battery Charger Low Output Volts	True when the battery charger output voltage is too low. (Battery Charger 1 shown.)	Pre-Alarm BCH1LOOUTPUTVOLTSPREALARM
Battery Charger Single Unit Fail	True when the battery charger has detected one or more charging output stages in a charger with multiple charging output stages has failed. (Battery Charger 1 shown.)	Pre-Alarm BCH1SNGLEUNTFAILPREALARM
Battery Charger Thermal Limit	True when the battery charger temperature is beyond the thermal limit. (Battery Charger 1 shown.)	Pre-Alarm BCH1THERMALLIMITPREALARM
Battery Overvoltage	True when the Battery Overvoltage pre-alarm threshold has been exceeded.	Pre-Alarm BATOVOLTPALM
Cannot Regen - Interlock Fail	True when the regeneration interlock has failed on a Yanmar ECU. Manual regeneration is blocked.	Pre-Alarm NOREGENINTERLOCKFAIL
Cannot Regen - Low Coolant Temp	True when the coolant temp is low on a Yanmar ECU. Manual regeneration is blocked.	Pre-Alarm NOREGENLOWCOOLTEMP
Cannot Regen - Not 50 Hours Since Last Regen	True when 50 hours has not elapsed since last regeneration on a Yanmar ECU. Manual regeneration is blocked.	Pre-Alarm NOREGENNOT50HOURS
Checksum Failure	True when some of the user settings or firmware code has been corrupted. Refer to the *Reporting and Alarms* chapter for more details.	Pre-Alarm CHECKSUMFAILPALM

Name	Description	Symbol
Contact Expansion Module Multiple Contact Expansion Modules Connected	True when more than one CEM-2020 is connected.	Pre-Alarm DUPCEMPALM
Contact Expansion Module Contact Expansion Module Comm Fail	True when communication from the CEM-2020 to the DGC-2020ES has been lost.	Pre-Alarm CEMCOMMFPALM
Contact Expansion Module Contact Expansion Modules Hardware Mismatch	True when the connected CEM-2020 does not have the same number of outputs as defined on the *System Parameters, Remote Module Setup* screen in BESTCOMS*Plus*.	Pre-Alarm CEMHWMISMATCHPALM
Coolant Temp Sender Fail	True when the Coolant Temp Sender Fail is configured as a pre-alarm and the activation delay has expired.	Pre-Alarm COOLTEMPSENDFAILPALM
DEF Consumption Incorrect	True when the engine ECU reports via CAN bus that a DEF Consumption Error has occurred.	Pre-Alarm DEFCONSUMPTIONINCORRECT
DEF Inducement	This is the lowest level of inducement not to operate the engine when Diesel Exhaust Fluid (DEF) is low or of poor quality or there is a problem with the Exhaust After Treatment System (EATS). The engine is operating in a reduced power mode. Eventually the level of inducement will be increased unless the problem with the DEF or malfunction in the EATS is corrected.	Pre-Alarm DEFENGINEDERATEPALM
DEF Low Severe	True when the engine ECU reports via CAN Bus that Diesel Exhaust Fluid (DEF) is at a level below 8%.	Pre-Alarm DEFEMPTYPALM
DEF Fluid Low	True when the engine ECU reports via CAN Bus that the Diesel Exhaust Fluid (DEF) is at a level between 8 and 23%.	Pre-Alarm DEFLOWPALM
DEF Inducement Override	This pre-alarm indicates a temporary override of inducement not to operate the engine. This is set by the ECU and is not a user setting.	Pre-Alarm DEFINDUCEOVERRIDEPALM
DEF Pre-severe Inducement	This pre-alarm indicates a high level of inducement not to operate the engine due to low or poor quality Diesel Exhaust Fluid (DEF), or a malfunction in the Exhaust After Treatment System (EATS). The engine may operate in a reduced power mode, or for a limited time, after which it will enter a state of severe inducement unless the problem with the DEF or malfunction in the EATS is corrected.	Pre-Alarm DEFPRESEVEREINDUCEPALM
DEF Quality Poor	True when the engine ECU reports "DEF Quality Poor" via CAN Bus.	Pre-Alarm DEFQUALITYPOOR

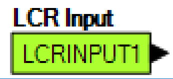
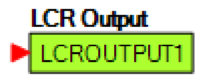
Name	Description	Symbol
DEF Severe Inducement	This pre-alarm indicates the highest level of inducement not to operate the engine due to low or poor quality Diesel Exhaust Fluid (DEF), or a malfunction in the Exhaust After Treatment System (EATS). The engine may operate in a reduced power mode, or for a limited time, or may be prevented from starting by the ECU until the problem is corrected. A service tool may be required to restart the engine.	Pre-Alarm DEFSEVEREINDUCEPALM
DEF Tampering	True when the engine ECU reports "DEF Tampering" via CAN Bus.	Pre-Alarm DEFTAMPERING
DEF Warning	This pre-alarm indicates the first level of warning when EATS is not functioning properly or DEF quality or level is not sufficient for proper operation.	Pre-Alarm DEFWARNINGPALM
DEF Warning Level 2	This pre-alarm indicates the second level of warning when EATS is not functioning properly or DEF quality or level is not sufficient for proper operation.	Pre-Alarm DEFWARNINGLEVEL2PALM
Diag Trouble Code	True when a Diagnostic Trouble Code exists.	Pre-Alarm DIAGTRBCODEPALM
DPF Regenerate Disabled	True when the Diesel Particulate Filter (DPF) lamp status broadcast over CAN Bus indicates that DPF regeneration is inhibited.	Pre-Alarm DPFREGENDISABLDPALM
DPF Regenerate Required	True when the Diesel Particulate Filter (DPF) lamp status broadcast over CAN Bus indicates that DPF regeneration is required.	Pre-Alarm DPFREGENREQPALM
DPF Soot Level High	True when the engine ECU reports via CAN Bus that Diesel Particulate Filter (DPF) soot level is high.	Pre-Alarm DPFSOOTHIPALM
DPF Soot Level Moderately High	True when Diesel Particulate Filter (DPF) lamp status (yellow warning) broadcast over CAN Bus indicates that the soot level is moderately high.	Pre-Alarm DPFSOOTMODHIPALM
DPF Soot Level Severely High	True when Diesel Particulate Filter (DPF) lamp status (red warning) broadcast over CAN Bus indicates that the soot level is severely high.	Pre-Alarm DPFSOOTEXTHIPALM
ECU Comm Loss	True when communication to ECU has been lost.	Pre-Alarm LOSSECUCOMMPALM
EGR Inducement Level Low	True when an issue has been detected in the Exhaust Gas Recirculation (EGR) system. This is the second level of inducement to correct the issue. There should also be Diagnostic Trouble Codes providing additional information about the issue.	Pre-Alarm EGRINDUCEMENTLVLLOW
EGR Inducement Severe	True when an issue has been detected in the Exhaust Gas Recirculation (EGR) system. This is the third level of inducement to correct the issue. If not corrected, engine power derating or shutdown may occur. There should also be Diagnostic Trouble Codes providing additional information about the issue.	Pre-Alarm EGRINDUCEMENTSEVERE
EGR Inducement Warning	True when an issue has been detected in the Exhaust Gas Recirculation (EGR) system. This is the first level of inducement to correct the issue. There should also be Diagnostic Trouble Codes providing additional information about the issue.	Pre-Alarm EGRINDUCEMENTWARN

Name	Description	Symbol
Engine kW Over Load 1	True when the Engine kW Overload 1 Pre-Alarm settings have been exceeded.	Pre-Alarm ENGKWOVRLD1PALM
Engine kW Over Load 2	True when the Engine kW Overload 2 Pre-Alarm settings have been exceeded.	Pre-Alarm ENGKWOVRLD2PALM
Engine kW Over Load 3	True when the Engine kW Overload 3 Pre-Alarm settings have been exceeded.	Pre-Alarm ENGKWOVRLD3PALM
Escape Mode	This pre-alarm indicates a temporary override of inducement not to operate the engine. This is set by the ECU and is not a user setting.	Pre-Alarm ESCAPEMODEPALM
Exhaust System Error	Pre-alarm indicating an Exhaust System Error has been detected. A number of conditions cause this; examples include DEF Tank Low indication, Purge in Progress, Exhaust System Error, Exhaust System Inducement Indications, etc. This is derived based on ECU Lamp conditions communicated from the Engine ECU to the DGC-2020ES via J1939 CAN Bus communications.	Pre-Alarm EXHAUSTSYSERRORPALM
Fuel Leak	True when the Fuel Leak Detect function is configured as a pre-alarm and the activation delay has expired.	Pre-Alarm FUELLEAKPALM
Fuel Level Sender Fail	True when the Fuel Level Sender Fail is configured as a pre-alarm and the activation delay has expired.	Pre-Alarm FUELLSENDFAILPALM
Generator Breaker Close Fail	True when a generator breaker close fail pre-alarm occurs. The pre-alarm occurs when the DGC-2020ES has issued a generator breaker close output but does not receive a generator breaker status input that indicates the breaker has closed before the breaker close wait time has expired.	Pre-Alarm GENBRKCLOSEFAIL
Generator Breaker Open Fail	True when a generator breaker open fail pre-alarm occurs. The pre-alarm occurs when the DGC-2020ES has issued a generator breaker open output but does not receive a generator breaker status input that indicates the breaker has opened before the breaker close wait time has expired.	Pre-Alarm GENBRKOPENFAIL
Fuel Filter 1 Leak	This logic status input indicates that the engine ECU has detected a leak in fuel filter 1, and has communicated this to the DGC-2020ES over CAN Bus.	Pre-Alarm FUELFILTER1LEAK
Fuel Filter 2 Leak	This logic status input indicates that the engine ECU has detected a leak in fuel filter 2, and has communicated this to the DGC-2020ES over CAN Bus.	Pre-Alarm FUELFILTER2LEAK
Generator Protection 27	True when the 27 element is configured as a pre-alarm and has tripped.	Pre-Alarm 27UNDRVLTPALM
Generator Protection 59	True when the 59 element is configured as a pre-alarm and has tripped.	Pre-Alarm 59OVOLTPALM
Generator Protection 47	True when the 47 element is configured as a pre-alarm and has tripped.	Pre-Alarm 47PH_IMBPALM

Name	Description	Symbol
Generator Protection 50	True when the 50 element is configured as a pre-alarm and has tripped.	Pre-Alarm 50OCURRPALM
Generator Protection 81 Over	True when the 81 Over element is configured as a pre-alarm and has tripped.	Pre-Alarm 81OFRQPALM
Generator Protection 81 Under	True when the 81 Under element is configured as a pre-alarm and has tripped.	Pre-Alarm 81UFRQPALM
Global Pre-Alarm	True when one or more pre-alarms are set.	Pre-Alarm GLBPALM
Heating for Exhaust Regen	A manual or automatic exhaust regeneration request has occurred, but the exhaust system is not hot enough for regeneration to occur. The ECU feeds fuel into the exhaust stream to increase the temperature to accomplish regeneration.	Pre-Alarm HEATINGFOREXHAUSTREGEN
Hi Coolant Temp	True when the High Coolant Temp Pre-Alarm threshold has been exceeded.	Pre-Alarm HITEMPPALM
High Exhaust Temperature	True when Diesel Particulate Filter (DPF) lamp status broadcast over CAN Bus indicates high exhaust temperature.	Pre-Alarm HIGHEXHTEMPPALM
High Fuel Level	True when the High Fuel Level Pre-Alarm settings have been exceeded.	Pre-Alarm HIFUELLPALM
Inter Generator Comm Fail	True when the DGC-2020ES detects that an individual generator previously connected to a generator network has lost connection.	Pre-Alarm INTERGENCOMFPALM
Isuzu DEF Low Refill DEF	True when an Isuzu engine ECU has detected low DEF level and has indicated the DEF symbol should be displayed.	Pre-Alarm ISUZUDEFLOWREFILLPALM
Isuzu Forced Purge Request	True when a forced purge has been requested by momentarily pressing the Manual Regeneration button or setting the DPF Regen setting on the front panel, or setting the DPF Manual Regenerate button in BESTCOMS*Plus*.	Pre-Alarm ISUZUFORCEPURGEREQPALM
Isuzu SCR Forced Purge	True when a forced purge is in progress after having been requested.	Pre-Alarm ISUZUSCRFORCEPURGEPALM
Isuzu SCR Purge	True when a normal SCR Purge is in progress. Normal purges occur during normal operation if the engine load is sufficient to allow purge to occur.	Pre-Alarm ISUZUSCRPURGEPALM
Isuzu Service Tool Forced Purge Request	True when a forced purge has been requested through the Isuzu Service Tool. This will remain true until the forced purge cycle begins.	Pre-Alarm ISUZUSERTOOLFORCEPRGEPALM
Low Battery Voltage	True when the Low Battery Voltage Pre-Alarm settings have been exceeded.	Pre-Alarm LOWBATVPALM
Low Coolant Level	True when the Low Coolant Level function is configured as a pre-alarm and the activation delay has expired. In addition, true when CAN Bus is enabled and the Low Coolant Level Pre-Alarm threshold has been exceeded.	Pre-Alarm LOWCOOLLVLPALM

Name	Description	Symbol
Low Coolant Temp	True when the Low Coolant Temp Pre-Alarm threshold has been exceeded.	Pre-Alarm LOWTEMPPALM
Low DPF Temp Add Load	True when a Yanmar engine ECU has received a regeneration request, but has detected that DPF temperature is too low to perform regeneration. Adding load to engine is recommended to increase temperature.	Pre-Alarm LOWDPFTEMPADDLOAD
Low Fuel Level	True when the Low Fuel Level Pre-Alarm threshold has been exceeded.	Pre-Alarm LOWFUELLPALM
Low Oil Pressure	True when the Low Oil Pressure Pre-Alarm threshold has been exceeded.	Pre-Alarm LOWOILPRPALM
Mains Breaker Close Fail	True when a mains breaker close fail pre-alarm occurs. The pre-alarm occurs when the DGC-2020ES has issued a mains breaker close output but does not receive a mains breaker status input that indicates the breaker has closed before the breaker close wait time has expired.	Pre-Alarm MAINBRKCLOSEFAIL
Mains Breaker Open Fail	True when a mains breaker open fail pre-alarm occurs. The pre-alarm occurs when the DGC-2020ES has issued a mains breaker open output but does not receive a mains breaker status input that indicates the breaker has opened before the breaker close wait time has expired.	Pre-Alarm MAINBRKOPENFAIL
Mains Fail Return Failed	True when a mains fail return fail pre-alarm has occurred. The pre-alarm occurs when the DGC-2020 is attempting to transfer from generator power to mains power after mains returns, but has not returned to the mains from the generator before the Mains Fail Return Delay has expired.	Pre-Alarm MAINSFAILRETURNFAIL
Maintenance Interval	True when the Maintenance Interval Pre-Alarm threshold has been exceeded.	Pre-Alarm MAINTINTPALM
MPU Fail	True when the MPU has failed.	Pre-Alarm MPUFAILPALM
Oil Pressure Sender Fail	True when the Oil Pressure Sender Fail is configured as a pre-alarm and the activation delay has expired.	Pre-Alarm OILPRESSENDFAILPALM
Regenerate Active	True when an exhaust system regeneration is in progress.	Pre-Alarm EXHREGENACTIVE
Serial Flash Read Fail	When the DGC-2020ES reads data from the serial flash, the data is read twice and then compared to verify that the data matches. If it does not match, the read cycle is repeated. After the second attempt, if the data does not match, the DGC-2020ES annunciates a serial flash read failure pre-alarm. This status input to logic indicates that the DGC-2020ES has detected a serial flash read failure.	Pre-Alarm SERIALFLASHREADFAIL

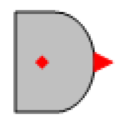
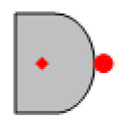
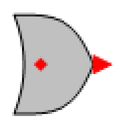
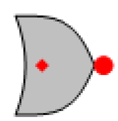
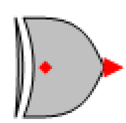
Name	Description	Symbol
Service Tool Forced Regenerate	A manual or forced regeneration is in progress and was initiated from a manufacturer's service tool. This indication is received from the engine ECU over J1939 CAN Bus as SPN 4175 Diesel Particulate Filter Active Regeneration Forced Status or SPN 6934 SCR System Cleaning Forced Status. When the value is 2, a Service Tool Forced Regenerate pre-alarm is annunciated.	Pre-Alarm EXHREGENFORCEDSERVICETOOL
Switch Forced Regenerate	A manual or forced regeneration is in progress and was initiated from a manual regeneration switch. This indication is received from the engine ECU over J1939 CAN Bus as SPN 4175 Diesel Particulate Filter Active Regeneration Forced Status or SPN 6934 SCR System Cleaning Forced Status. When the value is 1, a Switch Forced Regenerate pre-alarm is annunciated.	Pre-Alarm EXHREGENFORCEDSWITCH
Torque Limit	True while the engine is running in a reduced torque mode due to exhaust system issues such as Low DEF, Purge Required, Exhaust System Error, etc. This reflects the status of the exhaust system Torque Limit lamp, which is communicated from the Engine ECU to the DGC-2020ES via J1939 CAN Bus communications.	Pre-Alarm TORQUELIMIT
Torque Limit Severe	True while the engine is running in a severely reduced torque mode due to exhaust system issues such as Low DEF, Purge Required, Exhaust System Error, etc. This reflects the status of the exhaust system Torque Limit lamp, which is communicated from the Engine ECU to the DGC-2020ES via J1939 CAN Bus communications.	Pre-Alarm TORQUELIMITSEVERE
Voltage Sensing Fail	True when the Voltage Sensing Fail is configured as a pre-alarm and the activation delay has expired.	Pre-Alarm VOLTSENSFAILPALM
Weak Battery	True when the Weak Battery Voltage Pre-Alarm settings have been exceeded.	Pre-Alarm WEAKBATPALM
Senders		
Coolant Temp Sender Fail	True when the Coolant Temp Sender Fail is configured as either a pre-alarm or alarm and the activation delay has expired.	Sender Fail COOLTEMPSENDFAIL
Fuel Level Sender Fail	True when the Fuel Level Sender Fail is configured as either a pre-alarm or alarm and the activation delay has expired.	Sender Fail FUELLSENDFAIL
Oil Pressure Sender Fail	True when the Oil Pressure Sender Fail is configured as either a pre-alarm or alarm and the activation delay has expired.	Sender Fail OILPRESSENDFAIL
Speed Sender Fail	True when the Speed Sender Fail activation delay has expired.	Sender Fail SPDSENDFAIL
Voltage Sensing Fail	True when the Voltage Sensing Fail is configured as either a pre-alarm or alarm and the activation delay has expired.	Sender Fail VOLTSENSFAIL

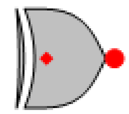
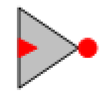
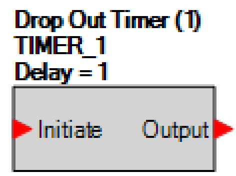
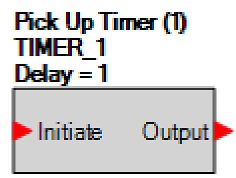
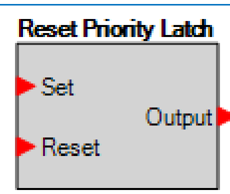
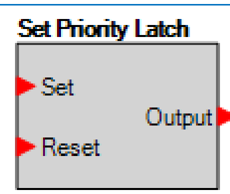
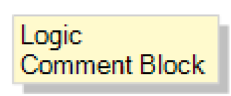
<table>
<tr><th>Name</th><th>Description</th><th>Symbol</th></tr>
<tr><td colspan="3">Logic Control Relays</td></tr>
<tr><td colspan="3">The logic control relays (LCR) consist of LCR outputs and LCR inputs. The output can be used to terminate the “output” end of a logic network, and then use the corresponding input as an input to logic elsewhere in the logic scheme. When a given LCR output is true the corresponding LCR input is true. In other words, when LCR Output N (N being a number from 1 to 16) becomes true, then LCR Input N is true also.
If you get a “too many logic levels” error while building a logic network, LCR outputs and inputs can be used as a solution to this problem. Place an LCR output on the end of the partial logic network and then use the corresponding LCR input to build more logic than was previously possible.</td></tr>
<tr><td>Inputs
Input 1-16</td><td>See description above.</td><td>
</td></tr>
<tr><td>Outputs
Output 1-16</td><td>See description above.</td><td>
</td></tr>
</table>

Components

This group contains Logic Gates, Pickup and Dropout Timers, Latches, and Comment Blocks. Table 13-2 lists the names and descriptions of the objects in the *Components* group.

Table 13-2. Components Group, Names and Descriptions

<table>
<tr><th>Name</th><th>Description</th><th>Symbol</th></tr>
<tr><td colspan="3">Logic Gates</td></tr>
<tr><td>AND</td><td><table><tr><th colspan="2">Input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table></td><td></td></tr>
<tr><td>NAND</td><td><table><tr><th colspan="2">Input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table></td><td></td></tr>
<tr><td>OR</td><td><table><tr><th colspan="2">Input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table></td><td></td></tr>
<tr><td>NOR</td><td><table><tr><th colspan="2">Input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table></td><td></td></tr>
<tr><td>XOR</td><td><table><tr><th colspan="2">Input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table>When an XOR gate has more than two inputs, the output is true whenever an odd number of inputs are true.</td><td></td></tr>
</table>

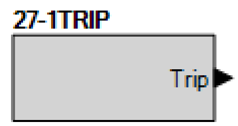
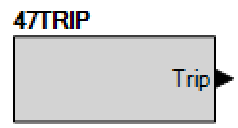
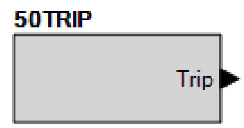
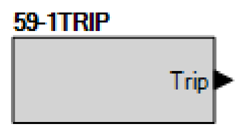
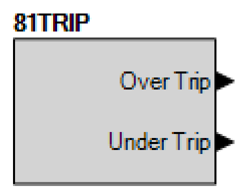
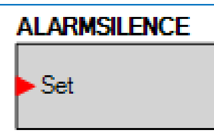
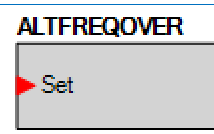
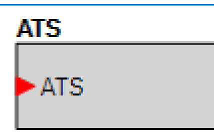
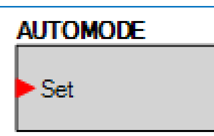
<table>
<tr><th>Name</th><th>Description</th><th>Symbol</th></tr>
<tr><td>XNOR</td><td><table><tr><th colspan="2">Input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table>When an XNOR gate has more than two inputs, the output is true whenever an even number of inputs are true. The output is also true if no inputs are true.</td><td></td></tr>
<tr><td>NOT (INVERTER)</td><td><table><tr><th>Input</th><th>Output</th></tr><tr><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td></tr></table></td><td></td></tr>
<tr><td colspan="3">Pickup and Dropout Timers</td></tr>
<tr><td>Drop Out Timer</td><td>Used to set a delay in the logic.
For more information, refer to Programming BESTlogicPlus, Pickup and Dropout Timers, later in this section.</td><td></td></tr>
<tr><td>Pickup Up Timer</td><td>Used to set a delay in the logic.
For more information, refer to Programming BESTlogicPlus, Pickup and Dropout Timers, later in this section.</td><td></td></tr>
<tr><td colspan="3">Latches</td></tr>
<tr><td>Reset Priority Latch</td><td>When the Set input is on and the Reset input is off, the latch will go to the SET (ON) state. When the Reset input is on and the Set input is off, the latch will go to the RESET (OFF) state. If both the Set and Reset inputs are on at the same time, a reset priority latch will go to the RESET (OFF) state.</td><td></td></tr>
<tr><td>Set Priority Latch</td><td>When the Set input is on and the Reset input is off, the latch will go to the SET (ON) state. When the Reset input is on and the Set input is off, the latch will go to the RESET (OFF) state. If both the Set and Reset inputs are on at the same time, a set priority latch will go to the SET (ON) state.</td><td></td></tr>
<tr><td colspan="3">Other</td></tr>
<tr><td>Comment Block</td><td>Enter user comments.</td><td></td></tr>
</table>

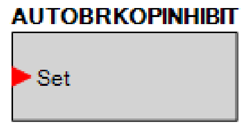
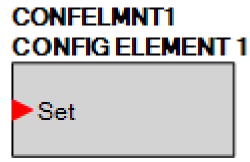
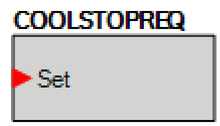
Elements

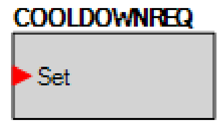
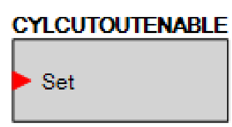
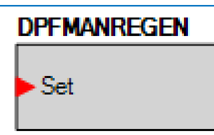
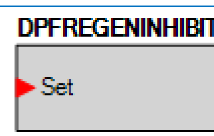
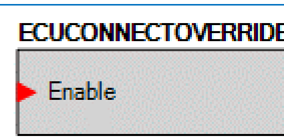
This group contains elements for the 27, 47, 50, 59, and 81. It also contains elements for Generator Breaker, Mains Breaker, Logic Alarm, Logic Pre-Alarm, Configurable Elements, AUTO Mode, OFF Mode, RUN Mode, Run with Load, Engine Run, ATS, Run Inhibit, Test Inhibit, Pre-Start Output, Start Output, Run Output, Cool Stop Request, Cool Down Request, External Start Delay, Start Delay Bypass, Alternate Frequency Override, Mains Fail Test, Load Take Over, EPS Supplying Load, MTU Speed Demand Switch, Reset, Alarm Silence, Lamp Test, Idle Request, Low Fuel Pre-Alarm, Diesel Particulate Filter Manual Regeneration, Diesel Particulate Filter Regeneration Inhibit, Emergency Stop, Speed Raise, Speed Lower, MTU Cylinder Cutout Disable, and Automatic Breaker Operation Inhibit from PLC.

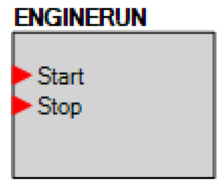
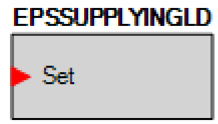
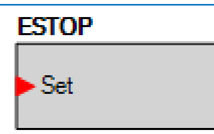
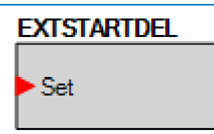
Table 13-3 lists the names and descriptions of the elements in the *Elements* group.

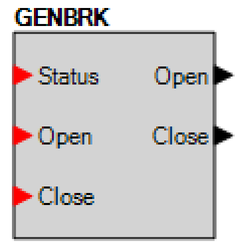
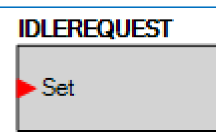
Table 13-3. Elements Group, Names and Descriptions

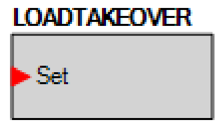
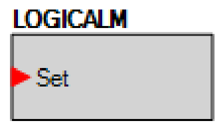
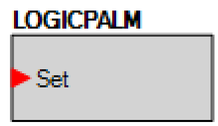
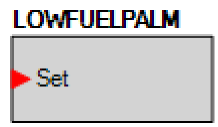
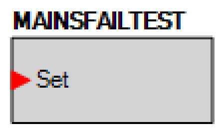
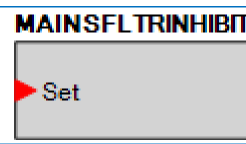
Name	Description	Symbol
Protection		
27TRIP	True when the 27-1 undervoltage is in a TRIP condition. Connect to another logic block input.	
47TRIP	True when the 47 phase imbalance is in a TRIP condition. Connect to another logic block input.	
50TRIP	True when the 50 overcurrent is in a TRIP condition. Connect to another logic block input.	
59TRIP	True when the 59-1 overvoltage is in a TRIP condition. Connect to another logic block input.	
81TRIP	True when the 81 frequency is in a TRIP condition. Connect to another logic block input.	
Other		
ALARMSILENCE	The alarm will be silenced when this element is true. The alarm can also be silenced by pressing the Alarm Silence button on the front panel of the DGC-2020ES.	
ALTFREQOVER	When this logic element is true, protection and bus condition detection is forced to operate at the Alternate Frequency instead of the Rated Frequency.	
ATS	When this logic element is true, and the DGC-2020ES is in AUTO mode, the generator will run. This can be used in place of the ATS programmable function if it is desired to generate the ATS signal as a combination of programmable logic rather than a simple contact input. If either the ATS logic element is true or the contact mapped to the ATS programmable function is true, and the DGC-2020ES is in AUTO mode, the generator will run. If both the ATS logic element and the ATS programmable function are false, and the DGC-2020ES is in AUTO mode, the generator will cool down and stop.	
AUTOMODE	When this input is true, and the DGC-2020ES is in OFF mode, the DGC-2020ES will switch to AUTO mode. This is a pulsed input. It does not need to be held after the desired mode switch has occurred.	

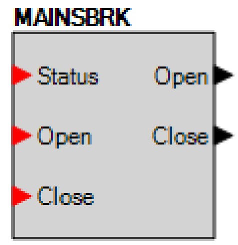
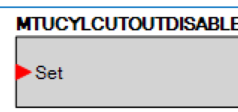
Name	Description	Symbol
AUTOBRKOP-INHIBIT	Automatic breaker operation is inhibited when the Set input is true.	
CONFELMNTX (X = 1 to 8)	Configurable elements (CONFELMNT1-8) are connected to the logic scheme as outputs. These elements are configurable in BESTCOMS*Plus* under *Programmable Outputs, Configurable Elements.* The user can assign a string of up to 16 characters, configure whether the element should generate an alarm or pre-alarm. If used for alarm or pre-alarm, the user's text is what will appear in the alarm or pre-alarm annunciation and in the DGC-2020ES event log.	
COOLSTOPREQ	<u>RUN Mode</u> If the unit is in RUN mode when the Cool Stop Request is received, the unit will unload, open its breaker, and go into a cooldown cycle. While in the cooldown cycle, the unit will display “COOL & STOP REQ” in addition to displaying the cooldown timer. After the cooldown timer expires, the unit will go to OFF mode. The Cool Stop Request must be removed before the unit can be run again. If the Cool Stop Request is removed during the cooldown process, the unit will remain running. Furthermore, if a condition occurs that normally causes the unit to close its breaker in RUN mode, the unit will close its breaker and reload. <u>AUTO Mode</u> If the unit is in AUTO mode when the Cool Stop Request is received, all conditions that would normally cause the unit to run in AUTO mode are cleared. Since all conditions that cause the unit to run have been removed, the unit goes into a cooldown cycle. While in the cooldown cycle, the unit will display “COOL & STOP REQ” in addition to displaying the cooldown timer. After the cooldown timer expires, the unit will shut down, remaining in AUTO. The Cool Stop Request must be removed before the unit can be run again. If the Cool Stop Request is removed during the cooldown process and some condition that would normally cause the unit to run in AUTO mode is true, the unit will remain running. Furthermore, if a condition occurs that normally causes the unit to close its breaker, the unit will close its breaker and reload.	

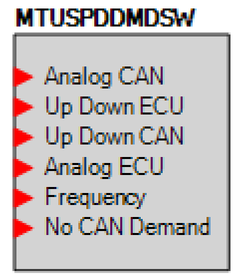
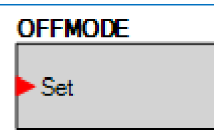
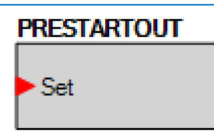
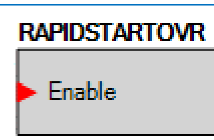
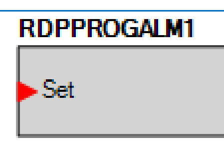
Name	Description	Symbol
COOLDOWNREQ	RUN Mode If the unit is in RUN mode when the Cool Down Request is received, the unit is forced to unload and open its breaker and then go into a cooldown cycle. While in the cool down cycle, the unit will display "COOLDOWN REQ" in addition to displaying the cooldown timer. After the cooldown timer expires, the unit will remain running in RUN mode. The Cool Down Request must be removed before the breaker can be closed again; this element blocks breaker closures. If the Cool Down Request is removed during the cool down process, the unit will remain running in RUN mode. Furthermore, if a condition occurs that normally causes the unit to close its breaker in RUN mode, the unit will close its breaker and reload. AUTO Mode If the unit is in AUTO mode and the Cool Down Request is received, the unit is forced to unload and open its breaker and go into a cooldown cycle. While in the cooldown cycle, the unit will display "COOLDOWN REQ" in addition to displaying the cooldown timer. After the cool down timer expires, the unit will remain running in AUTO mode, unless there are no conditions that cause the unit to run in AUTO mode, in which case it will shut down and remain in AUTO mode. The Cool Down Request must be removed before the breaker can be closed again; this element blocks breaker closures. If the Cool Down Request is removed during the cool down process and some condition that would normally cause the unit to run in AUTO mode is true, the unit will remain running in AUTO mode. Furthermore, if a condition occurs that normally causes the unit to close its breaker, the unit will close its breaker and reload.	
CYLCUTOUTENABLE (Cutout Enable Override)	When true, cylinder cutout is enabled. When false, cylinder cutout is disabled when any of the following are true: • Synchronization is in progress. • The machine is operating with the generator breaker closed. • The Cylinder Cutout Disable setting is true. • The Cylinder Cutout Disable logic element is true.	
DPFMANREGEN	Diesel Particulate Filter Regeneration is forced manually when the Set input is true.	
DPFREGENINHIBIT	Diesel Particulate Filter Regeneration is inhibited when the Set input is true.	
ECU Connect Override	When true, a Key On signal is applied to the ECU and CAN Bus data is updated any time except during the Disconnecting state.	

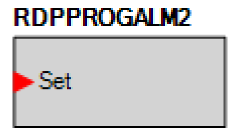
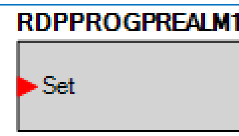
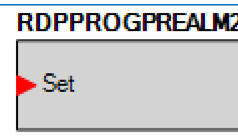
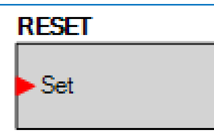
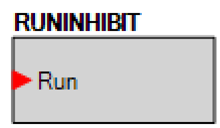
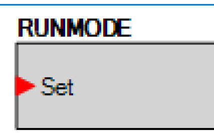
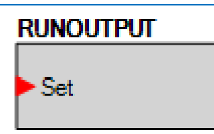
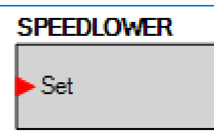
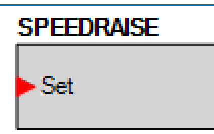
Name	Description	Symbol
ENGINERUN	The Start input starts the generator. No load is applied. The breaker remains open. The Stop input stops the generator. The DGC-2020ES only responds to this logic element when in AUTO mode.	
EPSSUPPLYINGLD	When true, the Set input forces a supplying load indication. This is useful when it is necessary for the supplying load indication to be true during test runs, but the system load is not enough to light the supplying load indication. A supplying load indication is true when the supplying load logic element is true and the generator is stable (voltage and frequency are within the limits programmed on the Gen Condition Detection screen under Breaker Management, Bus Condition Detection in the BESTCOMS*Plus* Settings Explorer). This is OR'ed with the traditional supplying load criteria that supplying load is true when the generator current is above a percentage of CT primary current (typically 3% minimum). When the supplying load indication has been driven from logic or from generator current levels, the DGC-2020ES will go through a cool down cycle when it is in AUTO mode and the ATS contact has been removed.	
ESTOP	When this element is true, an Emergency Shutdown alarm is annunciated and the Emergency Stop LED on the RDP-110 is illuminated.	
EXTSTARTDEL	If the Set input is true while the DGC-2020ES is in the Pre Start state, the DGC-2020ES will remain in the Pre Start state until the Set input is false.	

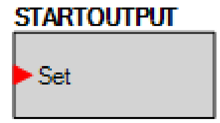
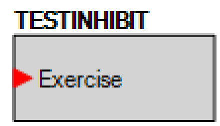
Name	Description	Symbol
GENBRK	This element is used to connect the breaker open and close output signals from the DGC-2020ES to physical output contacts to open and close the generator breaker, and map breaker status feedback to a contact input. In addition, contact inputs can be mapped to allow switches to be implemented to manually initiate breaker open and close requests. <u>Inputs</u> *Status:* This input allows a contact input to be mapped that will provide breaker status feedback to the DGC-2020ES. When the contact input is closed, the breaker is indicated to be closed. When the contact input is open, the breaker is indicated to be open. *Open:* This input allows a contact input to be mapped that can be used to initiate a manual breaker open request. When this input is pulsed closed while the DGC-2020ES is in RUN or AUTO mode, the breaker will open. *Close:* This input allows a contact input to be mapped that can be used to initiate a manual breaker close request. When this input is pulsed and the DGC-2020ES is in AUTO or RUN mode, and the generator is stable, a close request will be initiated. If bus is dead, the breaker will close; if the bus is not dead the generator breaker will not be closed. <u>Outputs</u> The outputs must be mapped to the contact outputs of the DGC-2020ES that will be used to drive the breaker. *Open:* This output is pulsed true (closes the output contact it is mapped to) when the DGC-2020ES is providing a signal to the breaker to open. It will be a pulse if the Breaker Output Contact Type is set to Pulse on the Breaker Hardware screen under Breaker Management in the Settings Explorer, and the length is determined by the Open Pulse Time. It will be a constant output if the Generator Breaker Hardware Contact Type is set to continuous. Note the pulse time must be set long enough for the breaker to actually open before the pulse is removed. *Close:* This output is pulsed true (closes the output contact it is mapped to) when the DGC-2020ES is providing a signal to the breaker to close. It will be a pulse if the Breaker Output Contact Type is set to Pulse on the Breaker Hardware screen under Breaker Management in the Settings Explorer, and the length is determined by the Open Pulse Time. It will be a constant output if the Generator Breaker Hardware Contact Type is set to continuous. Note the pulse time must be set long enough for the breaker to actually open before the pulse is removed.	
IDLEREQUEST	When this element is true, the DGC-2020ES sends an idle request to the ECU on J1939 engines that are equipped to receive such a request. The request consists of an enable bit command and an idle RPM setting. At this time, only Volvo and Cummins are implemented. ECUs that accept the idle RPM setting set the engine to the requested RPM. ECUs that accept only the enable bit command, set the engine to their internal idle speed setting, ignoring the requested idle RPM from the DGC-2020ES.	

Name	Description	Symbol
LAMPTEST	The lamp test will be performed when this element is true. The lamp test can also be accomplished by simultaneously pressing the *Up* and *Down* buttons on the front panel of the DGC-2020ES.	
LOADTAKEOVER	When this logic element is true, the generator is forced to start, assume load, and disconnect from the mains, in an open transition.	
LOGICALM	When this input is true, the DGC-2020ES goes into an alarm condition.	
LOGICPALM	When this input is true, the DGC-2020ES goes into a Pre-alarm condition.	
LOWFUELPALM	When this element is true, a Low Fuel Pre-Alarm is annunciated and the Low Fuel Level LED on the RDP-110 is illuminated.	
MAINSFAILTEST	When this element is true, the DGC-2020ES will exercise its mains fail transfer function exactly as it would if the mains were to fail on a mains fail machine. This can be used as a test of the mains fail transfer capability of the unit without having to cause a true mains failure.	
MAINSFLTRINHIBIT	The mains fail transfer function is inhibited when the Set input is true.	

Name	Description	Symbol
MAINSBRK	This element is used to connect the breaker open and close output signals from the DGC-2020ES to physical output contacts to open and close the mains breaker and map breaker status feedback to a contact input. In addition, contact inputs can be mapped to allow switches to be implemented to manually initiate breaker open and close requests. This element is only available when the Mains Breaker Hardware in configured on the *Breaker Hardware* screen via the *Breaker Management* tree branch. <u>Inputs</u> *Status:* This input allows a contact input to be mapped that will provide breaker status feedback to the DGC-2020ES. When the contact input is closed, the breaker is indicated to be closed. When the contact input is open, the breaker is indicated to be open. *Open:* This input allows a contact input to be mapped that can be used to initiate a manual breaker open request. When this input is pulsed closed while the DGC-2020ES is in RUN or AUTO mode, the breaker will open. *Close:* This input allows a contact input to be mapped that can be used to initiate a manual breaker close request. When this input is pulsed, the mains is stable, and both breakers are open, a close request will be initiated. <u>Outputs</u> The outputs must be mapped to the contact outputs of the DGC-2020ES that will be used to drive the breaker. *Open:* This output is pulsed true (closes the output contact it is mapped to) when the DGC-2020ES is providing a signal to the breaker to open. It will be a pulse if the Breaker Output Contact Type is set to Pulse on the Breaker Hardware screen under Breaker Management in the Settings Explorer, and the length is determined by the Open Pulse Time. It will be a constant output if the Mains Breaker Hardware Contact Type is set to continuous. Note the pulse time must be set long enough for the breaker to actually open before the pulse is removed. *Close:* This output is pulsed true (closes the output contact it is mapped to) when the DGC-2020ES is providing a signal to the breaker to close. It will be a pulse if the Breaker Output Contact Type is set to Pulse on the Breaker Hardware screen under Breaker Management in the Settings Explorer, and the length is determined by the Open Pulse Time. It will be a constant output if the Mains Breaker Hardware Contact Type is set to continuous. Note the pulse time must be set long enough for the breaker to actually open before the pulse is removed.	
MTUCYLCUTOUT-DISABLE (MTU Cylinder Cutout Disable)	When this logic element is true, Cylinder Cutout Disable 1 and Cylinder Cutout Disable 2 are both sent to the engine ECU with true status. When this logic element is false, Cylinder Cutout Disable 1 and Cylinder Cutout Disable 2 are sent to the engine ECU with states set by the values programmed for the Cylinder Cutout Disable 1 and Cylinder Cutout Disable 2 DGC-2020ES settings which are configured on the ECU Setup screen in BESTCOMS*Plus*.	

Name	Description	Symbol
MTUSPDDMDSW	This logic element can be used to specify the Speed Demand Source parameter value that is sent to an MTU Engine ECU. When no input is true, the value sent to the engine ECU is the value specified in the Speed Demand Source setting in the ECU configuration setting. If an input on this logic element is true, the selected Speed Demand Source will be sent rather than the value specified by the Speed Demand Source setting. If multiple inputs are true at the same time, the input that is closest to the top of the logic element symbol will specify the Speed Demand Source parameter value that is sent to the ECU. Analog CAN: This input configures the MTU ECU to accept speed bias requests over J1939 CAN Bus from the DGC-2020ES. Up Down ECU: This input configures the MTU ECU to accept speed raise/lower commands via contact inputs on the ECU. Up Down CAN: This input configures the MTU ECU to accept speed raise/lower commands via communications over J1939 CAN Bus. Analog ECU: This input configures the MTU ECU to accept speed bias via bias voltage input connections on the ECU. Frequency: This configures the MTU ECU to accept speed commands via a frequency signal input on the ECU. The mapping of input signal frequency to machine speed is configured in a curve within the engine ECU. No CAN Demand: This input configures the MTU ECU to disregard all speed requests or speed raise/lower requests from J1939 CAN Bus.	
OFFMODE	When this input is true, the DGC-2020ES will switch to OFF mode. This is a pulsed input. It does not need to be held after the desired mode switch has occurred.	
PRESTARTOUT	This element is used to drive the prestart output relay from logic when the Prestart Output Relay configuration is set to “Programmable”. When the Prestart Output Relay configuration is set to “Programmable”, the prestart relay will not close unless logic is used to drive this element. When the Prestart Output Relay configuration is set to “Predefined”, the prestart relay is closed according to the predefined prestart functionality of the DGC-2020ES. When the “Predefined” functionality is selected, the relay will not respond to this element.	
Rapid Start Override	When true, this element sets the Start mode to Rapid regardless of the Start mode setting.	
RDPPROGALM1	When true, this element illuminates the *Fuel Leak/Sender Failure* LED on the Remote Display Panel RDP-110. When this element is connected in logic, it overrides all other commands to the LED. Otherwise, the LED operates as normal.	

Name	Description	Symbol
RDPPROGALM2	When true, this element illuminates the *Sender Failure* LED on the Remote Display Panel RDP-110. When this element is connected in logic, it overrides all other commands to the LED. Otherwise, the LED operates as normal.	
RDPPROGPREALM1	When true, this element illuminates the *Battery Overvoltage* LED on the Remote Display Panel RDP-110. When this element is connected in logic, it overrides all other commands to the LED. Otherwise, the LED operates as normal.	
RDPPROGPREALM2	When true, this element illuminates the *Battery Charger Failure* LED on the Remote Display Panel RDP-110. When this element is connected in logic, it overrides all other commands to the LED. Otherwise, the LED operates as normal.	
RESET	Reset will be active when this element is true. Reset can also be accomplished by pressing the Reset button on the front panel of the DGC-2020ES.	
RUNINHIBIT	When this logic element is true, the DGC-2020ES is prevented from starting and running the generator, regardless of any condition that would normally cause the generator to run. If this element is false and there is <u>any</u> condition in effect which will cause the generator to run, the DGC-2020ES will start and run the generator.	
RUNMODE	When this input is true, and the DGC-2020ES is in OFF mode, the DGC-2020ES will switch to RUN mode. This is a pulsed input. It does not need to be held after the desired mode switch has occurred.	
RUNOUTPUT	This element is used to drive the run output relay from logic when the Run Output Relay configuration is set to “Programmable”. When the Run Output Relay configuration is set to “Programmable”, the run relay will not close unless logic is used to drive this element. When the Run Output Relay configuration is set to “Predefined”, the run relay is closed according to the predefined run functionality of the DGC-2020ES. When the “Predefined” functionality is selected, the relay will not respond to this element.	
RUNWLOAD	The Start input starts the generator and closes the Gen breaker. The Stop input stops the generator and opens the Gen breaker. The DGC-2020ES only responds to this logic element when in AUTO mode.	
SPEEDLOWER	This element lowers the speed setting of the DGC-2020ES by up to 2 rpm per second. After the speed has not been lowered for 30 seconds, the modified speed is saved to nonvolatile memory.	
SPEEDRAISE	This element raises the speed setting of the DGC-2020ES by up to 2 rpm per second. After the speed has not been raised for 30 seconds, the modified speed is saved to nonvolatile memory.	

Name	Description	Symbol
STARTDELBYP	This element allows the Pre Start state to be skipped based on logic. For example, a start delay may not be necessary when the engine is warm. This also allows an external device, such as an ECU, to control the pre start interval.	
STARTOUTPUT	This element is used to drive the start output relay from logic when the Start Output Relay configuration is set to “Programmable”. When the Start Output Relay configuration is set to “Programmable”, the start relay will not close unless logic is used to drive this element. When the Start Output Relay configuration is set to “Predefined”, the start relay is closed according to the predefined start functionality of the DGC-2020ES. When the “Predefined” functionality is selected, the relay will not respond to this element.	
TESTINHIBIT	When this logic element is true, the generator exercise timer cannot start the generator. If the TESTINHIBIT logic function is false during an exercise period, or transitions from true to false at any time during an exercise period, the DGC-2020ES will start and run the generator for the duration of the exercise period.	

Logic Schemes

A logic scheme is a group of logic variables written in equation form that defines the operation of a DGC-2020ES Digital Genset Controller. Each logic scheme is given a unique name. This gives you the ability to select a specific scheme and be confident that the selected scheme is in operation. One logic scheme is configured for typical control applications and is the default active logic scheme. Only one logic scheme can be active at a given time. In most applications, preprogrammed logic schemes eliminate the need for custom programming. Preprogrammed logic schemes may provide more inputs, outputs, or features than are needed for a particular application. This is because a preprogrammed scheme is designed for a large number of applications with no special programming required. Unneeded logic block outputs may be left open to disable a function or a function block can be disabled through operating settings.

When a custom logic scheme is required, programming time is reduced by modifying the default logic scheme.

The Active Logic Scheme

Digital Genset Controllers must have an active logic scheme in order to function. All Basler Electric DGC-2020ES units are delivered with a default, active logic scheme pre-loaded in memory. If the function block configuration and output logic of the default logic scheme meets the requirements of your application, then only the operating settings (power system parameters and threshold settings) need to be adjusted before placing the DGC-2020ES in service.

Copying and Renaming Preprogrammed Logic Schemes

Copying a saved logic scheme to the active logic and assigning a unique name is accomplished by loading the saved logic scheme into BESTCOMS*Plus* and then typing over the logic scheme's name. Changes are not activated until the new settings have been saved and uploaded to the device.

Sending and Retrieving Logic Schemes

To retrieve settings from the DGC-2020ES, it must be connected to a computer through a communications port. Once the necessary connections are made, settings can be downloaded from the DGC-2020ES by selecting *Download Settings and Logic* on the *Communication* pull-down menu.

To send settings to the DGC-2020ES, it must be connected to a computer through a communications port. Once the necessary connections are made, settings can be uploaded to the DGC-2020ES by selecting *Upload Settings and Logic* on the *Communication* pull-down menu.

Caution

Always remove the DGC-2020ES from service prior to changing or modifying the active logic scheme. Attempting to modify a logic scheme while the DGC-2020ES is in service could generate unexpected or unwanted outputs.

Modifying a logic scheme in BESTCOMS*Plus* does not automatically make that scheme active in the DGC-2020ES. The modified scheme must be uploaded into the DGC-2020ES.

Programming BESTlogic™Plus

Use BESTCOMS*Plus* to program BESTlogic*Plus*. Using BESTCOMS*Plus* is analogous to physically attaching wire between discrete DGC-2020ES terminals. To program BESTlogic*Plus*, use the Settings Explorer within BESTCOMS*Plus* to open the *BESTlogicPlus Programmable Logic* tree branch as shown in Figure 13-1.

The drag and drop method is used to connect a variable or series of variables to the logic inputs, outputs, components, and elements. To draw a wire/link from port to port (triangles), click the left mouse button on a port, pull the wire onto another port, and release the left mouse button. A red port indicates that a connection to the port is required or missing. A black port indicates that a connection to the port is not required. Drawing wires/links from input to input or output to output is not allowed. Only one wire/link can be connected to any one output. If the proximity of the endpoint of the wire/link is not exact, it may attach to an unintended port.

If an object or element is disabled, it will have a yellow X on it. To enable the element, navigate to the settings page for that element. A red X indicates that an object or element is not available per the style number of the DGC-2020ES.

The view of the Main Logic, Physical Outputs, Remote Outputs, and LCR Outputs can be automatically arranged by clicking the right mouse button on the window and selecting *Auto-Layout.*

The following must be met before BESTCOMS*Plus* will allow logic to be uploaded to the DGC-2020ES:

- A minimum of two inputs and a maximum of four inputs on any multi-port (AND, OR, NAND, NOR, XOR, and XNOR) gate.
- A maximum of five logic levels for any particular path. A path being an input block or an output side of an element block through gates to an output block or an input side of an element block. This is to include any OR gates on the Physical Output or Remote Output tab/pages, but not the matched pairs of Physical Output blocks or Remote Output blocks.
- Only 20 gates per logic level. All output blocks and input sides of element blocks are at the maximum logic level of the diagram. All gates are pushed forward/upwards in logic levels and buffered to reach the final output block or element block if needed. A maximum of 50 gates allowed per diagram.
- At all levels there can only be 64 used link/wired or endpoints. Endpoints being inputs, outputs, both sides of element blocks.

Three status indicators are located in the lower right corner of the BESTlogic*Plus* window. These indicators show the *Logic Save Status*, *Logic Diagram Status*, and *Logic Layer Status*. Table 13-4 defines the colors for each indicator.

Table 13-4. Status Indicators

Indicator	Color	Definition
Logic Save Status (Left Indicator)	Amber	Logic has changed since last save.
	Green	Logic has NOT changed since last save.
Logic Diagram Status (Center Indicator)	Red	Requirements NOT met as listed above.
	Green	Requirements met as listed above.
Logic Layer Status (Right Indicator)	Red	Requirements NOT met as listed above.
	Green	Requirements met as listed above.

Pickup and Dropout Timers

A pickup timer produces a true output when the elapsed time is greater than or equal to the Pickup Time setting after a false to true transition occurs on the Initiate input from the connected logic. Whenever the Initiate input status transitions to false, the output transitions to false immediately.

A drop out timer produces a true output when the elapsed time is greater than or equal to the Dropout Time setting after a true to false transition occurs on the Initiate input from the connected logic. Whenever the Initiate input transitions to true, the output transitions to false immediately. Refer to Figure 13-2.

To program logic timer settings, use the Settings Explorer within BESTCOMS*Plus* to open the *BESTlogicPlus Programmable Logic/Logic Timers* tree branch. Enter a *Name* label that you want to appear on the timer logic block. The *Time Delay* value range is 0 to 250 hours in 1 hour increments, 0 to 250 minutes in 1 minute increments, or 0 to 1,800 seconds in 0.1 second increments.

Next, open the *Components* tab inside the BESTlogic*Plus* window and drag a timer onto the program grid. Right click on the timer to select the timer you want to use that was previously set on the *Logic Timers* tree branch. The *Logic Timer Properties Dialog Box* will appear. Select the timer you want to use.

Timing accuracy is ±15 milliseconds.

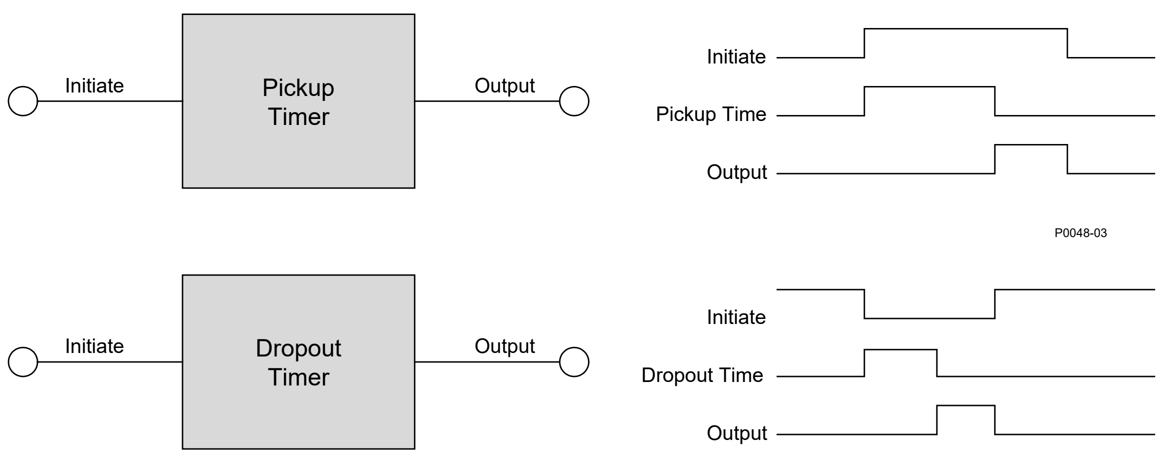


Figure 13-2. Pickup and Dropout Timer Logic Blocks

Offline Logic Simulator

The offline logic simulator allows you to change the state of various logic elements to illustrate how that state travels through the system. Before running the logic simulator, you must click the Save button on the BESTlogic*Plus* toolbar to save the logic to memory. Changes to the logic (other than changing the state) are disabled when the simulator is enabled. Colors are selected by clicking the Options button on the BESTlogic*Plus* toolbar. By default, Logic 0 is red and Logic 1 is green. Using your mouse, double-click on a logic element to change its state.

An example of the offline logic simulator is shown in Figure 13-3. Output 1 is Logic 0 (red) when Virtual Switch 1 is Logic 0 (red) and Fixed 1 is Logic 1 (green).

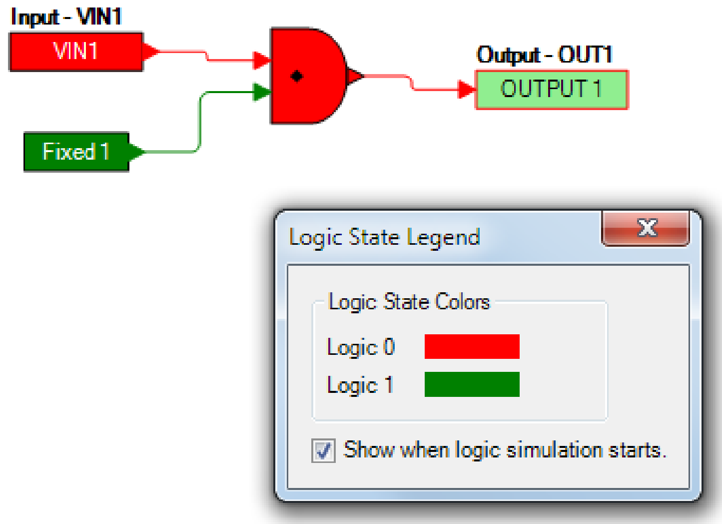


Figure 13-3. Offline Logic Simulator Example

BESTlogic™Plus File Management

To manage BESTlogic*Plus* files, use the Settings Explorer to open the *BESTlogicPlus Programmable Logic* tree branch. Use the BESTlogic*Plus* Programmable Logic toolbar to manage BESTlogic*Plus* files. Refer to Figure 13-4. For information on Settings Files management, refer to the *BESTCOMSPlus* chapter.

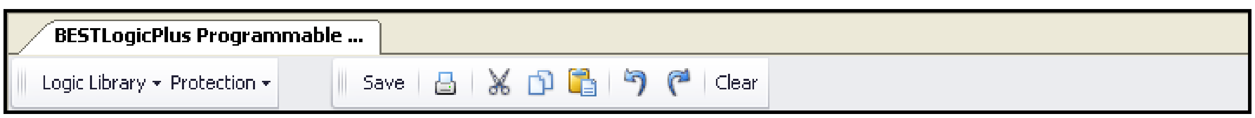


Figure 13-4. BESTlogic*Plus* Programmable Logic Toolbar

Saving a BESTlogic*Plus* File

After programming BESTlogic*Plus* settings, click on the *Save* button to save the settings to memory.

Before the new BESTlogic*Plus* settings can be uploaded to the DGC-2020ES, you must select *Save* from the *File* pull-down menu located at the top of the BESTCOMS*Plus* main shell. This step will save both the BESTlogic*Plus* settings and the operating settings to a file.

The user also has the option to save the BESTlogic*Plus* settings to a unique file that contains only BESTlogic*Plus* settings. Click on the *Logic Library* drop-down button and select *Save Logic Library File.* Use normal Windows® techniques to browse to the folder where you want to save the file and enter a filename.

Opening a BESTlogic*Plus* File

To open a saved BESTlogic*Plus* file, click on the *Logic Library* drop-down button on the BESTlogic*Plus* Programmable Logic toolbar and select *Open Logic Library File.* Use normal Windows techniques to browse to the folder where the file is located.

Protecting a BESTlogic*Plus* File

Objects in a logic diagram can be locked so that when the logic document is protected these objects cannot be changed. Locking and protecting is useful when sending logic files to other personnel to be modified. The locked object(s) cannot be changed. To view the lock status of the object(s), select *Show Lock Status* from the *Protection* drop-down menu. To lock object(s), use the mouse to select object(s) to be locked. Right click on the selected object(s) and select *Lock Object(s).* The gold colored padlock next to the object(s) will change from an open to a locked state. To protect a logic document, select *Protect Logic Document* from the *Protection* drop-down button. A password is optional.

Uploading a BESTlogic*Plus* File

To upload a BESTlogic*Plus* file to the DGC-2020ES, you must first open the file through BESTCOMS*Plus* or create the file using BESTCOMS*Plus*. Then pull down the *Communication* menu and select *Upload Logic.*

Downloading a BESTlogic*Plus* File

To download a BESTlogic*Plus* file from the DGC-2020ES, you must pull down the *Communication* menu and select *Download Logic*. If the logic in your BESTCOMS*Plus* has changed, a dialog box will open asking you if want to save the current logic changes. You may choose *Yes* or *No*. After you have taken the required action to save or not save the current logic, the downloading is executed.

Printing a BESTlogic*Plus* File

To view a preview of the printout, click on the *Print Preview* icon located on the BESTlogic*Plus* Programmable Logic toolbar. If you wish to print to a printer, select the printer icon in the upper left corner of the *Print Preview* screen.

You may skip the print preview and go directly to print by clicking on the *Printer* icon on the BESTlogic*Plus* Programmable Logic toolbar. A dialog box, *Select Views to Print* opens allowing you to check which views you would like to print. Next, the *Print* dialog box opens with the typical Windows choice to setup the properties of printer. Execute this command, as necessary, and then select *Print*.

A *Page Setup* icon is also provided on the BESTlogic*Plus* Programmable Logic toolbar allowing you to select *Paper Size, Paper Source, Orientation,* and *Margins.*

Clearing the On-Screen Logic Diagram

Click on the *Clear* button to clear the on-screen logic diagram and start over.

BESTlogic™Plus Examples

Example 1 - GENBRK Logic Block Connections

Figure 13-5 illustrates the GENBRK logic block, three input logic blocks, and two output logic blocks. Output 3 is active while the GENBRK is sending an “open breaker” command and Output 4 is active while the GENBRK is sending the “close breaker” command.

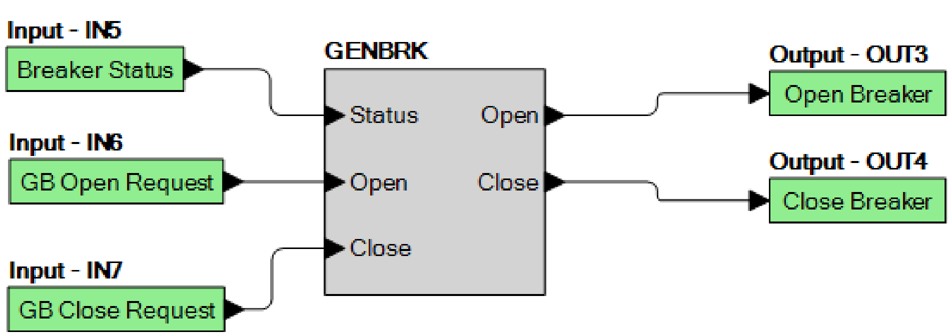


Figure 13-5. Example 1 – GENBRK Logic Block Connections

Example 2 - AND Gate Connections

Figure 13-6 illustrates a typical AND gate connection. In this example, Output 11 will become active when the Low Fuel alarm AND the Low Oil Pressure alarm are true.

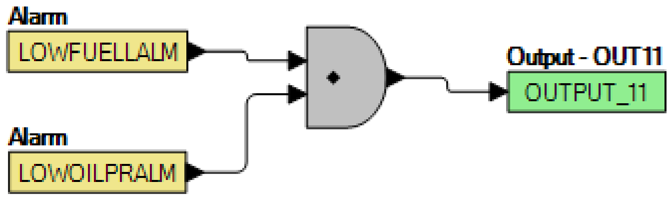


Figure 13-6. Example 2 – AND Gate Connections

Example 3 - Multiple Logic Connections

In this example, there are two comment boxes, which may be placed on the logic diagram. Double-click a comment box to modify the inside text. Output 3 becomes true when the 27TRIP is true. Output 1 becomes true when the High Coolant Temp is true. Output 2 becomes true when the DGC-2020ES is in RUN mode (RUN Mode true). Refer to Figure 13-7.

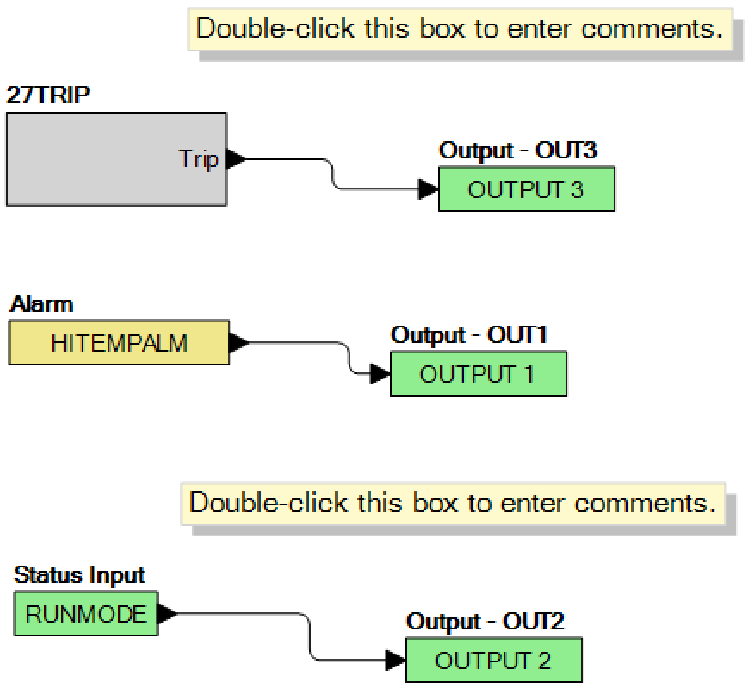


Figure 13-7. Example 3 – Multiple Logic Connections

14 • Exhaust Treatment

Diesel Particulate Filter (DPF)

In order to meet Tier 4 emission requirements, some engine manufacturers are applying Diesel Particulate Filters (DPF) to the exhaust system of the engine. A Diesel Particulate Filter traps particulate matter contained in diesel exhaust and prevents it from distributing into the air. The particulate matter is later burned off during a regeneration process.

The DGC-2020ES communicates DPF control and status information to and from the engine ECU via J1939 communications in the form of various Parameter Group Numbers (PGN) and Suspect Parameter Numbers (SPN). These are summarized in the following paragraphs.

Regeneration

Regeneration is accomplished by operating the engine at elevated exhaust temperatures where the accumulated particulate is burned off. If, in normal operation, the engine can be loaded to a high enough level to achieve the elevated exhaust temperature, then regeneration can occur as a part of normal operation. This is known as *passive regeneration*.

High exhaust temperatures can also be accomplished by methods such as providing dampers in the exhaust stream or heating the exhaust through the burning of fuel. This is known as *active regeneration* since it is outside of normal engine operation.

Heavily loaded engines will seldom require active regeneration. A lightly loaded engine will likely undergo active regeneration when regeneration is required.

DPF Control

DPF control information is sent from the DGC-2020ES to the Engine ECU through PGN Number 57244 (0xE000). A manual regeneration request is sent using SPN 3695, Diesel Particulate Filter Regeneration Force Switch. Regeneration can be inhibited by SPN 3695, Diesel Particulate Filter Regeneration Inhibit Switch.

Manual Regeneration

The operator can force a regeneration cycle by turning on the Manual Regeneration setting found on the front panel under Settings > Communication > CANBus Setup > ECU Setup > DPF Regenerate Setup. The parameter will remain on for a few seconds then go off. The ECU will respond to the momentary setting by logging the request to force a manual regeneration. A continuous request is not used because this can be problematic for some engine ECUs.

Manual regeneration can also be initiated by clicking the *Manual Regeneration* button on the ECU Setup screen in BESTCOMS*Plus*®. BESTlogic™*Plus* programmable logic can also be used to initiate manual regeneration by setting the DPF Manual Regeneration (DPFMANREGEN) logic element true.

Regeneration Inhibit

The operator can inhibit regeneration by turning on the DPF Regeneration Disable setting found on the ECU Setup screen in BESTCOMS*Plus*.

Regeneration can also be disabled by turning on the Disable Regeneration setting on the ECU Setup screen in BESTCOMS*Plus*.

BESTlogic*Plus* programmable logic can also be used to inhibit regeneration by setting the DPF Regeneration Inhibit (DPFREGENINHIBIT) logic element true.

DPF Status and Pre-Alarms

The DGC-2020ES receives DPF status information which is broadcast from the engine ECU in various Parameter Group Numbers (PGN) and Suspect Parameter Numbers (SPN). The DGC-2020ES displays this information on the front panel, and in BESTCOMS*Plus*, via DPF related pre-alarms. The J1939 parameters and the resulting DGC-2020ES pre-alarms are summarized in the following paragraphs.

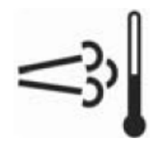
- PGN 64892 (0xFD7C) Diesel Particulate Filter Control 1
    - *SPN 3697, Diesel Particulate Filter Lamp Command*

      DPF REGEN REQUIRED Pre-Alarm: When SPN 3697 has a value of 1 or 4 indicating the DPF lamp is on, the DGC-2020ES will annunciate a pre-alarm with text of DPF REGEN REQUIRED. The DPF symbol, shown to the right, will accompany the text when the pre-alarm appears on the DGC-2020ES front panel.

    - *SPN 3698, Exhaust System High Temperature Lamp Command*

      HIGH EXHAUST TEMP Pre-Alarm: When SPN 3698 has a value of 1 indicating the high exhaust temperature lamp is on, the DGC-2020ES will annunciate a pre-alarm with text of HIGH EXHAUST TEMP. The high exhaust temperature symbol, shown to the right, will accompany the text when the pre-alarm appears on the DGC-2020ES front panel.

    - *SPN 3701 Diesel Particulate Filter Status*

      SPN 3701 indicates that regeneration is required at the lowest level, moderate level, or most severe level. The DGC-2020ES uses this parameter for DPF Soot Level Pre-alarms which are described in the following paragraphs.

    - *SPN 3703 Diesel Particulate Filter Active Regeneration Inhibited Due to Inhibit Switch*

      DPF REGEN INHIBITED Pre-Alarm: When SPN 3703 has a value of 1 indicating the DPF Regeneration is inhibited due to the inhibit switch being set, the DGC-2020ES will annunciate a pre-alarm with text of DPF REGEN INHBTD. The DPF regeneration inhibited symbol, shown to the right, will accompany the text when the pre-alarm appears on the DGC-2020ES front panel.

- DPF Soot Level Annunciation

  The DGC-2020ES annunciates DPF Soot Level pre-alarms which are described in the following paragraphs.

    - SOOT LEVEL HIGH Pre-Alarm

      This pre-alarm is annunciated when one of the following occurs.

        - A DTC is received with SPN 3719 (Diesel Particulate Filter Soot Load Percent) with FMI = 15 (*Data Valid But Above Normal Operating Range Least Severe Level)*
        - SPN 3701 (Diesel Particulate Filter Status) is received with a value of 001 (*regeneration is needed – lowest level)*

      The pre-alarm text is SOOT LVL HI.

      The DPF symbol, shown to the right, accompanies the text when the pre-alarm appears on the DGC-2020ES front panel.

    - SOOT LEVEL MODERATELY HIGH Pre-Alarm

      This pre-alarm is annunciated when one of the following occurs.

        - A DTC is received with SPN 3719 (Diesel Particulate Filter Soot Load Percent) with FMI = 16 (*Data Valid But Above Normal Operating Range Moderately Severe Level)*

- SPN 3701 (Diesel Particulate Filter Status) is received with a value of 010 (*regeneration is needed – moderate level)*

The pre-alarm text is SOOT LVL MOD HI.

The DPF warning symbol, shown to the right, accompanies the text when the pre-alarm appears on the DGC-2020ES front panel.

- SOOT LEVEL EXTREMELY HIGH Pre-Alarm

  This pre-alarm is annunciated when one of the following occurs.

  - A DTC is received with SPN 3719 (Diesel Particulate Filter Soot Load Percent) with FMI = 0 (*Data Valid But Above Normal Operating Range Most Severe Level)*
  - SPN 3701 (Diesel Particulate Filter Status) is received with a value of 011 (*regeneration is needed – highest level)*

  The pre-alarm text is SOOT LVL EXT HI.

The DPF stop symbol, shown to the right, accompanies the text when the pre-alarm appears on the DGC-2020ES front panel. If the DPF soot level reaches the most severe level, the engine ECU may shut the engine down, preventing it from running, or allow it to run, but at a reduced power level. The DGC-2020ES only indicates a pre-alarm, it does not prevent the engine from running or cause operation at a reduced power level. However, the operator should be aware that the engine ECU or after treatment system may cause such behavior.

Exhaust After-Treatment Systems (EATS)

In order to meet Tier 4 emission requirements, some engine manufacturers are adding Exhaust After Treatment Systems (EATS) which treat the engine exhaust within the exhaust system to reduce particulate matter and harmful contaminants prior to releasing the exhaust into the atmosphere. One such system uses urea-based Diesel Exhaust Fluid (DEF) catalyst which is combined with the exhaust gasses in the EATS to bring the emissions to acceptable levels.

The DGC-2020ES meters EATS information from the engine ECU via J1939 CANBus and displays the DEF level within the DEF tank(s), and also displays several pre-alarms related to the EATS system. Any DEF related pre-alarms annunciated on the front panel display the symbol used for DEF functions which is shown to the right.

Most systems will contain one DEF tank, while some may contain two tanks. The DGC-2020ES front panel displays the level of DEF in each tank under Metering > Alarms-Status > J1939 Status > DEF Tank1 LVL% and Metering > Alarms-Status > J1939 Status > DEF Tank2 LVL%. The tank 1 level is sent from the ECU via SPN 1761 in J1939 PGN 65110 - After Treatment 1 Reagent Tank 1 Information. The tank 2 level is sent from the ECU via SPN 4367 in J1939 PGN 64829 - After Treatment 1 Reagent Tank 2 Information. The tank levels are expressed in units of percent.

Pre-Alarms

The ECU sends DEF level diagnostics to the DGC as SPNs 5245 and 5246 in PGN 65110 (the AT1TI PGN). SPN 5245 communicated DEF level diagnostics, whereas SPN 5246 communicates DEF inducement level status.

There are several pre-alarms related to the EATS which annunciate DEF level diagnostics and DEF inducement level status. They are always enabled and will annunciate when received from the engine ECU. Each of them contains the symbol for DEF functions when annunciated on the front panel; however it will not be displayed in BESTCOMS*Plus*. The pre-alarms are summarized in the following paragraphs.

- DEF FLUID LOW: This pre-alarm displays when SPN 5245 has a value of 1, indicating that the DEF tank level is low. The exact DEF levels which constitute a low DEF condition vary among manufacturers.

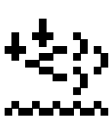
- DEF LOW SEVERE: This pre-alarm displays when SPN 5245 has a value of 4, indicating that the DEF tank level is severely low or empty. The exact DEF levels which constitute a severely low DEF condition vary among manufacturers. When this occurs and is not remedied, the engine ECU may enter a mode of inducement not to operate the engine where some of the conditions in the pre-alarms descriptions below may occur.
- DEF WARNING: This pre-alarm displays when SPN 5246 has a value of 1. This is the lowest level of warning which indicates the EATS is not functioning properly or DEF quality or level is insufficient for proper operation.
- DEF WARNING LVL2: This pre-alarm displays when SPN 5246 has a value of 2. This is a higher level of warning which indicates the EATS is not functioning properly or DEF quality or level is insufficient for proper operation. If the problem causing this warning is not corrected, the system will eventually enter the DEF inducement states. In these states, the engine power or operating speed may be derated depending on the engine manufacturer and engine application.
- DEF INDUCEMENT: This pre-alarm displays when SPN 5246 has a value of 3, indicating the first level of inducement. The engine power or operating speed may be derated at this level of inducement depending on engine manufacturer and engine application. This is the lowest level of inducement and is caused by either the EATS not functioning properly or insufficient DEF quality or level for proper operation.
- DEF PRESEVERE INDUCEMENT: This pre-alarm displays when SPN 5246 has a value of 4, indicating the Pre-Severe Inducement level of inducement. This indicates that the engine has entered the second highest level of inducement not to operate. This is caused by either the EATS not functioning properly or insufficient DEF quality or level for proper operation. The engine power or operating speed may be derated at this level of inducement depending on engine manufacturer and engine application. The ECU will allow the engine to run for a limited time in this condition after which the engine will enter the severe inducement state.
- DEF SEVERE INDUCEMENT: This pre-alarm displays when SPN 5246 has a value of 5, indicating the Severe Inducement level of inducement. This is caused by either the EATS not functioning properly or insufficient DEF quality or level for proper operation. In this condition, the engine may either operate with reduced power or RPM or be shut down depending on manufacturer or engine application. The engine will remain at this level of inducement until the problem causing the inducement is resolved.

- DEF INDUCEMENT OVERRIDE: This pre-alarm displays when SPN 5246 has a value of 6, indicating the Temporary Override of inducement. This indicates DEF inducement is temporarily overridden. The engine may operate with reduced power, or for a limited time, after which time it may re-enter the SEVERE INDUCEMENT state.

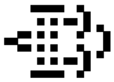
Exhaust System Status Annunciation

When an exhaust system condition requires annunciation, the DGC-2020ES displays the exhaust system information across the bottom of the front panel screen. The parameters and symbols in the Exhaust System Status Display are listed below. The symbol images below are the actual bit-mapped images that are viewed on the front panel screen of the DGC-2020ES.

DEF Tank Level – The DEF Tank Level is the level of Diesel Exhaust Fluid (DEF) in the DEF Tank. When the DEF Level is getting low and DEF related conditions require annunciation, the caption of the DEF Tank level will change from “DEF” to the DEF symbol. Details of the DEF symbol are described below.

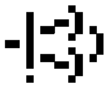


DEF Symbol – When the symbol is on solid, it indicates that DEF is low or there is an issue with the Selective Catalytic Reduction (SCR) system. When it is flashing, it indicates the DEF level is critically low or there is a critical issue with the SCR system.



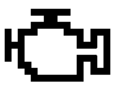
DPF Symbol – When the DPF symbol is on solid, it indicates that the Diesel Particulate Filter (DPF) or exhaust system filter requires regeneration. When flashing it indicates a more urgent need for regeneration. Some manufacturers also show this symbol along with the High Exhaust Temperature Symbol when a Regeneration is in process.

Regeneration Inhibited Symbol – When this symbol is visible, it indicates that Regeneration is Inhibited. Operation with Regeneration Inhibited is not recommended. If Regeneration is not allowed when required, eventually the machine may shut down and cannot be restarted without a service call from the engine manufacturer. However, ample warning is given through various pre-alarms to allow removal of the inhibit so regeneration can occur and prevent an unwanted exhaust related shutdown condition.



Exhaust System Malfunction Symbol – When this symbol is visible, an exhaust system malfunction is in effect. Pre-alarms and/or Diagnostic Trouble Codes (DTC's) will provide additional information. It may be necessary to contact the engine manufacturer if the pre-alarms and DTC's do not provide sufficient failure information.

High Exhaust Temperature Symbol – This is visible when the exhaust system temperature has been elevated to perform a DPF Regeneration and typically indicates a DPF Regeneration is active. Some manufacturers also show this symbol when there is a mechanism to heat the exhaust stream and it is in the process of heating in preparation for a DPF Regeneration.

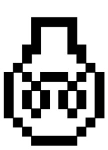


Check Engine Symbol – This is visible when Active Diagnostic Trouble Codes (DTCs) are present.

Torque Limit Symbol – This symbol is visible when operating in a Limited Torque mode due to exhaust system issues. When on solid, it indicates torque reduction. When flashing, it indicates increased torque reduction.

Amber Warning Lamp Symbol– This symbol indicates the engine ECU is lighting the Amber Warning Lamp. When flashing, it indicates a higher degree of severity.

Red Lamp Symbol – This symbol indicates the engine ECU is lighting the Red Warning Lamp. When flashing, it indicates a higher degree of severity. An engine shutdown may accompany this symbol.



Wait To Start Symbol – This symbol is visible when the engine is in a state of preparation for starting the engine. Examples include engine pre-heating or engine pre-lubrication.

Exit Conditions for DEF Severe Inducement

- First Restart: Return to 0% torque reduction in exit condition, until proper DEF level and quality evaluation. If low level or poor DEF quality is detected during the next monitoring cycle, the severe inducement will be active after the next restart. After the second restart, a service tool is required to exit the severe inducement.
- With Service Tool Clearing: Invoke 0% torque reduction with service tool clearing until proper DEF level and quality evaluation. If low level or poor DEF quality is detected during the next monitoring cycle, the severe inducement will be active after the next restart.

15 • Troubleshooting

If you do not get the results that you expect from the DGC-2020ES, first check the programmable settings for the appropriate function. Use the following troubleshooting procedures when difficulties are encountered in the operation of your genset control system.

Communications

USB Port Does Not Operate Properly

Step 1. Verify that the proper port of your computer is being used. For more information, refer to the *Communication* chapter.

CAN Communication Does Not Operate Properly

Step 1: Verify that there is a 120-ohm termination resistor on each end of the bus section of the wiring, and that there are not any termination resistors at any node connections that are on stubs from the main bus.

Step 2: Check all CAN wiring for loose connections and verify that the CAN H and CAN L wires have not gotten switched somewhere on the network.

Step 3: Verify that the cable length of the bus section of the wiring does not exceed 40 meters (131 feet), and verify that any stubs from the main bus do not exceed 3 meters (9.8 feet) in length.

Step 4: If the engine is equipped with a Volvo or MTU ECU, verify that the ECU Configuration setting is set to match the actual ECU configuration.

Inputs and Outputs

Programmable Inputs Do Not Operate as Expected

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Confirm that the inputs are programmed properly.

Step 3. Ensure that the input at the DGC-2020ES is actually connected to the BATT– terminal (17).

Programmable Outputs Do Not Operate as Expected

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Confirm that the outputs are programmed properly.

Metering/Display

Incorrect Display of Battery Voltage, Coolant Temperature, Oil Pressure, or Fuel Level

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Confirm that the SENDER COM terminal (2) is connected to the negative battery terminal and the engine-block side of the senders. Current from other devices sharing this connection can cause erroneous readings.

Step 3. If the displayed battery voltage is incorrect, ensure that the proper voltage is present between the BATT+ terminal (18) and the SENDER COM terminal (2).

Step 4. Verify that the correct senders are being used.

Step 5. Use a voltmeter connected between the BATT– terminal (17) and the SENDER COM terminal (2) on the DGC-2020ES to verify that there is no voltage difference at any time. Any voltage differences may manifest themselves as erratic sender readings. Wiring should be corrected so that no differences exist.

Step 6: Check the sender wiring and isolate sender wiring from any of the ac wiring in the system. The sender wiring should be located away from any power ac wiring from the generator and any ignition wiring. Separate conduits should be used for sender wiring and any ac wiring.

Incorrect Display of Generator Voltage

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Ensure that the proper voltage is present at the DGC-2020ES voltage sensing inputs (40, 41, 43, and 45).

Step 3. Verify that the voltage transformer ratio and sensing configuration is correct.

Step 4. Confirm that the voltage sensing transformers are correct and properly installed.

Incorrect Measurement or Display of Generator Current

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Ensure that the proper current is present at the DGC-2020ES current sensing inputs 33, 34, 35, 36, 37, and 38.

Step 3. Verify that the current sensing transformer ratios are correct.

Step 4. Confirm that the current sensing transformers are correct and properly installed.

Incorrect Display of Engine RPM

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Verify that the flywheel teeth setting is correct.

Step 3. Verify that the prime mover governor is operating properly.

Step 4. Verify that the measured frequency of the voltage at the MPU input (31 and 32) is correct.

Step 5. If the MPU is shared with the governor, verify that the polarity of the MPU input to the governor matches the polarity of the MPU input to the DGC-2020ES.

DGC-2020ES Indicates Incorrect Power Factor

Check the rotation of the machine and the labeling of the A-B-C terminals. The machine must be rotating in the same phase sequence as dictated by the generator phase rotation setting for correct power factor metering. A power factor indication of 0.5 with resistive load present is a symptom of incorrect phase rotation.

LCD is Blank and all LEDs are Flashing at Approximately Two-Second Intervals

This indicates that the DGC-2020ES does not detect that valid application firmware is installed. The unit is running its boot loader program, waiting to accept a firmware upload.

Step 1. Start BESTCOMS*Plus*®. Use the top pull-down menu and select FILE > NEW > DGC-2020ES.

Step 2. Select COMMUNICATIONS > UPLOAD DEVICE FILES and select the device package file that contains the firmware and language you want to upload.

Step 3. Check the boxes for DGC-2020ES Firmware and DGC-2020ES Language Module. Click the UPLOAD button to start the upload process.

Ground Faults Detected in Ungrounded System Applications

Step 1: Verify that there is no connection from the neutral connection of the generator to the system ground.

Step 2: Perform insulation resistance tests on the system wiring to check for insulation integrity in the overall system.

Step 3: If ground faults are detected on a DGC-2020ES in an ungrounded system application, it is recommended that potential transformers be employed on the voltage sensing inputs to provide full isolation between the DGC-2020ES and monitored voltage phases.

Step 4: If potential transformers are in place, remove the connectors from the DGC-2020ES one at a time. If removal of a connector removes the ground fault, check the system wiring to that connector and out into the system to verify that connections are secure and all wiring insulation is in good condition.

Generator Breaker and Mains Breaker

Generator Breaker Will Not Close to a Dead Bus

Step 1: Review the description of how the generator breaker logic element functions contained in the GENBRK logic element description in the BESTlogic™*Plus* chapter.

Step 2: Review the section on breaker close requests in the *Breaker Management* chapter.

Step 3: Navigate to the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE > GEN BREAKER screen and set DEAD BUS CL ENBL to ENABLE.

Step 4: Verify that the Generator status is stable. The breaker will not close if the generator status is not stable. Check status by using the Metering Explorer in BESTCOMS*Plus* and verify that when the generator is running, the GEN STABLE status LED is lit. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen.

Step 5: Verify the bus status is DEAD. Check status by using the Metering Explorer in BESTCOMS*Plus* and verify that when the generator is running, the BUS DEAD status LED is lit. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen.

Step 6: Verify the connections in BESTlogic*Plus* Programmable Logic to the generator breaker logic element. The *Status* input must be driven by an "A" or normally open contact from the generator breaker. The OPEN and CLOSE command inputs on the left side of the logic block are inputs for open and close commands. These can be wired to physical inputs if it is desired to have open and close command switches. If they are wired, they must either be pulsed inputs, or some logic must be employed so that the open and close command inputs are never driven at the same time. If these are both driven at the same time, the breaker is receiving open and close commands simultaneously. The breaker will not change state if it is being commanded to open and close at the same time.

Step 7: Verify the breaker is receiving a close command. Breaker close command sources are:

- The DGC-2020ES itself when the automatic mains fail transfer (ATS) feature is enabled.
- The DGC-2020ES itself when the RUN WITH LOAD logic element receives a *Start* pulse in the programmable logic.

- The DGC-2020ES itself when started from the Exercise Timer and the Run with Load box is checked in the Generator Exerciser settings.
- Manual Breaker Close Input Contacts applied to the Open and Close inputs on the left side of the Generator Breaker logic element in the programmable logic.

Step 8: Verify the wiring to the breaker from the DGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker open output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

Generator Breaker Does Not Open When It Should

Step 1: Review the description of how the generator breaker logic element functions contained in the GENBRK logic element description in the *BESTlogicPlus* chapter.

Step 2: Review the section on breaker operation requests in the *Breaker Management* chapter.

Step 3: Verify the connections in BESTlogic*Plus* Programmable Logic to the generator breaker logic element. The *Status* input must be driven by an “A” or normally open contact from the generator breaker. The OPEN and CLOSE command inputs on the left side of the logic block are inputs for open and close commands. These can be wired to physical inputs if it is desired to have open and close command switches. If they are wired, they must either be pulsed inputs, or some logic must be employed so that the open and close command inputs are never driven at the same time. If these are both driven at the same time, the breaker is receiving open and close commands simultaneously. The breaker will not change state if it is being commanded to open and close at the same time.

Step 4: Verify the breaker is receiving an open command. Breaker open command sources are:

- The DGC-2020ES itself when the automatic transfer (ATS) feature is enabled.
- The DGC-2020ES itself when the RUN WITH LOAD logic element receives a *Stop* pulse in the programmable logic.
- The DGC-2020ES itself when shutting down the engine due to an active alarm.
- The DGC-2020ES itself when ending a run session from the Exercise Timer and the *Run with Load* box is checked in the Generator Exerciser settings.
- Manual Breaker Open Input Contacts applied to the Open and Close inputs on the left side of the Generator Breaker logic element in the programmable logic.

Step 5: Verify the wiring to the breaker from the DGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker open output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

Mains Breaker Does Not Open When Mains Fails

Step 1: Verify that a Mains Breaker has been configured by examining the settings on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 2: Verify the mains breaker has been correctly included in the programmable logic.

Step 3: Verify that the MAINS FAIL TRANSFER parameter is set to ENABLE on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 4: Verify that a failure of the mains is detected by the DGC-2020ES. Check status using the Metering Explorer in BESTCOMS*Plus* and verify that the MAINS FAIL status LED is lit when the power on the DGC-2020ES bus voltage input is either out of voltage or frequency range. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen to achieve correct detection.

Step 5: Verify the wiring to the breaker from the DGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker close output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

Mains Breaker Does Not Close After Mains Returns

Step 1: Verify that a Mains Breaker has been configured by examining the settings on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 2: Verify the mains breaker has been correctly included in the programmable logic.

Step 3: Verify that the MAINS FAIL TRANSFER parameter is set to ENABLE on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 4: Verify that stable mains power is detected by the DGC-2020ES. Check status using the Metering Explorer in BESTCOMS*Plus* and verify that the MAINS STABLE status LED is lit when the power on the DGC-2020ES bus voltage input is good. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen to achieve correct detection.

Step 5: Verify the wiring to the breaker from the DGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker open output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

DGC-2020ES Front Panel Debug Screen

There is one debug screen in the DGC-2020ES that can be useful for debugging I/O module related issues. The following debug screen is available: CEM DEBUG

CEM DEBUG

This screen shows the binary data that is being sent between the CEM-2020 (Contact Expansion Module) and the DGC-2020ES.

The CEM DEBUG screen is located on the front panel at SETTINGS > SYSTEM PARAMS > REMOTE MODULE SETUP > CEM SETUP > CEM DEBUG MENU.

The following parameters are visible on the CEM DEBUG screen:

- DGC TO CEM BP: DGC-2020ES to CEM-2020 Binary Points. This is the status of the CEM-2020 output relays being transmitted from the DGC-2020ES to the CEM-2020. This is a 32-bit, bit packed number representing the desired states of the CEM-2020 outputs. The left most bit is the first output, etc.
- CEM TO DGC BP: CEM-2020 to DGC-2020ES Binary Points. This is the status of the CEM-2020 inputs being transmitted from the CEM-2020 to the DGC-2020ES. This is a 32-bit, bit packed number representing the metered states of the CEM-2020 inputs. The left most bit is the first input, etc.

16 • BESTCOMS*Plus*® Settings Loader Tool

Introduction

The BESTCOMS*Plus*® Settings Loader Tool is a software application, which allows the user to instantly upload settings to Basler BESTCOMS*Plus*-compatible products by scanning a pre-registered bar code, which promotes consistency, reduces potential errors, and saves time.

Setup

The BESTCOMS*Plus* Settings Loader Tool software and a bar code reader (acquired separately) must be installed on the same PC.

BESTCOMS*Plus* Settings Loader Tool Installation

System Recommendations

The BESTCOMS*Plus*® Settings Loader Tool is bundled with BESTCOMS*Plus* software. BESTCOMS*Plus* software is built on the Microsoft® .NET Framework. The setup utility that installs BESTCOMS*Plus* on your PC also installs the BESTCOMS*Plus* Settings Loader Tool and the required version of .NET Framework (if not already installed). BESTCOMS*Plus* operates with systems using Windows® XP 32-bit SP3, Windows Vista 32-bit SP1, Windows 7 32-bit (all editions), Windows 7 64-bit (all editions), Windows 8, and Windows 10. Microsoft Internet Explorer 5.01 or later must be installed on your PC before installing BESTCOMS*Plus*. System recommendations for the .NET Framework and BESTCOMS*Plus* are listed in Table 16-1.

Table 16-1. System Recommendations for BESTCOMS*Plus* and the .NET Framework

System Type	Component	Recommendation
32/64 bit	Processor	2.0 GHz
32/64 bit	RAM	1 GB (minimum), 2 GB (recommended)
32 bit	Hard Drive	100 MB (if .NET Framework is already installed on PC)
		950 MB (if .NET Framework is not already installed on PC)
64 bit	Hard Drive	100 MB (if .NET Framework is already installed on PC)
		2.1 GB (if .NET Framework is not already installed on PC)

To install and run BESTCOMS*Plus*, a Windows user must have Administrator rights.

Installation

Note
Do not connect a USB cable until setup completes successfully. Connecting a USB cable before setup is complete may result in errors.

1. Insert the BESTCOMS*Plus* CD-ROM into the PC CD-ROM drive.
2. When the BESTCOMS*Plus* Setup and Documentation CD menu appears, click the Install button for the BESTCOMS*Plus* application. The setup utility installs BESTCOMS*Plus*, the .NET Framework (if not already installed), the USB driver, and the BESTCOMS*Plus* Settings Loader Tool on your PC.

When BESTCOMS*Plus* installation is complete, a Basler Electric folder is added to the Windows programs menu. This folder is accessed by clicking the Windows Start button and then accessing the

Basler Electric folder in the Programs menu. The Basler Electric folder contains an icon that starts the BESTCOMS*Plus* Settings Loader Tool.

Bar Code Reader and Bar Codes

The BESTCOMS*Plus*® Settings Loader Tool is compatible with bar code readers, which conform to UnifiedPOS specifications. Bar code readers and bar code labels are not provided and must be acquired separately. Refer to the bar code reader's documentation for installation instructions.

Any bar code compatible with your bar code reader may be used.

BESTCOMSPlus® Settings Loader Tool Settings

BESTCOMS*Plus* Settings Loader Tool settings are found on two main screens, the Loader Grid and Configuration screen. The Loader Grid contains management options for the product settings files and their associated bar codes. The Configuration screen contains product-specific options for the default behavior of the BESTCOMS*Plus* Settings Loader Tool. These settings are described in the following paragraphs.

Loader Grid

One entry, or row, in the Loader Grid contains all of the necessary data to associate a product settings file with a bar code. New entries can be added. Existing entries can be edited, deleted, and uploaded to a Basler product.

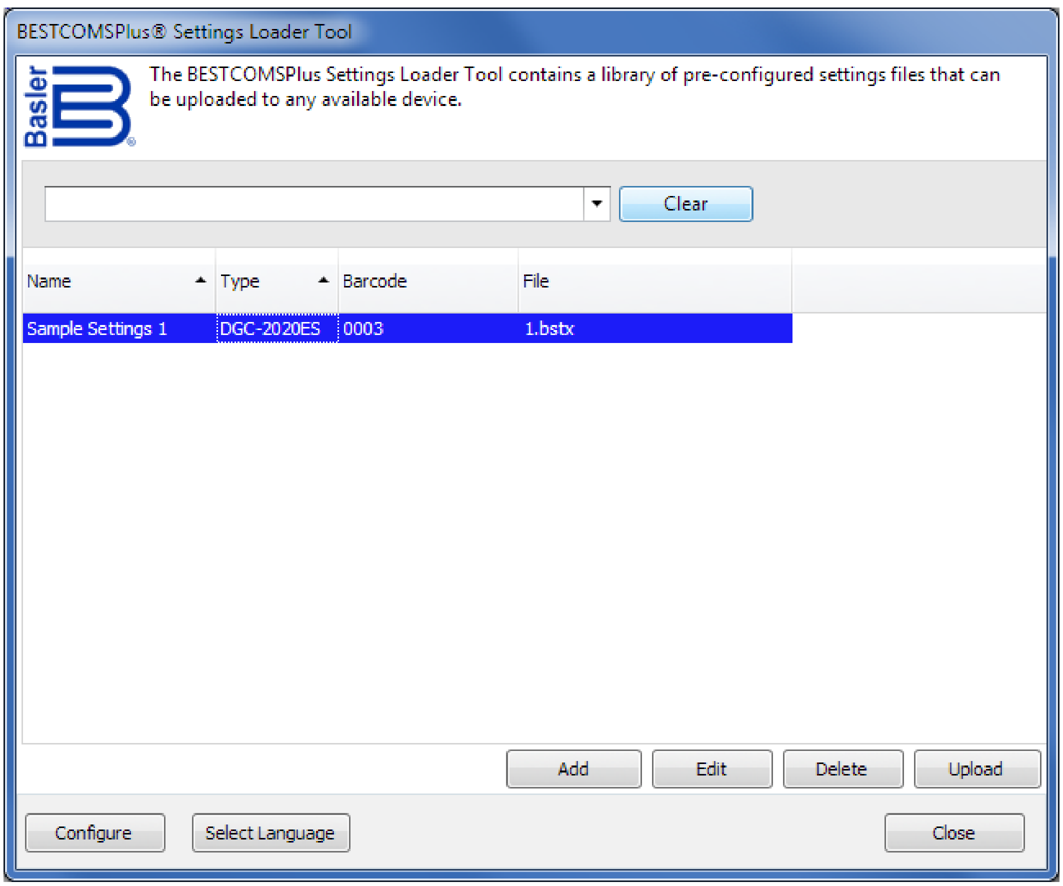


Figure 16-1. Loader Grid

Scanning Bar Codes

Place the cursor in the text field, found at the top of the Loader Grid screen, and scan a bar code. If successful, the digits which comprise the bar code appear in the text field. The BESTCOMS*Plus* Settings

Loader Tool automatically searches for this bar code among the entries in the Loader Grid and displays the matching entry. Click Clear to remove the digits from the text field.

Adding an Entry

Click Add to create an entry. The BESTCOMS*Plus*® Settings Loader Tool: Add Device dialog box appears (Figure 16-2).

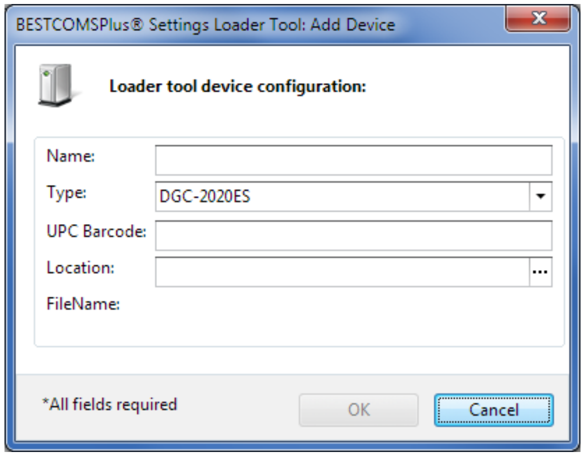


Figure 16-2. Add Device Screen

Enter the name of the entry in the Name field. This appears in the first column of the Loader Grid.

Select the product type from the Type drop-down menu. This appears in the second column of the Loader Grid.

Enter the bar code of the entry in the UPC Barcode field by placing the cursor in the UPC Barcode field and scanning the bar code.

To select the product settings file for the entry, click the browse (…) button in the Location field. Use standard Windows methods to navigate to the desired product settings file and click Open. Ensure that the selected product type in the Type field matches that of the product settings file specified in the Location field.

Click OK when finished.

Editing an Entry

To Edit an existing entry, select the entry in the Loader Grid and click Edit. The BESTCOMSPlus Settings Loader Tool: Edit Device dialog box appears. The options are identical to those of the Add Device dialog. When the desired changes have been made, click OK.

Deleting an Entry

To delete an entry from the Loader Grid, select the entry and click the Delete button. A prompt appears providing the option to confirm or cancel the deletion.

Uploading an Entry

Select an entry and click Upload. A dialog appears which provides connection options for the appropriate type of device. Refer to the Basler product instruction manual for detailed connection information. Once a connection is established, the product settings associated with the entry are uploaded.

Configuration Settings

For configuration settings, click the Configure button in the bottom left of the Loader Grid. The product tabs on the left represent the compatible Basler products. Each product tab contains tabs for Settings Files and Connection Options. The options on these tabs are described below.

Setting Files Options

Use Saved Path: When enabled, the path specified in the Loader Grid entry is used when uploading the settings file.

Single Folder: When enabled, this specifies a single folder which contains all settings files for the product. The Windows filename specified in the Location field of the Loader Grid entry is searched for in the Single Folder location. For example, all settings files for a product are located in “C:\files”. The Location field in the Loader Grid entry for a device contains “C:\documents\settings\DGC-2020ES Settings.bstx”. The BESTCOMS*Plus* Settings Loader Tool searches in “C:\files” for the file named “DGC-2020ES Settings.bstx”.

Append Bar-Code to Location: When enabled, the bar code is appended to the specified location when uploading the settings file. For example, an entry with the bar code “0002” is located in C:\files\0002 and an entry with the bar code “0003” is located in C:\files\0003.

Logon: If User Name and Password are specified, you will not be prompted for credentials when required.

Save After Upload: After uploading a settings file, the settings are downloaded from the connected device and saved to the specified location, when enabled.

Upload Security: When enabled, the security settings stored in the settings file are uploaded to the device. Credentials will be requested if not already specified.

Figure 16-3 illustrates the Setting Files tab.

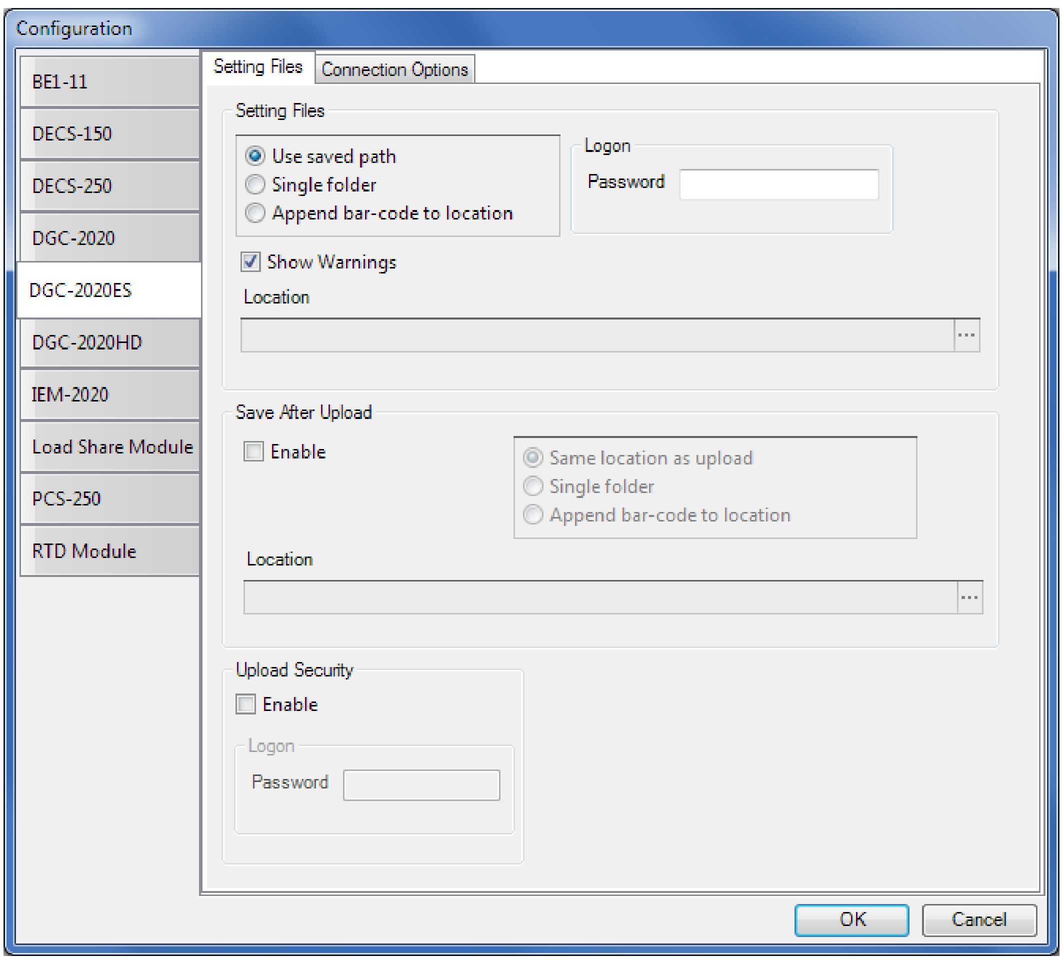


Figure 16-3. Configuration, Settings Files Tab

Connection Options

Connection options consist of the three selections described below. Refer to the Basler product instruction manual for detailed connection information.

Always Prompt for Connection: When enabled, a dialog appears which provides connection options for the appropriate type of device each time a connection attempt is made.

Ethernet Connection: When enabled, the BESTCOMS*Plus* Settings Loader Tool automatically attempts to connect to the specified IP address before uploading settings.

USB Connection: When enabled, the BESTCOMS*Plus*® Settings Loader Tool automatically attempts to connect to the device via USB port before uploading settings.

Figure 16-4 illustrates the Connection Options tab.

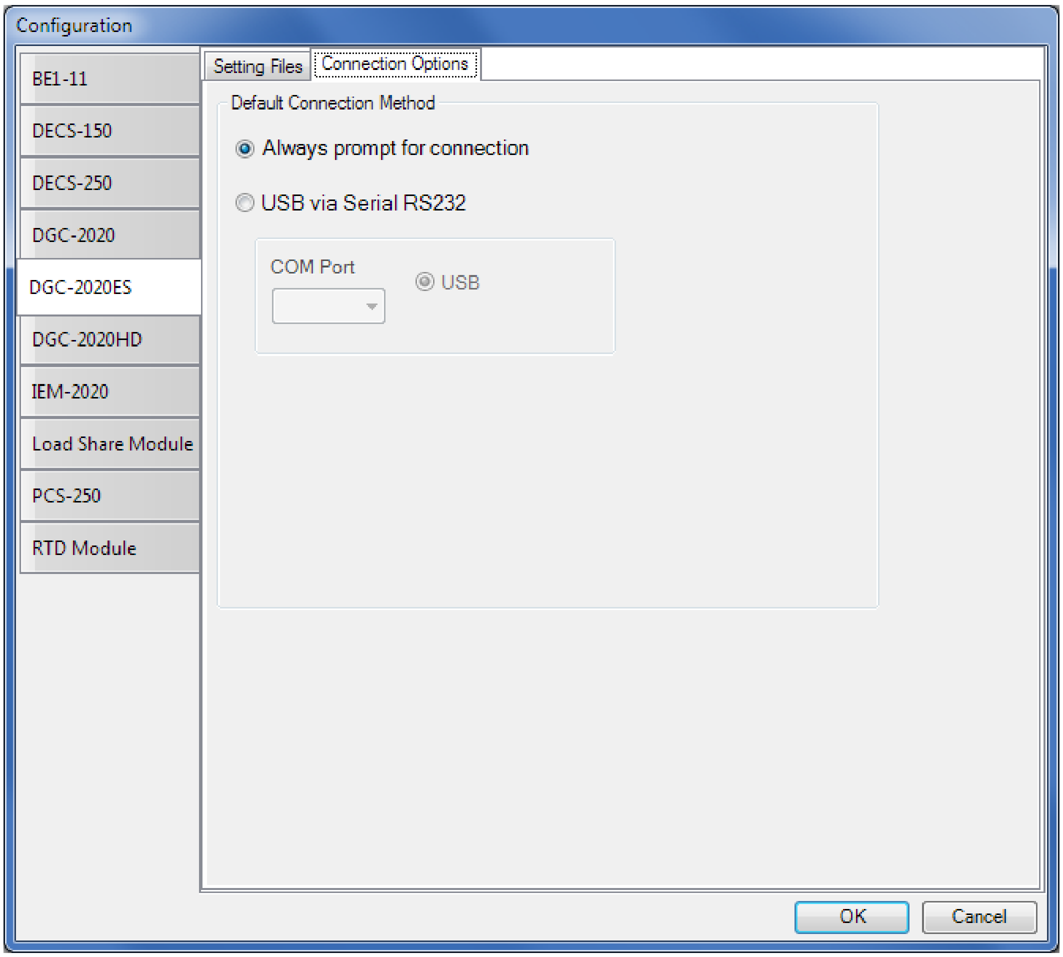


Figure 16-4. Configuration, Connection Options Tab

General Operation

The steps listed below are provided as a general guideline for how to operate the BESTCOMS*Plus* Settings Loader Tool when the initial setup is complete and the settings files are associated with bar codes.

1. Power on the device which will receive the new settings. Ensure proper communication connections have been made between the device and the PC running BESTCOMS*Plus* Settings Loader Tool.
2. Run BESTCOMS*Plus* Settings Loader Tool.
3. Place cursor in search bar.

4. Scan bar code.
5. Settings file is automatically highlighted and isolated in the grid.
6. Click Upload.
7. BESTCOMS*Plus* Settings Loader Tool automatically connects to device and uploads settings. Device connection is automatic unless “Always prompt for connection” is enabled.

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DGC-2020ES

Digital Genset Controller

Operation Instruction Manual

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Preface

This instruction manual provides information about the operation of the DGC-2020ES Digital Genset Controller. To accomplish this, the following information is provided:

- Controls and indicators
- Operating modes
- Metering
- Reporting and alarms
- Troubleshooting

Conventions Used in this Manual

Important safety and procedural information is emphasized and presented in this manual through Warning, Caution, and Note boxes. Each type is illustrated and defined as follows.

Warning!

Warning boxes call attention to conditions or actions that may cause personal injury or death.

Caution

Caution boxes call attention to operating conditions that may lead to equipment or property damage.

Note

Note boxes emphasize important information pertaining to Digital Genset Controller installation or operation.

DGC-2020ES Instruction Manual Catalog

Available instruction manuals for the DGC-2020ES are listed in Table 1.

Table 1. Instruction Manuals

Part Number	Description
9469200993	Quick Start
9469200994	Installation
9469200995	Configuration
9469200996	Operation (this manual)
9469200997	Accessories

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Warning!
READ THIS MANUAL. Read this manual before installing, operating, or maintaining the DGC-2020ES. Note all warnings, cautions, and notes in this manual as well as on the product. Keep this manual with the product for reference. Only qualified personnel should install, operate, or service this system. Failure to follow warning and cautionary labels may result in personal injury or property damage. Exercise caution at all times.

Basler Electric does not assume any responsibility to compliance or noncompliance with national code, local code, or any other applicable code. This manual serves as reference material that must be well understood prior to installation, operation, or maintenance.
For terms of service relating to this product and software, see the *Commercial Terms of Products and Services* document available at www.basler.com/terms.
This publication contains confidential information of Basler Electric Company, an Illinois corporation. It is loaned for confidential use, subject to return on request, and with the mutual understanding that it will not be used in any manner detrimental to the interests of Basler Electric Company and used strictly for the purpose intended. It is not the intention of this manual to cover all details and variations in equipment, nor does this manual provide data for every possible contingency regarding installation or operation. The availability and design of all features and options are subject to modification without notice. Over time, improvements and revisions may be made to this publication. Before performing any of the following procedures, contact Basler Electric for the latest revision of this manual.
The English-language version of this manual serves as the only approved manual version.

Revision History

A historical summary of the changes made to this instruction manual is provided below. Revisions are listed in reverse chronological order.

Visit www.basler.com to download the latest hardware, firmware, and BESTCOMS*Plus*® revision histories.

Instruction Manual Revision History

Manual Revision and Date	Change
B, Nov-19	• Removed Rev Letter from all pages. • Changed sequential numbering to sectional numbering. • Moved Instruction Manual Revision History into Preface. • Removed standalone Revision History chapter. (Revision histories for hardware, firmware, and software are now in separate documents on www.basler.com.) • Added support for firmware version 1.04.00 and BESTCOMS*Plus* version 4.01.00.
A1, Apr-19	• Updated Proposition 65 statement
A, Sep-18	• Updated Revision History chapter
—, Apr-17	• Initial release

Contents

1 • Controls and Indicators

DGC-2020ES controls and indicators are located on the front panel and are intended for local control and monitoring of DGC-2020ES operation. Front panel controls consist of pushbuttons. Front-panel indicators consist of LED (light emitting diode) indicators and a backlit LCD (liquid crystal display).

DGC-2020ES controls and indicators are illustrated in Figure 1-1. Lettered locators in Figure 1-1 correspond to the control and indicator descriptions of Table 1-1.

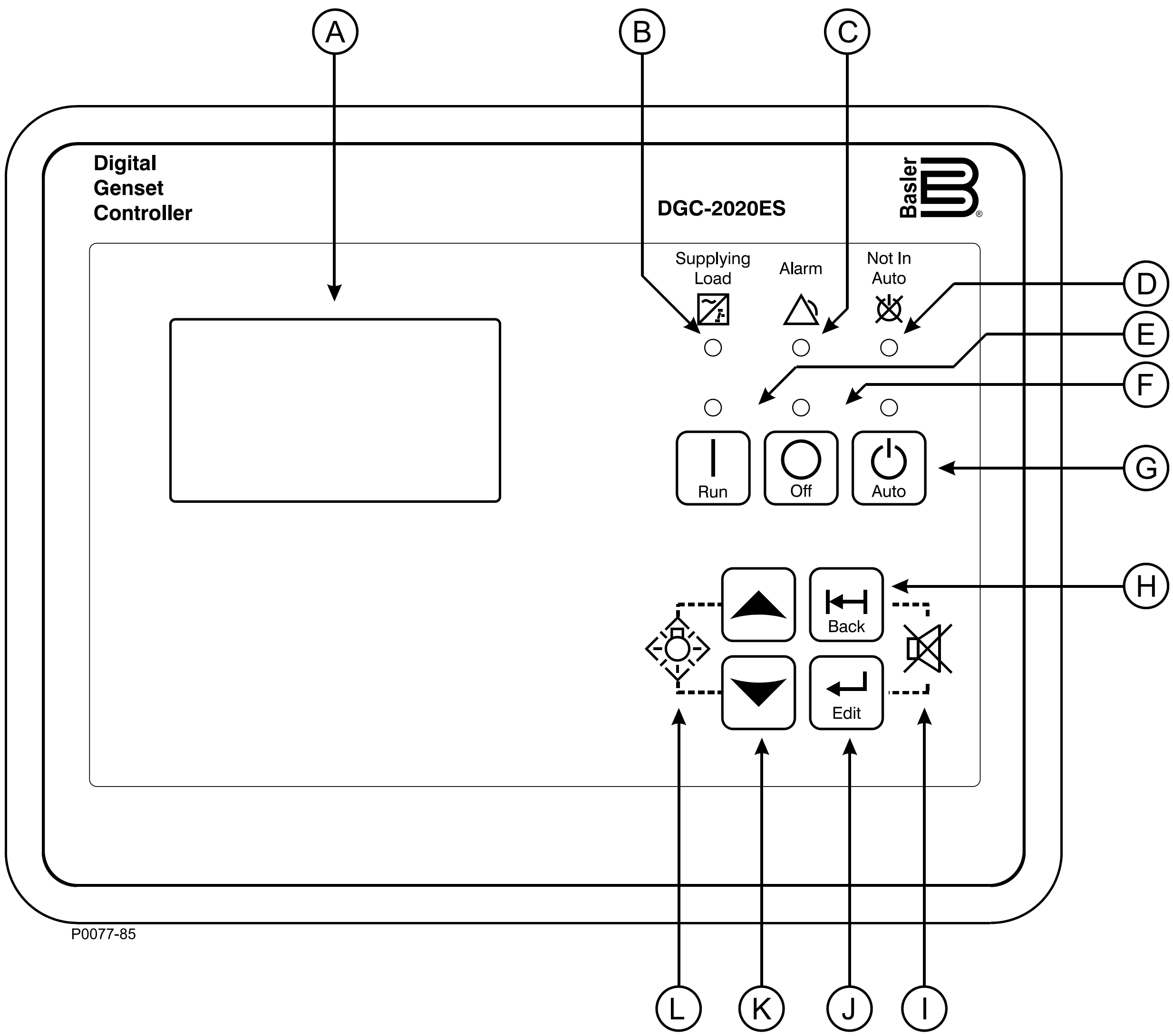


Figure 1-1. Front Panel

Table 1-1. Front-Panel HMI Descriptions

Locator	Description
A	*Liquid Crystal Display.* The backlit, 64 by 128 pixel LCD serves as the local information source for metering, alarms, pre-alarms, and protective functions. Display operation is maintained at –40°C.
B	*Supplying Load Indicator.* This green LED lights when the generator current is greater than Emergency Power Supply (EPS) threshold current.
C	*Alarm Indicator.* This red LED lights continuously during alarm conditions and flashes during pre-alarm conditions.

Locator	Description
D	*Not in Auto Indicator.* This red LED lights when the DGC-2020ES is not operating in Auto mode. When the DGC-2020ES is operating in Run or Off mode, this LED is on.
E	*Run Pushbutton and Mode Indicator.* Pressing this button places the DGC-2020ES in Run mode. The green Run mode LED lights when Run mode is active.
F	*Off Pushbutton and Mode Indicator.* Pressing this button places the DGC-2020ES in Off mode. The red Off mode LED lights when the DGC-2020ES is in Off mode. This button also resets the Breaker Management Pre-Alarms and all MTU ECU Alarms.
G	*Auto Pushbutton and Mode Indicator.* Pressing the Auto button places the DGC-2020ES in Auto mode. The green Auto mode LED lights when Auto mode is active.
H	*Back Pushbutton.* This button is pressed to cancel a settings editing session and discard any settings changes. When navigating through menus, pressing this button moves upward a level. When pressed momentarily, this button also resets the Breaker Management Pre-Alarms and all MTU ECU Alarms. This button is also used to reset the Maintenance Interval when pressed for 10 seconds while viewing Hours Until Maintenance or Maintenance Due Pre-Alarm.
I	*Alarm Silence Pushbutton Combination*. Simultaneously pressing both the *Back* and *Edit* buttons opens the relay output programmed as the horn output.
J	*Edit Pushbutton.* Pressing this button starts an editing session and enables changes to DGC-2020ES settings. At the conclusion of an editing session, the Edit pushbutton is pressed again to save the setting changes. When navigating through menus, pressing this button moves downward one level. When entering a string, such as a password, this button locks the selected character and moves to the next position. When finished, press Edit twice to submit the string.
K	*Arrow Pushbuttons.* These two buttons are used to navigate through the front-panel display menus and modify settings. Within a level, the up- and down-arrow buttons are used to move among items within the menu level. Pressing the down-arrow button moves to items lower in the list. Pressing the up-arrow button moves to items higher in the list. During a settings editing session, the up- and down-arrow buttons are used to raise and lower the value of the selected setting.
L	*Lamp Test Pushbutton Combination*. Simultaneously pressing both the Up- and Down-arrow buttons tests the DGC-2020ES indicators by exercising all LCD pixels and lighting all LEDs for as long as both buttons are held.

Display Operation and Navigation

The front-panel display is used to make settings changes and display metering values. Refer to locators H, J, and K in Table 1-1 for information on changing settings through the front panel and navigating through the Metering screens.

Login and Permissions

To login, navigate to the SETTINGS, ENTER PASSWORD screen and press the *Edit* key. Use the *Up/Down* arrow keys to scroll through the characters. Use the *Edit* key to accept a character and move to the next space. Once the password has been entered, press the *Edit* key again to login. A LOGOUT selection now appears in the list of SETTINGS. To logout, navigate to SETTINGS > LOGOUT and press the *Edit* key. The LOGOUT selection is removed from the SETTINGS list.

If communication access is active through the USB port, the front panel will display REMOTE COMMS, FRONT PANEL IS READ ONLY, and the summary screen. This informs the user that the front panel can only be used for viewing metering data and settings information. USB port access must be ended before modifying settings through the front panel.

If a front-panel key is not pressed for more than 15 minutes, the user is automatically logged out.

Summary Screen and Configurable Metering

The summary screen can be set to standard or scrolling. When set to standard, only the following parameters are displayed:

- VOLT∗
- AMP∗
- PH∗
- Hz
- OIL
- FUEL
- TEMP
- BATT

∗ When set to standard, individual phase information can be automatically toggled at a rate set by the Phase Toggle Delay setting. Navigate to the SETTINGS > GENERAL SETTINGS > FRONT PANEL HMI screen and edit PH TOG DELAY. When the Phase Toggle Delay is set to zero, information for each phase is obtained by pressing the *Up* or *Down* arrow keys on the front-panel HMI. When it is set to a number other than zero, the display will toggle through the phases automatically at the rate specified by the Phase Toggle Delay Setting.

When the summary screen is set to scrolling, you can select/configure the metering values that are displayed. Up to 20 values can be displayed and these values will scroll at a delay time specified by the user. To select a standard or scrolling summary, navigate to the SETTINGS > GENERAL SETTINGS > FRONT PANEL HMI screen and edit the SUMMARY VIEW. The SCROLL DELAY setting is also found on this screen.

To select the scrolling values, navigate to the SETTINGS > GENERAL SETTINGS > FRONT PANEL HMI screen and edit the CONFIGURABLE METERING. The following parameters may be placed in the scrolling summary:

- BATT V
- BLANK (Shows nothing on this line)
- BOOST PRESS
- BUS Hz
- BUS VAB
- BUS VBC
- BUS VCA
- CHRG AIR TMP
- COOLANT PRESS
- DEF1 %
- DEF2 %
- ENGINE % LOAD
- ENG INTCLR TEMP
- ENG OIL TEMP
- FUEL
- FUEL DELV P
- FUEL RATE
- FUEL TEMP
- GEN Hz
- GEN IA
- GEN IB
- GEN IC
- GEN PF
- GEN VAB
- GEN VAN
- GEN VBC
- GEN VBN
- GEN VCA
- GEN VCN
- INJ RAIL PRS
- INTAK MNFLD TMP
- kVA A
- kVA B
- kVA C
- kVA TOT
- kvar A
- kvar B
- kvar C
- kvar TOTAL
- kW A
- kW B
- kW C
- kW LD%
- kWh
- kW TOT
- NONE (Removes a line from the scrolling list)
- OIL P
- RPM
- RPM SRC
- RUN HRS
- TEMP
- TOTAL FUEL USED

Sleep Mode

Sleep mode de-energizes the LCD backlight and heater and turns off the front-panel LEDs when no pushbutton activity is detected for 15 minutes and the DGC-2020ES is operating in OFF mode or Auto mode with the engine not running. Normal display operation resumes when any pushbutton is pressed or the genset is started remotely via the ATS input. Sleep mode will not be entered while an alarm is active. Sleep mode can be permanently disabled through BESTCOMS*Plus*® or the front panel.

One-Line Diagram

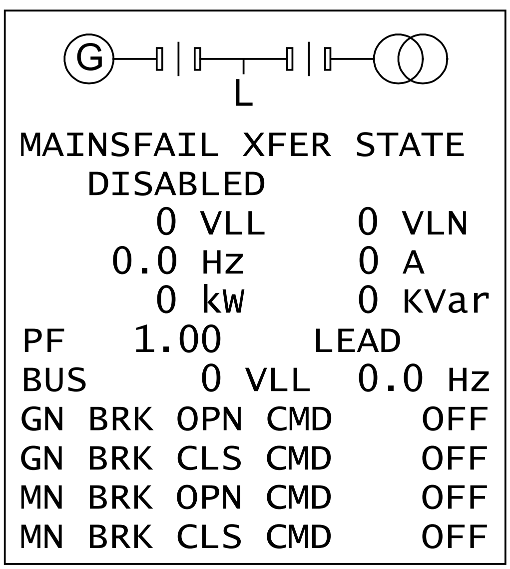
A one-line diagram of the breaker hardware configuration can be displayed on the front panel. This diagram changes in real time to reflect the current state of the configured breakers. The one-line diagram is disabled by default. To display the one-line diagram using front panel controls, navigate to Settings > General Settings > Front Panel HMI > One-Line Diagram and enable the setting. If using BESTCOMS*Plus,* navigate to Settings Explorer, General Settings, Front Panel HMI and select Enable on the One-Line Diagram setting.

Once enabled, the one-line diagram appears on both the front-panel Summary and Main Menu screens. The One-Line Diagram Menu screen provides metering for mains fail transfer, generator and bus parameters as well as breaker controls. To access the One-Line Diagram Menu screen, go to the Main Menu and select the one-line diagram as you would a normal menu option and press the *Edit* pushbutton. The one-line diagram, mains fail transfer state (if enabled), generator and bus parameters, and breaker controls are displayed respectively from the top of the menu.

Further mains fail transfer state metering is available by selecting the "MAINSFAIL XFER STATE" and pressing the *Edit* pushbutton. Mains fail transfer state, transfer delay, return delay, and max transfer time are displayed.

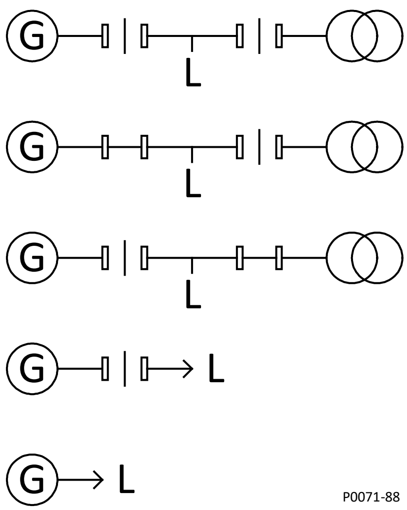
To issue a breaker open or breaker close command, select the appropriate menu option, press *Edit* and select ON.

The ONE-LINE DIAGRAM screen options are shown in Figure 1-2.



P0071-89

Figure 1-2. One-Line Diagram Menu Options (Available when One-Line Diagram is Enabled)



Generator and mains breakers are configured and both breakers are open.

Generator and mains breakers are configured. The generator breaker is closed and the mains breaker is open.

Generator and mains breakers are configured. The generator breaker is open and the mains breaker is closed.

Generator breaker is configured and open.

No breakers are configured.

Figure 1-3. One-Line Diagram: Breaker Hardware Status Indication

Mains Fail Transfer Status Display

Mains Fail Transfer Status can be viewed from three locations; however, the DGC-2020ES must be equipped with Mains Fail Transfer (style number xx2) and Mains Fail Transfer must be enabled.

To enable Mains Fail Transfer, navigate to Settings > Breaker Management > Breaker Hardware > Mains Fail Transfer using the front panel controls or Settings Explorer, Breaker Management, Mains Fail using BESTCOMS*Plus*.

Mains Fail Transfer Status is displayed on the front panel in Metering > Alarms-Status > Mains Fail Transfer and also on the Breaker Hardware One-Line Diagram screen. It is displayed in BESTCOMS*Plus* on the Metering Explorer, Mains Fail Transfer Status screen.

These screens display the Mains Fail Transfer State and any timers relevant to the mains fail transfer process. These parameters are listed below.

Mains Fail Transfer State: The different mains fail transfer states are described below.

Power From Mains: Power is being supplied to the load from the mains bus.

Transfer Timer Active: Transfer Delay timer is actively counting.

Transferring to Gens: Load is being transferred to the generator bus.

Power From Gens: Power is being supplied to the load from the generator bus.

Return Timer Active: Return Delay timer is actively counting.

Transferring to Mains: Load is being transferred to the mains bus.

Disabled: DGC-2020 is in the OFF or RUN operating mode or in the alarm state.

Transfer Delay: Displays the current timer value in seconds.

Return Delay: Displays the current timer value in seconds.

Max Transfer Time: Displays the current timer value in seconds.

Note
The Mains Fail Transfer screen found at Metering > Alarms-Status > Mains Fail Transfer shows only timers that are actively counting and are relevant to mains fail transfer. They are not otherwise visible.

Changing a Setting

To change a setting, navigate to the setting you want to change and press the *Edit* key. If you are not already logged in, you will be prompted for your password. Use the *Up/Down* arrow key to raise or lower the value. Press the *Edit* key again when finished.

Front-Panel Display Structure

The front-panel display structure begins with the SUMMARY SCREEN. Pressing the *Edit* key opens the MAIN MENU screen. The MAIN MENU screen consists of METERING, SETTINGS and, when enabled, the ONE-LINE DIAGRAM, indicated by this symbol: . The METERING screen branches are shown in Figure 1-4. Details of the METERING screen branches follow Figure 1-4. The SETTINGS screen branches are shown in Figure 1-5. Details of the SETTINGS screen branches follow Figure 1-5.

METERING

ENGINE
GENERATOR
POWER
RUN STATISTICS
ALARMS-STATUS
DIAGNOSTICS

P0067-82

Figure 1-4. Metering Screen Branches

ENGINE

- **OIL PRESSURE**
- **COOLANT TMP**
- **BATTERY VOLT**
- **RPM**
- **SPEED SRC**
- **FUEL LEVEL**
- **ENGINE LOAD**
- **COOLANT LEVL** (Visible when CAN Bus is enabled.)
- **RUN HOURS**
- **HRS TO MAINT**
- **DEF TANK 1 LVL %** (Visible when CAN Bus is enabled.)
- **DEF TANK 2 LVL %** (Visible when CAN Bus is enabled.)
- **REQUESTED RPM**
- **REQ ACCL PEDAL** (Visible when the selected ECU type is Volvo Penta.)
- **REQ SPEED BIAS** (Visible when the selected ECU type is Cummins.)

GENERATOR

- **GEN CONNECT**
- **GEN VAB**
- **GEN VBC**
- **GEN VCA**
- **GEN VAN**
- **GEN VBN**
- **GEN VCN**
- **GEN FREQ**
- **GEN AMPS A**
- **GEN AMPS B**
- **GEN AMPS C**
- **BUS CONNECT**
- **BUS VAB**
- **BUS FREQ**

POWER

- **kW A**
- **kW B**
- **kW C**
- **kW TOTAL**
- **kVA A**
- **kVA B**
- **kVA C**
- **kVA TOTAL**
- **kvar A**
- **kvar B**
- **kvar C**
- **kvar TOTAL**
- **PF**

RUN STATISTICS

- **CUMULATIVE**
    - CUMULATIVE
        - START
        - # STARTS
        - HRS TO MAINT
        - kW-HRS
    - TOTAL RUN TIME
        - HOURS
        - MINUTES
    - LOADED RUN TIME
        - HOURS
        - MINUTES
    - UNLOADED RUN TIME
        - HOURS
        - MINUTES
- **SESSION**
    - SESSION
        - START
        - kW-HRS
    - TOTAL RUN TIME
        - HOURS
        - MINUTES
    - LOADED RUN TIME
        - HOURS
        - MINUTES
    - UNLOADED RUN TIME
        - HOURS
        - MINUTES

ALARMS-STATUS

- **ACTIVE ALARMS**
- **ACTIVE PRE-ALARMS**
- **MTU FAULT CODES** (Visible when ECU is configured for MTU MDEC, MTU ADEC, MTU ECU7/ECU8 or MTU Smart Connect.)
- **MTU STATUS** (Visible when ECU is configured for MTU MDEC, MTU ADEC, MTU ECU7/ECU8, or MTU Smart Connect.)
    - NMT-ALIVE STATUS (Visible when ECU is configured for MTU MDEC or MTU ECU7/ECU8.)
        - SPS_NODE
        - SW_TYP
        - SW_VAR
        - SW_ED1
        - SW_ED2
        - REV
        - SW_MOD
    - TRIP FUEL (Visible when ECU is configured for MTU ECU7/ECU8.)
        - TRIP HRS

        - TRIP IDLE HRS
        - FUEL RATE
        - TRIP FL RATE
        - TOTAL RUN TM
        - DAILY FUEL
        - TOTAL FUEL
    - FUEL (Visible when ECU is configured for MTU ADEC.)
        - DAY TANK LVL
        - STORE TANK LVL
    - ENGINE STATUS (Visible when ECU is configured for MTU ADEC, MTU ECU7/ECU8, or MTU Smart Connect.)
        - MTU FAULT CODES
        - ENG RUNNING
        - CYL CUTOUT
        - ENG OPTIMIZED (Visible when ECU is configured for MTU ADEC or MTU ECU7/ECU8.)
        - PREHT NT RCHD (Visible when ECU is configured for MTU ADEC or MTU ECU7/ECU8.)
        - SPEC TORQUE (Visible when ECU is configured for MTU ADEC or MTU ECU7/ECU8.)
        - SPD DMD FL MD (Visible when ECU is configured for MTU ADEC.)
        - CURR P DEGREE (Visible when ECU is configured for MTU ADEC.)
        - LOAD GEN ON (Visible when ECU is configured for MTU ADEC, MTU ECU7/ECU8, or MTU Smart Connect.)
        - PRIME PUMP ON (Visible when ECU is configured for MTU ADEC.)
        - RUNUP SPD LO (Visible when ECU is configured for MTU ADEC.)
        - IDLE SPD LO (Visible when ECU is configured for MTU ADEC.)
        - CYL CUTOUT CD (Visible when ECU is configured for MTU ECU7/ECU8.)
        - RPM (Visible when ECU is configured for MTU ECU7/ECU8.)
        - DROOP % (Visible when ECU is configured for MTU ECU7/ECU8 or MTU Smart Connect.)
        - ENG COOL TEMP (Visible when ECU is configured for MTU ECU7/ECU8.)
        - CHRG AIR TMP (Visible when ECU is configured for MTU ECU7/ECU8.)
        - INTRCOOLR TEMP (Visible when ECU is configured for MTU ECU7/ECU8.)
        - ENG OIL TEMP (Visible when ECU is configured for MTU ECU7/ECU8.)
        - FUEL TEMP (Visible when ECU is configured for MTU ECU7/ECU8.)
        - ECU TEMP (Visible when ECU is configured for MTU ECU7/ECU8.)
        - OIL PRESSURE (Visible when ECU is configured for MTU ECU7/ECU8.)
        - CHG AIR P (Visible when ECU is configured for MTU ECU7/ECU8.)
        - FUEL DELV P (Visible when ECU is configured for MTU ECU7/ECU8.)
        - FL RAIL P (Visible when ECU is configured for MTU ECU7/ECU8.)
        - CAMSHAFT RPM (Visible when ECU is configured for MTU ECU7/ECU8.)
        - IDLE RPM (Visible when ECU is configured for MTU ECU7/ECU8.)
        - ECU SHUTDOWN (Visible when ECU is configured for MTU ECU7/ECU8.)
        - TOTAL RUN TM (Visible when ECU is configured for MTU ECU7/ECU8.)
        - ECU SUPP VOLTS (Visible when ECU is configured for MTU ECU7/ECU8.)
        - INJCT DBR % (Visible when ECU is configured for MTU ECU7/ECU8.)
        - RATED RPM (Visible when ECU is configured for MTU ECU7/ECU8.)
        - INJCT QTY (Visible when ECU is configured for MTU ECU7/ECU8.)
        - RATED KW (Visible when ECU is configured for MTU ECU7/ECU8.)
        - RESRV PWR % (Visible when ECU is configured for MTU ECU7/ECU8.)
        - START SEQ (Visible when ECU is configured for MTU ECU7/ECU8 or MTU Smart Connect.)
        - ECU OVRD FDBK (Visible when ECU is configured for MTU Smart Connect.)
        - COOLNT PRHT DONE (Visible when ECU is configured for MTU Smart Connect.)
        - REQ TORQUE (Visible when ECU is configured for MTU Smart Connect.)
        - EXT STOP (Visible when ECU is configured for MTU Smart Connect.)
        - OPERATING MODE (Visible when ECU is configured for MTU Smart Connect.)
    - SPEED (Visible when ECU is configured for MTU ADEC, MTU ECU7/ECU8, or MTU Smart Connect.)
        - SPD DMD SRC
        - CAN SPD DMD
        - ANLG SPD DMD
        - SPEED DEMAND (Visible when ECU is configured for MTU Smart Connect.)
        - SEL SPD DMD (Visible when ECU is configured for MTU ADEC or MTU ECU7/ECU8.)
        - EFF SET SPEED (Visible when ECU is configured for MTU ADEC or MTU ECU7/ECU8.)
        - SPD DMD FL MD (Visible when ECU is configured for MTU ECU7/ECU8 or MTU Smart Connect.)
        - RATED RPM (Visible when ECU is configured for MTU ECU7/ECU8.)
        - RPM (Visible when ECU is configured for MTU ECU7/ECU8.)
        - CAMSHAFT RPM (Visible when ECU is configured for MTU ECU7/ECU8.)

        - IDLE RPM (Visible when ECU is configured for MTU ECU7/ECU8.)
        - FREQ RPM DMD (Visible when ECU is configured for MTU ECU7/ECU8.)
    - SIGNL FEEDBK (Visible when ECU is configured for MTU ADEC, MTU ECU7/ECU8, or MTU Smart Connect.)
        - ECU_OVRD_FDBK
        - EXT STOP
        - SPD UP IN
        - SPD DN IN
        - CAN MODE FDBK (Visible when ECU is configured for MTU ADEC or MTU ECU7/ECU8.)
        - CYL CUTOUT (Visible when ECU is configured for MTU ECU7/ECU8.)
    - DIAGNOSTICS (Visible when ECU is configured for MTU ECU7/ECU8.)
        - AL PWR AMP 1
        - AL PWR AMP 2
        - XSTR OUT AL
        - XSTR OUT STS
        - ECU SHUTDOWN
    - CAN BUS (Visible when ECU is configured for MTU ECU7/ECU8.)
        - CAN MODE FDBK
        - CAN NODES
        - LOST NODES
    - LIMITS (Visible when ECU is configured for MTU ECU7/ECU8.)
        - OIL PRESSURE
        - LO LIM OILP
        - LOLOLIM OILP
        - ENG COOL TEMP
        - CLNT LMT HI
        - CLNT LMT HIHI
        - CHRG AIR TMP
        - CHG AIR LMT HI
        - ECU SUPP VOLTS
        - L1L ECU VOLTS
        - L2L ECU VOLTS
        - U1L ECU VOLTS
        - U2l ECU VOLTS
        - INTRCOOLR TMP
        - INTCLR LMT HI
- **STATUS**
    - AUTO XFER SWITCH (Visible when the Auto Transfer Switch programmable function is configured to be driven by an input.)
    - EPS SUPP. LOAD
    - GEN BREAKER
    - MAINS BREAKER
    - BATTLE OVERRIDE (Visible when the Battle Override programmable function is configured to be driven by an input.)
    - LOW LINE OVERRIDE (Visible when the Low Line Override programmable function is configured to be driven by an input.)
    - LOW COOL LEVEL (Visible when the Low Coolant Level programmable function is configured to be driven by an input.)
    - LOW FUEL LEVEL (Visible when the Low Coolant Level programmable function is configured to be driven by an input.)
    - BATT CHRG FAIL (Visible when the Battery Charger Fail programmable function is configured to be driven by an input.)
    - FUEL LEAK DETECT (Visible when the Fuel Leak Detect programmable function is configured to be driven by an input.)
    - GRND DELTA O-RIDE (Visible when Generator Connection is configured for Delta and the Grounded Delta Override programmable function is configured to be driven by an input.)
    - 1 PHASE O-RIDE (Visible when the 1-Phase Override programmable function is configured to be driven by an input.)
    - BUS DEAD
    - BUS STABLE
    - BUS FAILED
    - GEN DEAD
    - GEN STABLE
    - GEN FAILED
    - ENG RUNNING

- CLDN TMR ACTVE
- OFF MODE COOLDN
- COOLDN REQ
- COOL & STOP REQ
- EXT START DEL
- START DEL BYPASS
- ALT FRQ O-RIDE
- RESET
- ALARM SILENCE
- LAMP TEST
- IDLE REQUEST
- LOAD TAKEOVER
- MAINS FAIL TEST
- CEM CONNECTED
- MF TRANSFER INHBT
- AUTO BRKR OP INH

- **INPUTS**
  - INPUT X (X = 1 to 7 (8 to 17 optional))
- **OUTPUTS**
  - START
  - RUN
  - PRESTART
  - OUTPUT X (X = 1 to 4 (5 to 28 optional))
- **LOGIC CTL RELAYS**
  - LCR X (X = 1 to 16)
- **CONF ELEMENTS**
  - CONFIG ELEMENT X (X = 1 to 8)
- **EVENT LOG**
  - [EVENT NAME]
    - ACTIVE
    - OCCURRENCE COUNT
    - FIRST DATE
    - FIRST TIME
    - LAST DATE
    - LAST TIME
    - FIRST ENG HRS
    - LAST ENG HRS
    - DETAILS
      - OCCURRENCE (Use the *Edit/Up/Down* keys to change the occurrence.)
      - DATE
      - TIME
      - ENG HRS
    - CLEAR EVENT (Visible when logged in through the front panel.)
- **J1939 DATA** (Visible when CAN bus is enabled and ECU is configured for Standard, Volvo Penta, MTU ADEC, GM/Doosan, Cummins, MTU Smart Connect, Scania, or John Deere.)
  - ENGINE ECU ADDR
  - THROTTLE POSITN
  - LOAD @ CRNT RPM
  - ACTUAL ENG TORQ
  - ENGINE SPEED
  - DESIRED SPEED
  - INJ CNTRL PRESS
  - INJ RAIL PRS
  - ENGINE HOURS
  - TRIP FUEL
  - TRIP AVE FL RT
  - TOTAL FUEL USED
  - ENG COOLANT TEMP
  - COOLNT PRHT DONE
  - FUEL TEMP
  - ENG OIL TEMP
  - ENG INTCLR TEMP
  - INTRCR CLNT LVL
  - FUEL DELV P
  - ENG OIL LEVEL

- ENG OIL PRESS
- COOLANT PRESS
- COOLANT LEVEL
- FUEL RATE
- BAROMETRIC PRESS
- AMB AIR TEMP
- AIR INLET TEMP
- BOOST PRESS
- INTAK MNFLD TEMP
- INTAK MNFLD1 ABS PRESS
- AIR FLTR DIF PRS
- EXHAUST GAS TEMP
- BATTERY VOLTAGE
- ECU INPUT VOLTS
- TRANS OIL PRESS
- TRANS OIL TEMP
- WINDG 1 TEMP
- WINDG 2 TEMP
- WINDG 3 TEMP
- ECU TEMP
- AUX PRESSURE1
- AUX PRESSURE2
- RATED KW
- RATED RPM
- EXHAUST TMP A
- EXHAUST TMP B
- AFT1 DPF OUT TEMP
- CHRG AIR TMP
- FUEL 1 LEAK
- FUEL 2 LEAK
- ALARM RST FDBK
- ECU SHUTDOWN
- DEF TANK 1 LVL %
- DEF TANK 2 LVL %
- DPF SOOT LEVEL %
- DPF ASH LEVEL %
- CRANKCASE PRESSURE
- FUEL FLT DF PRS
- OIL FLTR DIFF PRS
- DOC INLET TEMP
- DOC OUTLET TEMP

- **J1939 ENGINE CONFIG** (Visible when CAN bus is enabled and ECU is configured for Standard, Volvo Penta, MTU ADEC, GM/Doosan, Cummins, or MTU Smart Connect.)
  - SPD @ IDLE PNT 1
  - TRQ @ IDLE PNT 1
  - SPD @ PNT 2
  - TRQ @ PNT 2
  - SPD @ PNT 3
  - TRQ @ PNT 3
  - SPD @ PNT 4
  - TRQ @ PNT 4
  - SPD @ PNT 5
  - TRQ @ PNT 5
  - SPD @ PNT 6
  - ENDSPEED GOV KP
  - REF ENG TORQUE
  - O-RIDE SPD PNT 7
  - O-RIDE TIME LMT
  - SPEED LOWER LMT
  - SPEED UPPER LMT
  - TORQUE LOWER LMT
  - TORQUE UPPER LMT
- **J1939 ECU LAMP STATUS**
  - WARNING LAMP
  - RED LAMP

  - PROTECT LAMP
  - MALFUNC LAMP
- **J1939 ACTIVE DTC**
- **J1939 PREV DTC**
- **J1939 DTC CLEAR**
  - CLEAR ACTIVE DTCS
  - CLEAR PREV DTCS
- **ISUZU STATUS** (Visible when CAN bus is enabled and ECU is configured for Isuzu)
  - DPF AMBER LAMP
  - DPF GREEN LAMP
  - DPF MODE
- **YANMAR STATUS** (Visible when CAN bus is enabled and ECU is configured for Yanmar)
  - REGEN STATUS
  - EGR STATUS
  - AMB AIR TEMP
  - INTK MANIFLD PRESSURE
  - EXH MANIFOLD PRESSURE
  - DOC INLET TEMP
  - DOC OUTLET TEMP
  - DPF SOOT LEVEL %
  - DPF ASH LEVEL %
  - REGEN INTRLK STATUS
  - REGEN MODE
  - REGEN REQ FLG
  - ASH CLEAN REQ
- **MAINS FAIL TRANSFER** (Visible when DGC-2020ES style number is xx2 and Mains Fail Transfer is enabled.)
  - **MAINSFAIL XFER STATE**
    - **DISABLED** (The possible mains fail transfer states are as follows: Power From Mains, Transfer Timer Active, Transferring to Gens, Power From Gens, Return Timer Active, Transferring to Mains, Disabled (when DGC is in OFF or RUN modes, or in the alarm state))
  - **TRANSFER DELAY** (Visible when actively counting and relevant to mains fail transfer.)
  - **RETURN DELAY** (Visible when actively counting and relevant to mains fail transfer.)
  - **MAX TRANSFER TIME** (Visible when actively counting and relevant to mains fail transfer.)

DIAGNOSTICS

- **FLASH WR**

SETTINGS

GENERAL SETTINGS
COMMUNICATIONS
SYSTEM PARAMS
PROGRAMMABLE INPUTS
PROGRAMMABLE OUTPUTS
ALARM CONFIGURATION
GENERATOR PROTECTION
BREAKER MANAGEMENT
LOGIC TIMERS
ENTER PASSWORD

P0067-83

Figure 1-5. Settings Screen Branches

GENERAL SETTINGS

- **FRONT PANEL HMI**
  - SUMMARY VIEW
  - SCROLL DELAY
  - PH TOG DELAY
  - LCD CONTRAST
  - SLEEP MODE
  - LANGUAGE
  - CONFIGURABLE METERING
    - ITEM X (X = 1 to 20)
  - ONE LINE DIAGRAM

    - ENG HRS DISPLAY
    - OVERVIEW
    - EXH DISPLAY
    - EXH DISPL SCRN
    - BATT CHG DISPLAY
    - FUEL LVL DISPLAY
- **CONFIGURE DATE/TIME**
    - YEAR
    - MONTH
    - DAY
    - HOURS
    - MINUTES
    - SECONDS
    - UTC OFFSET
    - DST ENABLED
    - CLK NOT SET WRN
- **VIEW DATE/TIME**
- **VERSION INFO**
    - DGC-2020ES
        - FIRMWARE VERSION
        - BOOT CODE VERSION
        - SERIAL NUMBER
        - PART NUMBER
        - MODEL NUMBER
        - LANGUAGE VERSION
        - LANGUAGE PART NUM
        - FONT VERSION
        - FONT PART NUM
        - STYLE CODE
    - CEM-2020 (Visible when CEM-2020 is enabled.)
        - FIRMWARE VERSION
        - BOOT CODE VERSION
        - SERIAL NUMBER
        - PART NUMBER
        - MODEL NUMBER
        - BUILD DATE

COMMUNICATIONS∗

∗(Visible when the optional J1939 CAN bus is enabled, style code xCx.)

- **CAN BUS SETUP**
    - CAN BUS SETUP
        - CAN BUS ENABLE
        - DTC ENABLE (Visible when CAN BUS is enabled.)
        - SPN CONV METHOD (Visible when CAN BUS is enabled.)
        - CAN BUS ADDR (Visible when CAN BUS is enabled.)
        - ENGINE ECU ADDRESS (Visible when CAN BUS is enabled.)
        - ECU OPT SLCT (Visible when CAN BUS is enabled.)
        - ECU PULSING (Visible when CAN BUS is enabled.)
        - ENG SHTDN TM (Visible when CAN BUS is enabled.)
        - PLS CYCL TM (Visible when CAN BUS is enabled.)
        - ECU SET TM (Visible when CAN BUS is enabled.)
        - RESP TIMEOUT (Visible when CAN BUS is enabled.)
        - COOL TEMP SRC (Visible when CAN BUS is enabled.)
        - OIL PRESS SRC (Visible when CAN BUS is enabled.)
        - ENGINE RUN TM SRC (Visible when CAN BUS is enabled.)
    - ECU SETUP (Visible when CAN BUS is enabled.)
        - ECU CONF
        - CUMMINS ECU SETUP
            - CUMMINS GEN CONTROL
        - ISUZU ECU SETUP
            - CLEAR ECU MEMORY
            - ESCAPE MODE
        - YANMAR ECU SETUP

- NUMBER OF CYLINDERS
- GEN DATA TRANSMIT
- ENGINE PARAM XMT
- TRIP RESET (Visible when ECU is configured for Standard, Volvo Penta, MTU ADEC, GM/Doosan, Cummins, or MTU Smart Connect.)
- START MODE
- DPF REGENRATE SETUP (Visible when ECU is configured for Standard, Volvo Penta, MTU ADEC, GM/Doosan, Cummins, or MTU Smart Connect.)
    - DPF MANUAL REGEN
    - DPF REGEN DISABLE
- BATT CHARGER SETUP
    - CHARGER 1 TYPE
    - CHARGER 2 TYPE
- BATT CHARGR PREALARMS
    - CH1 COMMS FAIL
    - CH1 BATTERY FAIL
    - CH1 CHARGER FAIL
    - CH1 AC OFF
    - CH2 COMMS FAIL
    - CH2 BATTERY FAIL
    - CH2 CHARGER FAIL
    - CH2 AC OFF
- SENS CHARGR PREALARMS
    - CH1 THERMAL LIMIT (Visible when CHARGER 1 TYPE is set to SENS)
    - CH1 HI DC VOLTS (Visible when CHARGER 1 TYPE is set to SENS)
    - CH1 LOW DC VOLTS (Visible when CHARGER 1 TYPE is set to SENS)
    - CH1 LO CRANK V (Visible when CHARGER 1 TYPE is set to SENS)
    - CH1 INVLD SETTINGS (Visible when CHARGER 1 TYPE is set to SENS)
    - CH1 SNGL UNIT FL (Visible when CHARGER 1 TYPE is set to SENS)
    - CH2 THERMAL LIMIT (Visible when CHARGER 2 TYPE is set to SENS)
    - CH2 HI DC VOLTS (Visible when CHARGER 2 TYPE is set to SENS)
    - CH2 LOW DC VOLTS (Visible when CHARGER 2 TYPE is set to SENS)
    - CH2 LO CRANK V (Visible when CHARGER 2 TYPE is set to SENS)
    - CH2 INVLD SETTINGS (Visible when CHARGER 2 TYPE is set to SENS)
    - CH2 SNGL UNIT FL (Visible when CHARGER 2 TYPE is set to SENS)
- SPEED SELECT (Visible when ECU is configured for Volvo Penta.)
- ACCEL POSITION (Visible when ECU is configured for Volvo Penta.)
- MODULE TYPE (Visible when ECU is configured for MTU MDEC or MTU ECU7/ECU8.)
- ALIVE MSG (Visible when ECU is configured for MTU MDEC or MTU ECU7/ECU8.)
- SPEED SETUP
    - J1939 RPM ENABLE (Visible when ECU is configured for Standard, Volvo Penta, MTU ADEC, GM/Doosan, Cummins, or MTU Smart Connect.)
    - ENGINE RPM
    - SAVE RPM ADJUSTS
    - RPM BAND WIDTH
    - IDLE RPM
    - RPM CHECKSUM
    - SPEED UP (Visible when ECU is configured for MTU ADEC, MTU MDEC 304, MTU ECU7/ECU8, or MTU Smart Connect.)
    - SPEED DN (Visible when ECU is configured for MTU ADEC, MTU MDEC 304, MTU ECU7/ECU8, or MTU Smart Connect.)
    - TEST OVRSPEED (Visible when ECU is configured for MTU ADEC, MTU MDEC 304, MTU ECU7/ECU8, or MTU Smart Connect.)
    - SPD DMAND SRC (Visible when ECU is configured for MTU ADEC, MTU MDEC 304, MTU ECU7/ECU8, or MTU Smart Connect.)
    - IDLE REQUEST (Visible when ECU is configured for MTU MDEC 304, MTU ECU7/ECU8, or MTU Smart Connect.)
    - INCREASE IDLE (Visible when ECU is configured for MTU MDEC 304, or MTU ECU7/ECU8.)
- ECU SETUP (Visible when ECU is configured for MTU ADEC, MTU MDEC 304, MTU ECU7/ECU8, or MTU Smart Connect.)
    - TRIP RESET (Visible when ECU is configured for MTU MDEC 304, or MTU ECU7/ECU8.)
    - INT OIL PRIME

        - GOV PRM SW (Visible when ECU is configured for MTU ADEC or MTU Smart Connect.)
        - ENG STRT PRIME (Visible when ECU is configured for MTU MDEC 304, or MTU ECU7/ECU8.)
        - FAN OVERRIDE (Visible when ECU is configured for MTU MDEC 304, or MTU ECU7/ECU8.)
        - MODE SWITCH (Visible when ECU is configured for MTU MDEC 304, or MTU ECU7/ECU8.)
        - GOV PARAM SET (Visible when ECU is configured for MTU ECU7/ECU8.)
        - CAN RATING SW 1 (Visible when ECU is configured for MTU ECU7/ECU8.)
        - CAN RATING SW 2 (Visible when ECU is configured for MTU ECU7/ECU8.)
        - DIS CYL CUT 1 (Visible when ECU is configured for MTU MDEC 304, or MTU ECU7/ECU8.)
        - DIS CYL CUT 2 (Visible when ECU is configured for MTU MDEC 304, MTU ECU7/ECU8 or MTU Smart Connect.)
        - OPERATING MODE (Visible when ECU is configured for MTU Smart Connect.)

SYSTEM PARAMS

- **SYSTEM SETTINGS**
    - GEN CONNECT
    - BUS CONNECT
    - RATED kW
    - RATED VOLTS
    - RATED FREQ
    - ALTRNATE FRQ
    - RATED RPM
    - RATED PF
    - ROTATION
    - EPS
        - EPS THRESHLD
        - LOW LINE SF (Visible when an input is selected for the Low Line Override programmable function.)
    - FUEL LVL TYP
    - SYSTEM UNITS
    - PRESSURE UNITS (Visible when Metric is selected for System Units.)
    - BATTERY VOLT
    - FLYWHL TEETH
    - SPEED SOURCE
    - MAINT RESET
    - NFPA LEVEL
    - POWER UP DELAY
- **REMOTE MODULE SETUP**
    - CEM SETUP
        - ENABLE
        - OUTPUTS (Visible when CEM-2020 is enabled.)
        - CAN BUS ADDR (Visible when CEM-2020 is enabled.)
        - VERSION INFO (Visible when CEM-2020 is enabled.)
            - FIRMWARE VERSION
            - BOOT CODE VERSION
            - SERIAL NUMBER
            - PART NUMBER
            - MODEL NUMBER
            - BUILD DATE
        - CEM DEBUG MENU (Visible when CEM-2020 is enabled.)
            - DGC TO CEM BP
            - CEM TO DGC BP
- **CRANK SETTINGS**
    - DISCNCT LMIT
    - PRECRNK DELY
    - PRESTRT CNTCT
    - STYLE
    - # CYCLES (Visible when Cycle is selected for Cranking Style.)
    - CONT TIME (Visible when Continuous is selected for Cranking Style.)

- CYCLE TIME
- REST TIME
- COOLDWN TIME
- COOLDOWN CONFIG
- RESTART DELAY
- OFF MODE COOLDN
- PRESTART REST CONFIG
  - CONF
- OIL PRS CRANK DISC
  - ENABLE
  - CRANK DISC PRS

- **AUTOMATIC RESTART**
  - ENABLE
  - ATTEMPTS
  - INTERVAL
- **EXERCISE TIMER**
  - MODE
  - RUN WITH LOAD
  - START HOUR
  - START MINUTE
  - RUN HOURS
  - RUN MINUTES
- **SENSING TRANS**
  - GEN PT PRI V
  - GEN PT SEC V
  - GEN CT PRI A
  - CT LOW LINE SF (Visible when an input is selected for the Low Line Override programmable function.)
  - BUS PT PRI V
  - BUS PT SEC V
- **RELAY CONTROL**
  - START
  - RUN
  - PRESTART
- **AUTO CONFIG DETECT**
  - ENABLE
  - LOW LINE THRESH
  - 1-PH THRESH
  - 1 PH GEN CONN
- **ENGINE STATISTICS**
  - START YEAR
  - START MONTH
  - START DAY
  - # STARTS
  - HRS TO MAINT
  - kW-HRS
  - TOTAL HRS
  - LOADED HRS
  - UNLOADED HRS

PROGRAMMABLE INPUTS

- **CONFIGURABLE INPUTS**
  - INPUT X (X = 1 to 7)
    - ALARM CONFIG
    - ACTIVATN DLY
    - RECOGNITION
- **PROG FUNCTIONS**
  - EMERGENCY STOP
    - INPUT
  - AUTO XFER SWITCH
    - INPUT
    - RECOGNITION (Visible when an INPUT is selected.)
  - GRND DELTA O-RIDE
    - INPUT
    - RECOGNITION (Visible when an INPUT is selected.)

  - BATTLE OVERRIDE
    - INPUT
    - RECOGNITION (Visible when an INPUT is selected.)
  - LOW LINE OVERRIDE
    - INPUT
    - RECOGNITION (Visible when an INPUT is selected.)
  - 1 PHASE O-RIDE
    - INPUT
    - RECOGNITION (Visible when an INPUT is selected.)
  - BATT CHRG FAIL
    - INPUT
    - ALARM CONFIG (Visible when an INPUT is selected.)
    - ACTIVATN DLY (Visible when an INPUT is selected.)
    - RECOGNITION (Visible when an INPUT is selected.)
  - LOW COOL LEVEL
    - INPUT
    - ALARM CONFIG (Visible when an INPUT is selected.)
    - ACTIVATN DLY (Visible when an INPUT is selected.)
    - RECOGNITION (Visible when an INPUT is selected.)
  - LOW FUEL LEVEL
    - INPUT
    - ALARM CONFIG (Visible when an INPUT is selected.)
    - ACTIVATN DLY (Visible when an INPUT is selected.)
    - RECOGNITION (Visible when an INPUT is selected.)
  - FUEL LEAK DETECT
    - INPUT
    - ALARM CONFIG (Visible when an INPUT is selected.)
    - ACTIVATN DLY (Visible when an INPUT is selected.)
    - RECOGNITION (Visible when an INPUT is selected.)

PROGRAMMABLE OUTPUTS

- **CONFIG ELEMENTS**
  - CONFIG ELEMENT X (X = 1 to 8)
    - ALARM CONFIG
    - ACTIVATN DLY
    - RECOGNITION

ALARM CONFIGURATION

- **HORN CONFIGURATION**
  - HORN
  - NOT IN AUTO HORN
- **PRE-ALARMS**
  - HIGH COOLANT TEMP
    - ENABLE
    - THRESHOLD
  - LOW COOLANT TEMP
    - ENABLE
    - THRESHOLD
  - LOW OIL PRESSURE
    - ENABLE
    - THRESHOLD
  - LOW FUEL LEVEL
    - ENABLE
    - THRESHOLD
    - HYSTERESIS
  - ENGINE OVERLOAD
    - ENG KW OVRLD 1
    - ENG KW OVRLD 2
    - ENG KW OVRLD 3
  - MAINTENANCE INTERVAL
    - ENABLE
    - THRESHOLD
  - BATTERY OVERVOLTAGE

        - ENABLE
        - THRESHOLD
    - LOW BATTERY VOLTAGE
        - ENABLE
        - THRESHOLD
        - ACTIVATN DLY
    - WEAK BATTERY VOLTAGE
        - ENABLE
        - THRESHOLD
        - ACTIVATN DLY
    - HIGH FUEL LEVEL
        - ENABLE
        - THRESHOLD
        - ACTIVATN DLY
        - HYSTERESIS
    - ACTIVE DTC (Visible when DTC is enabled.)
        - ENABLE
    - ECU COMMS FAIL (Visible when CAN BUS is enabled.)
        - ENABLE
    - COOLANT LEVEL (Visible when CAN BUS is enabled.)
        - ENABLE
        - THRESHOLD
    - CEM COMM FAIL (Visible when CEM-2020 is enabled.)
        - ENABLE
    - CHECKSUM FAIL
        - ENABLE
    - BRK CLOSE FAIL PALM
        - ENABLE
    - BRK OPEN FAIL PALM
        - ENABLE
    - REVERSE ROTATION
        - ENABLE
- **ALARMS**
    - HIGH COOLANT TEMP
        - ENABLE
        - THRESHOLD
        - ARMING DELAY
    - LOW OIL PRESSURE
        - ENABLE
        - THRESHOLD
        - ARMING DELAY
    - LOW FUEL LEVEL
        - ENABLE
        - THRESHOLD
        - ACTIVATN DLY
    - OVERSPEED
        - ENABLE
        - THRESHOLD
        - ACTIVATN DLY
    - COOLANT LEVEL (Visible when CAN bus is enabled.)
        - ENABLE
        - THRESHOLD
    - CAN LOW COOL LEVEL

Note
The HIGH COOLANT TEMP and LOW OIL PRESSURE alarms have an ARMING DLY setting that disables the alarm for the specified time after engine startup.

- **SENDER FAIL**
    - COOL TEMP SENDR FAIL
        - CONFIG TYPE
        - RECOGNITION
        - ACTIVATN DLY
        - MIN OHMS

        - MAX OHMS
        - SF DISPLAY
    - OIL PRESS SENDR FAIL
        - CONFIG TYPE
        - RECOGNITION
        - ACTIVATN DLY
        - MIN OHMS
        - MAX OHMS
        - SF DISPLAY
    - FUEL LEVL SENDR FAIL
        - CONFIG TYPE
        - RECOGNITION
        - ACTIVATN DLY
        - MIN OHMS
        - MAX OHMS
        - SF DISPLAY
    - VOLTAGE SENSE FAIL
        - CONFIG TYPE
        - ACTIVATN DLY
    - SPEED SENDR FAIL
        - TIME DELAY

GENERATOR PROTECTION

- **27 UNDERVOLTAGE**
    - LOW LINE SF (Visible when an input is selected for the Low Line Override programmable function.)
    - 3 / 1 PHASE SETTINGS
        - PICKUP
        - HYSTERESIS
        - TIME DELAY
        - FREQ INHIBIT
        - ALARM CONFIG
- **59 OVERVOLTAGE**
    - LOW LINE SF (Visible when an input is selected for the Low Line Override programmable function.)
    - 3 / 1 PHASE SETTINGS
        - PICKUP
        - HYSTERESIS
        - TIME DELAY
        - ALARM CONFIG
- **47 PHASE IMBALANCE**
    - PICKUP
    - HYSTERESIS
    - TIME DELAY
    - ALARM CONFIG
    - LOW LINE SF (Visible when an input is selected for the Low Line Override programmable function.)
- **81 O/U FREQUENCY**
    - UNDERFREQUENCY
        - INHIBIT VOLTS
        - PICKUP
        - HYSTERESIS
        - TIME DELAY
        - ALARM CONFIG
    - OVERFREQUENCY
        - PICKUP
        - HYSTERESIS
        - TIME DELAY
        - ALARM CONFIG
    - ALTRNT FRQ SCALE FCTR
        - ALT FREQ SF
- **50 OVERCURRENT**
    - LOW LINE SF (Visible when an input is selected for the Low Line Override programmable function.)
    - 3 / 1 PHASE SETTINGS
        - PICKUP
        - TIME DELAY
        - ALARM CONFIG

BREAKER MANAGEMENT

- **BREAKER HARDWARE**
  - MAINS FAIL TRANSFER
    - ENABLE
    - RETURN DELAY
    - TRANSFER DELAY
    - MAX TRANSFER TIME
  - CLOSE WAIT TIME
    - TIME
  - GEN BREAKER
    - CONTINUOUS
    - CLOSING TIME
    - OPEN CMD
    - CLOSE CMD
  - MAINS BREAKER
    - CONFIGURED
    - CONTINUOUS (Visible when configured.)
    - CLOSING TIME (Visible when configured.)
    - OPEN CMD (Visible when configured.)
    - CLOSE CMD (Visible when configured.)
  - BRK CLOSE FAIL PALM
  - BRK OPEN FAIL PALM
- **BUS CONDITION DETECT**
  - GEN DEAD
    - THRESHOLD
    - TIME DELAY
  - GEN STABLE
    - OV PICKUP
    - OV DROPOUT
    - UV PICKUP
    - UV DROPOUT
    - OF PICKUP
    - OF DROPOUT
    - UF PICKUP
    - UF DROPOUT
    - TIME DELAY
    - LOW LINE SF (Visible when an input is selected for the Low Line Override programmable function.)
    - ALT FREQ SF
  - GEN FAILED
    - TIME DELAY
  - BUS DEAD
    - THRESHOLD
    - TIME DELAY
  - BUS STABLE
    - OV PICKUP
    - OV DROPOUT
    - UV PICKUP
    - UV DROPOUT
    - OF PICKUP
    - OF DROPOUT
    - UF PICKUP
    - UF DROPOUT
    - TIME DELAY
    - LOW LINE SF (Visible when an input is selected for the Low Line Override programmable function.)
    - ALT FREQ SF
  - BUS FAILED
    - TIME DELAY

LOGIC TIMERS

- **TIMER X (X = 1 to 10)**
    - HOURS
    - MINUTES
    - SECONDS

ENTER PASSWORD

LOGOUT (Visible when logged in through the front panel.)

2 • Operating Modes

Three operating modes provide the versatility to meet the application's needs. The DGC-2020ES operates in Off, Run, or Auto mode. These operating modes are described in the following paragraphs.

Off

In OFF mode, the DGC-2020ES will not start under any circumstance. It cannot be started automatically. Programmable logic functions normally in this mode.

Run

In RUN (manual) mode, the DGC-2020ES runs and cannot be shut off automatically. The breaker can be opened or closed through programmable logic inputs. Programmable logic functions normally in this mode.

Auto

In AUTO mode, the DGC-2020ES may be started automatically or "self-start" from an automatic starting feature described in the following paragraphs. If the DGC-2020ES is not in AUTO mode, the self-starting modes will have no effect. The self-starting modes are independent, meaning that if any self-starting mode indicates that the unit should run, it will run. It will not shut down unless all self-starting modes indicate that the unit should not be running.

ATS Contact Input

The ATS (automatic transfer switch) programmable function has an input mapped to it through BESTCOMS*Plus*®. The unit will start and run when this contact is closed, and will stop when the contact is open.

Generator Exerciser

The unit starts at the designated time and runs for the specified duration. The breaker will be closed if "Run with Load" is checked in the generator exerciser settings.

Mains Fail Transfer Functionality

If mains fail transfer is enabled, the unit runs when any phase of the utility is dead or unstable, and will not stop until all phases of the utility are stable and the load has been transitioned to the utility.

Run-with-Load Logic Element

When the run-with-load logic element start input is energized, the unit starts and closes its breaker. When the run-with-load logic element stop input is energized, the unit opens its breaker and stops.

Engine Run Logic Element

When the engine run logic element start input is energized, the unit starts. When the engine run logic element stop input is energized, the unit opens its breaker if needed, cools down, and then stops.

Operating States

The DGC-2020ES goes through the operating states listed in Table 2-1 when starting and stopping the generator.

Table 2-1. Operating States

State	Description
Reset	The first state after a DGC-2020ES power up. Not running and not able to run until system initialization is complete.
Ready	The engine is not running. The DGC-2020ES is ready to run. This is the normal state of the DGC-2020ES in OFF mode, and in AUTO mode when the engine is not running, or in the process of starting or stopping.
Cranking	The DGC-2020ES is cranking the engine as part of the start sequence.
Resting	The DGC-2020ES is resting (not cranking) the starter between crank cycles as part of the start sequence.
Running	The engine is running.
Alarm	The engine is not running and is in the Alarm state. The engine cannot be run until the alarm is cleared by pressing the OFF button on the front panel. If the engine was running when the alarm state was entered, the unit will shut down.
Prestart	The DGC-2020ES is in a pre-start state for engine pre-heat or pre-lube purposes in anticipation of an engine start.
Cooling	The engine is running to allow cooldown in anticipation of an engine shutdown.
Connecting	The engine is not running. The DGC-2020ES is attempting to connect to the engine ECU to read data or establish communications for control. This state precedes an engine startup as part of the start sequence.
Disconnect	The engine is not running and possibly spinning down after completion of a run session. The DGC-2020ES removes KEY ON from the ECU after a run session is complete. This allows the engine to spin down prior to reconnecting to the ECU to read data after the engine has stopped.
Pulsing	The engine is not running. The DGC-2020ES is attempting to connect to the ECU to read data from it.
Unloading	When the DGC-2020ES is part of a multiple-unit, load-sharing system or is operating in parallel with utility power, the engine is running, but kW output is being reduced in anticipation of cooldown and subsequent shutdown.

Operating Mode Control

Controls for selecting operating mode are located on the front panel and within BESTCOMS*Plus*.

Refer to the *Controls and Indicators* chapter for more information.

3 • Metering

The DGC-2020ES provides comprehensive metering of internal and system conditions. These capabilities include extensive parameter metering, status indication and reporting.

Metering Explorer

DGC-2020ES metering is accessed through the metering explorer menu on the front panel display or the BESTCOMS*Plus*® metering explorer.

Front Panel

On the front panel, the metering explorer is accessed through the Metering branch of the menu. Refer to the *Controls and Indicators* chapter for more information.

BESTCOMS*Plus*®

In BESTCOMS*Plus,* the metering explorer is located in the upper left portion of the application window.

Metering Screen Docking

A docking feature within the metering explorer allows arrangement and docking of multiple metering screens. Clicking and dragging a metering screen tab displays a blue, transparent square, several arrow boxes, and a tab box. These docking elements are illustrated in Figure 3-1 and described in Table 3-1.

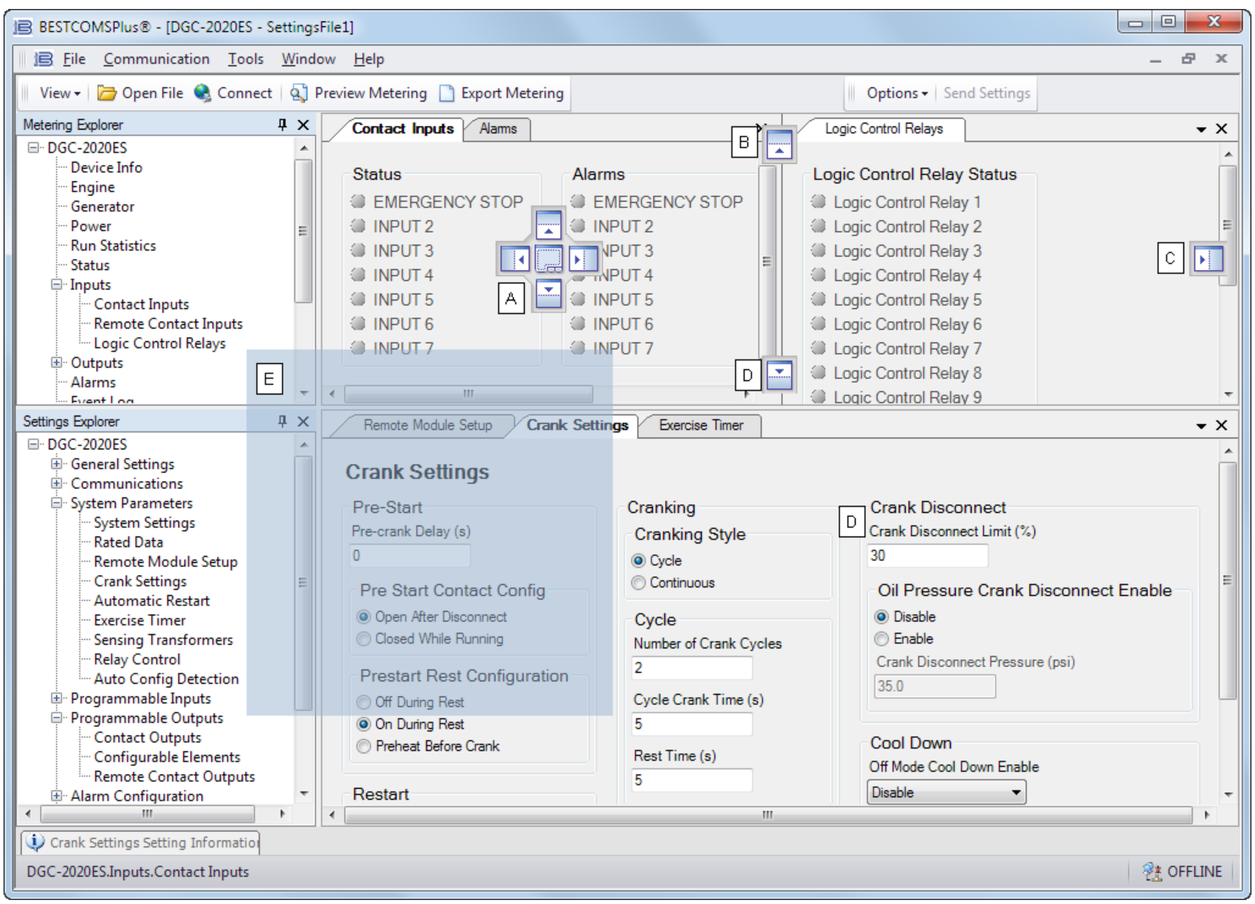
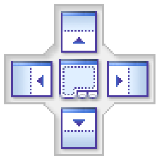


Figure 3-1. Metering Screen Docking Options

Table 3-1. Descriptions of Call-outs in Error! Reference source not found..

Call-Out	Symbol	Description
A		Holding the left mouse button down on a metering tab and dragging it to one of the four arrow boxes will place the metering tab inside the selected window on the location selected. To place the metering tab as a tab inside the selected window, drop it on the tabs button in the center of the arrow buttons.
B		Holding the left mouse button down on a metering tab and dragging it to this arrow box will place it across the top of the screen. Click on the (thumbtack) to dock it on the top bar. To display a screen that is docked, simply use the mouse to hover the pointer over the tab on the top bar.
C		Holding the left mouse button down on a metering tab and dragging it to this arrow box will place it across the side of the screen. Click on the (thumbtack) to dock it on the side bar. To display a screen that is docked, simply use the mouse to hover the pointer over the tab on the side bar.
D		Holding the left mouse button down on a metering tab and dragging it to this arrow box will place it across the bottom of the screen. Click on the (thumbtack) to dock it on the bottom bar. To display a screen that is docked, simply use the mouse to hover the pointer over the tab on the bottom bar.
E		Holding the left mouse button down on a metering tab and dragging it anywhere other than an arrow box will place it as a floating metering screen. This floating screen can later be closed by clicking on the in the upper right corner. It can also be dragged to one of the arrow boxes used for docking.

BESTspace™

BESTspace provides the ability to manage customized workspaces. Refer to the *BESTCOMSPlus* chapter in the *Configuration* manual for more information on BESTspace.

Engine

The *Engine* metering screen (Figure 3-2) provides information and metering of engine components. Parameters that do not apply to your engine are marked as either NS (not sent) or NA (not applicable).

The *Engine* screen is found in the BESTCOMS*Plus Metering Explorer*. If using the front panel, navigate to Metering > Engine.

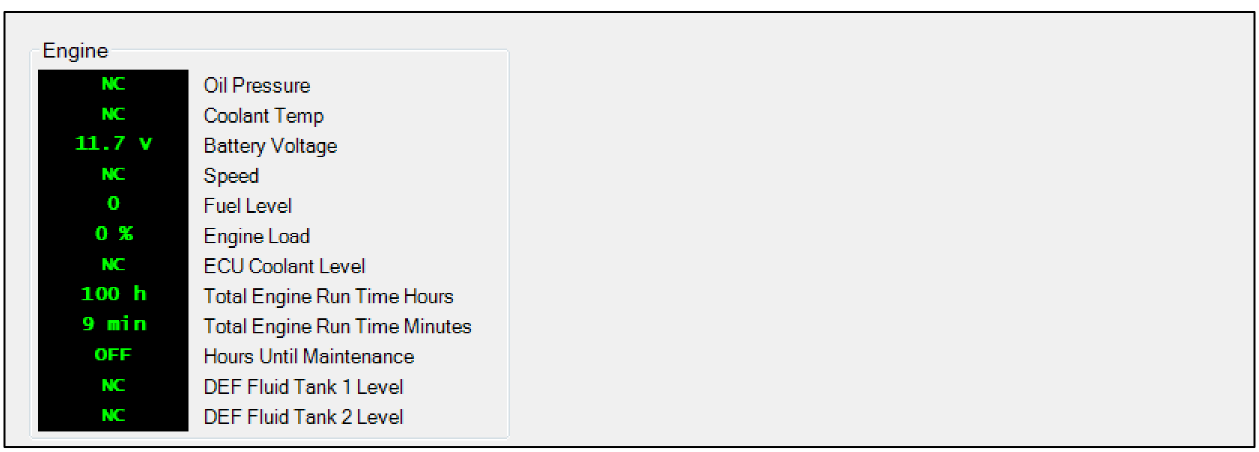


Figure 3-2. Metering Explorer, Engine Screen

Battery Charger

This screen provides information and metering for battery chargers 1 and 2. Refer to Figure 3-3.

The *Battery Charger* screen is found in the BESTCOMS*Plus Metering Explorer*. If using the front panel, navigate to Metering > Battery Charger.

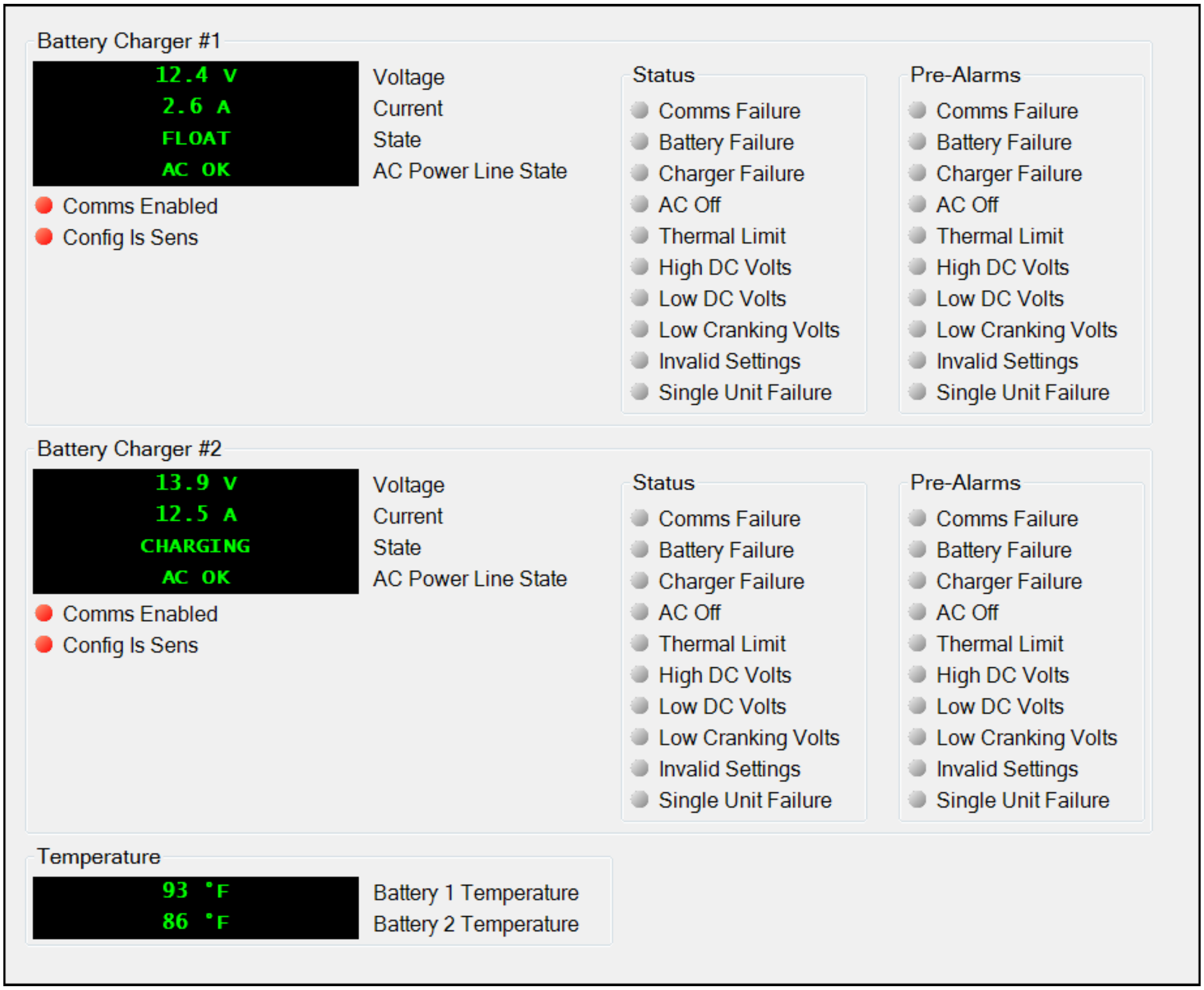


Figure 3-3. Metering Explorer, Battery Charger Screen

Generator

This screen provides metering of generator voltages and currents. See Figure 3-4.

The *Generator* screen is found in the BESTCOMS*Plus Metering Explorer*. If using the front panel, navigate to Metering > Generator.

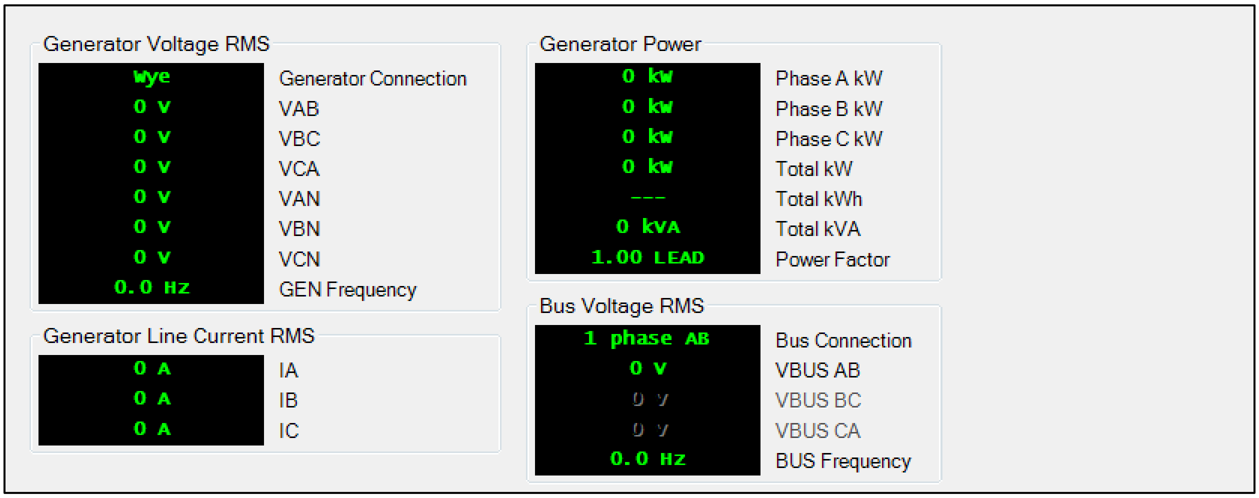


Figure 3-4. Metering Explorer, Generator Screen

Power

This screen provides metering of generator power and power factor. See Figure 3-5.

The *Power* screen is found in the BESTCOMS*Plus Metering Explorer*. If using the front panel, navigate to Metering > Power.

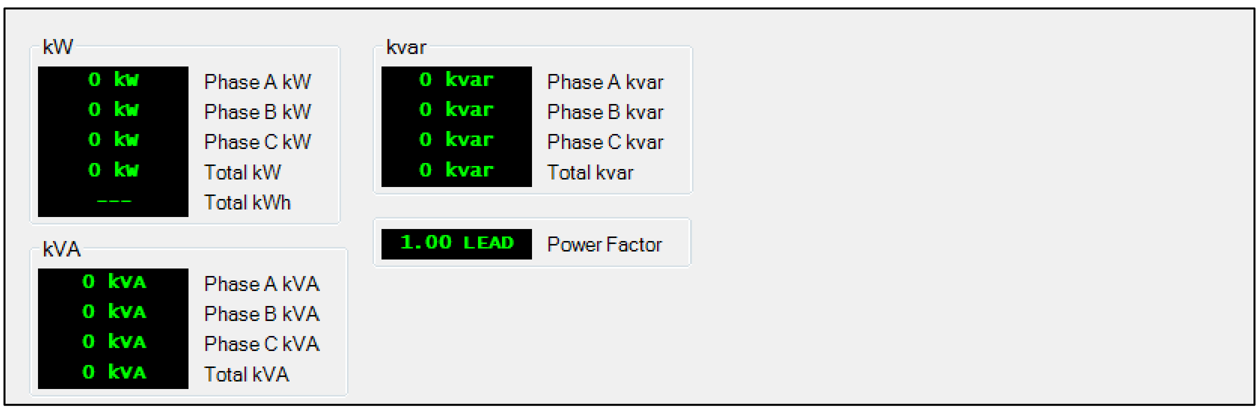


Figure 3-5. Metering Explorer, Power Screen

Run Statistics

This screen provides Cumulative Run Statistics, Session Run Statistics, and Commission Date. See Figure 3-6.

The Cumulative Run Statistics are tracked from the first time the genset was started. The Session Run Statistics are tracked from the last time the genset was started until the following shutdown.

The Number of Starts, Hours Until Maintenance, Total kWh, Total Engine Run Time, Loaded Run Time, and Unloaded Run time can be changed by clicking the *Edit Cumulative Run Statistics* button. This is helpful when installing the DGC-2020ES into a pre-existing system. This allows the current statistics of the genset to be transferred into the DGC-2020ES for uninterrupted tracking.

The Hours Until Maintenance pre-alarm is configured on the Pre-Alarms screen in the Settings Explorer. The Hours Until Maintenance field displays “OFF” when the Maintenance Interval pre-alarm is disabled. Clicking *Reset Maintenance Interval* resets the Hours Until Maintenance to the value set for the Maintenance Interval pre-alarm on the Pre-Alarms screen in the Settings Explorer.

To change the commission date, click *Edit DGC Commission Date.* The DGC Commission Date dialog box appears. Enter the new commission date and click *Upload Data to Device.* Click *Close*. Note that the Commission Date field on the BESTCOMS*Plus* screen updates after the *Close* button is clicked.

The *Run Statistics* screen is found in the BESTCOMS*Plus Metering Explorer*. If using the front panel, navigate to Metering > Run Statistics.

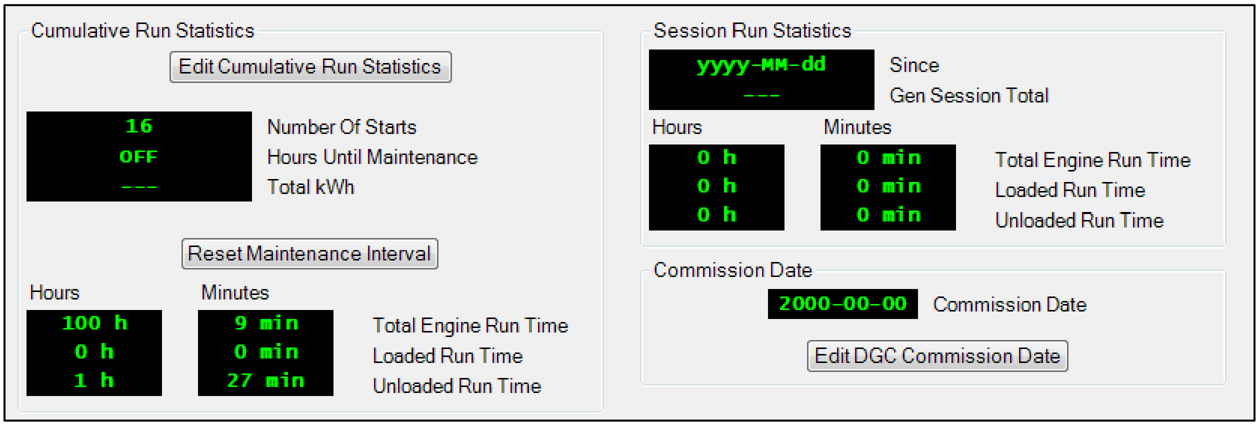


Figure 3-6. Metering Explorer, Run Statistics Screen

Status Indication

This screen indicates status of breakers, modes, switches, and I/O connection status. The status is TRUE when the corresponding indicator is red. See Figure 3-7.

The *Status* screen is found in the BESTCOMS*Plus Metering Explorer*. If using the front panel, navigate to Metering > Alarms-Status > Status.

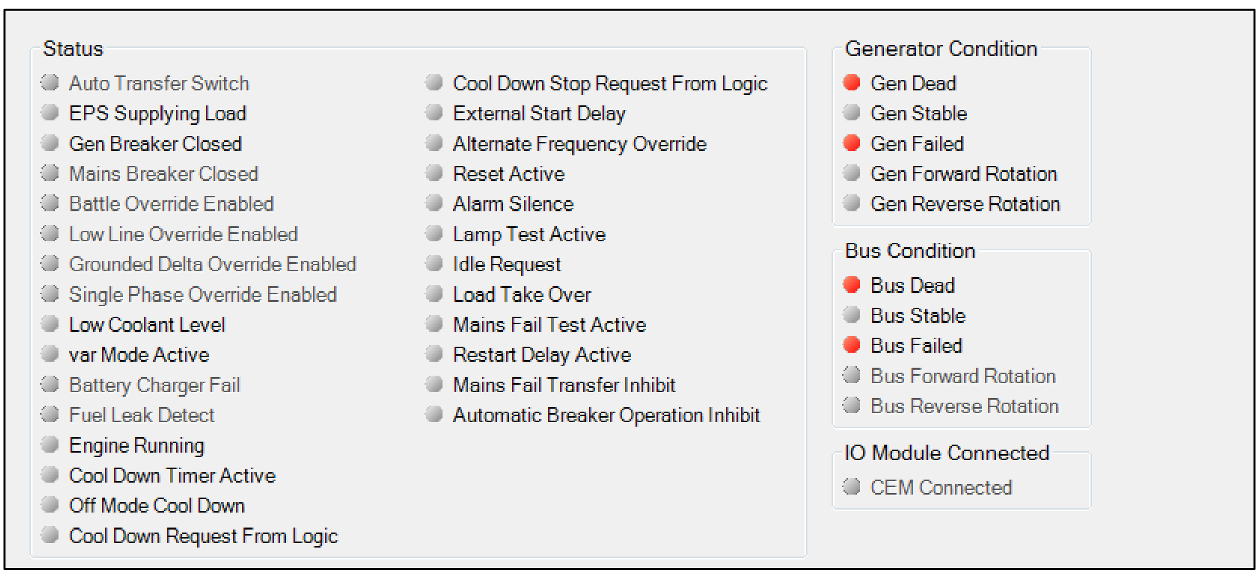


Figure 3-7. Metering Explorer, Status Screen

Inputs

Contact Inputs

This screen indicates the status of contact inputs, contact input alarms, and contact input pre-alarms. The status is TRUE when the corresponding indicator is red. See Figure 3-8.

The *Contact Inputs* screen is found in the BESTCOMS*Plus Metering Explorer* under the *Inputs* category. If using the front panel, navigate to Metering > Alarms-Status > Inputs.

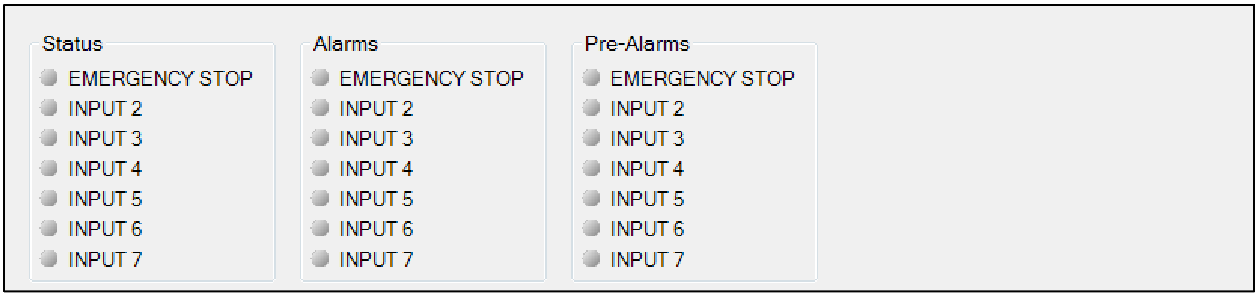


Figure 3-8. Metering Explorer, Inputs, Contact Inputs Screen

Contact Input Timers

This screen displays the current time (count) of the Activation Delays for the contact inputs. See Figure 3-9

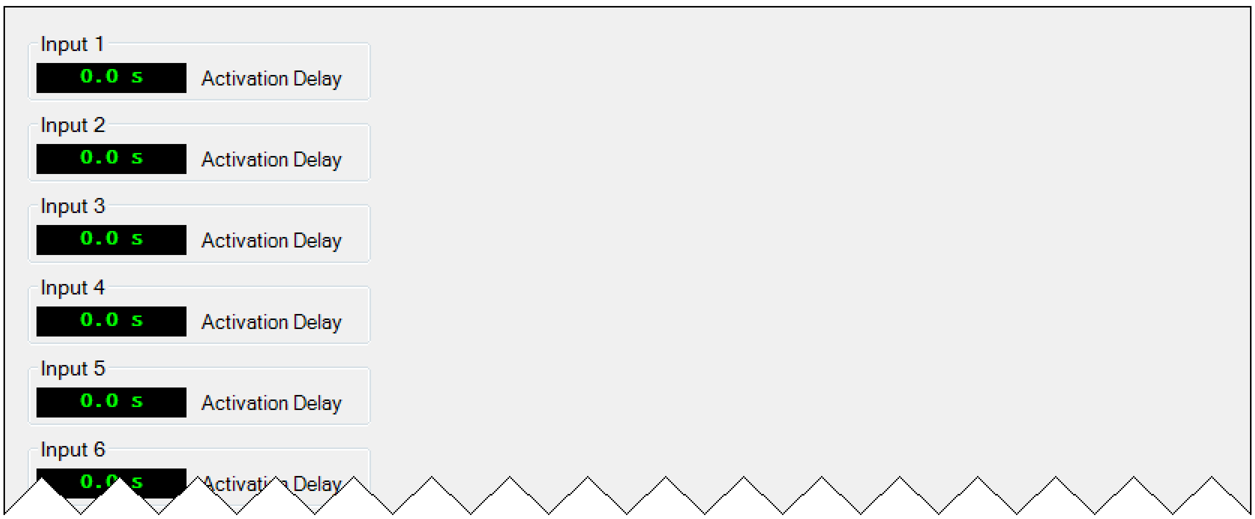


Figure 3-9. Metering Explorer, Inputs, Contact Input Timers Screen

Remote Contact Inputs

When an optional CEM-2020 (Contact Expansion Module) is connected, the status of the remote contact inputs, configurable remote contact input alarms, and remote contact input pre-alarms are shown on this screen. The status is TRUE when the corresponding indicator is red. See Figure 3-9.

The *Remote Contact Inputs* screen is found in the BESTCOMS*Plus Metering Explorer* under the *Inputs* category. If using the front panel, navigate to Metering > Alarms-Status > Inputs.

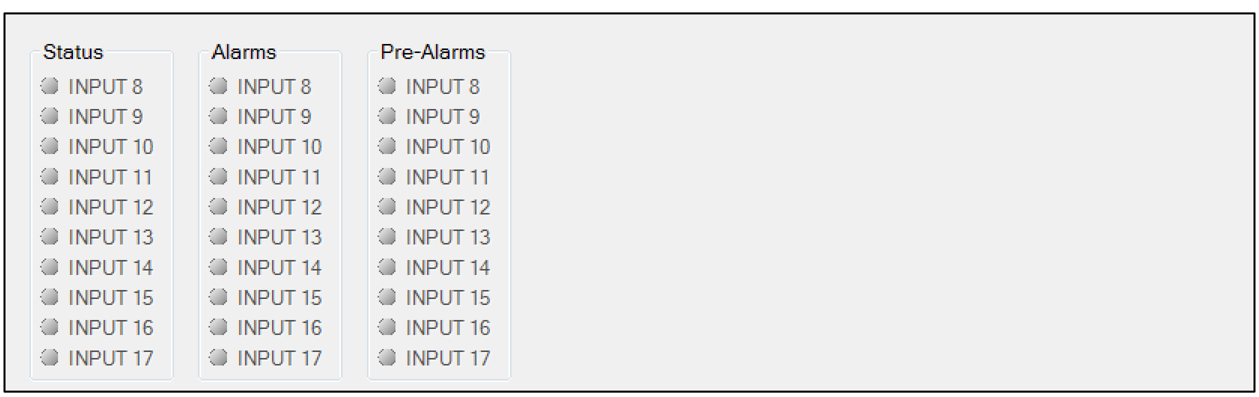


Figure 3-10. Metering Explorer, Inputs, Remote Contact Inputs Screen

Logic Control Relays

This screen indicates the status of logic control relays. The status is TRUE when the corresponding indicator is green. See Figure 3-10.

The *Logic Control Relays* screen is found in the BESTCOMS*Plus Metering Explorer* under the *Inputs* category. If using the front panel, navigate to Metering > Alarms-Status > Logic Control Relays.

Figure 3-11. Metering Explorer, Inputs, Logic Control Relays Screen

Outputs

Contact Outputs

This screen indicates the status of contact outputs. The status is TRUE when the corresponding indicator is green. See Figure 3-11.

The *Contact Outputs* screen is found in the BESTCOMS*Plus Metering Explorer* under the *Outputs* category. If using the front panel, navigate to Metering > Alarms-Status > Outputs.

Figure 3-12. Metering Explorer, Outputs, Contact Outputs Screen

Remote Contact Outputs

When an optional CEM-2020 (Contact Expansion Module) is connected, the status of the remote contact outputs is shown on this screen. The status is TRUE when the corresponding indicator is green. See Figure 3-12.

The *Remote Contact Outputs* screen is found in the BESTCOMS*Plus Metering Explorer* under the *Outputs* category. If using the front panel, navigate to Metering > Alarms-Status > Outputs.

Figure 3-13. Metering Explorer, Outputs, Remote Contact Outputs Screen

Configurable Elements

This screen indicates the status of configurable elements. It also indicates alarms and pre-alarms of configurable elements. The status is TRUE when the corresponding indicator is green. See Figure 3-13.

The *Configurable Elements* screen is found in the BESTCOMS*Plus Metering Explorer* under the *Outputs* category. If using the front panel, navigate to Metering > Alarms-Status > Configurable Elements.

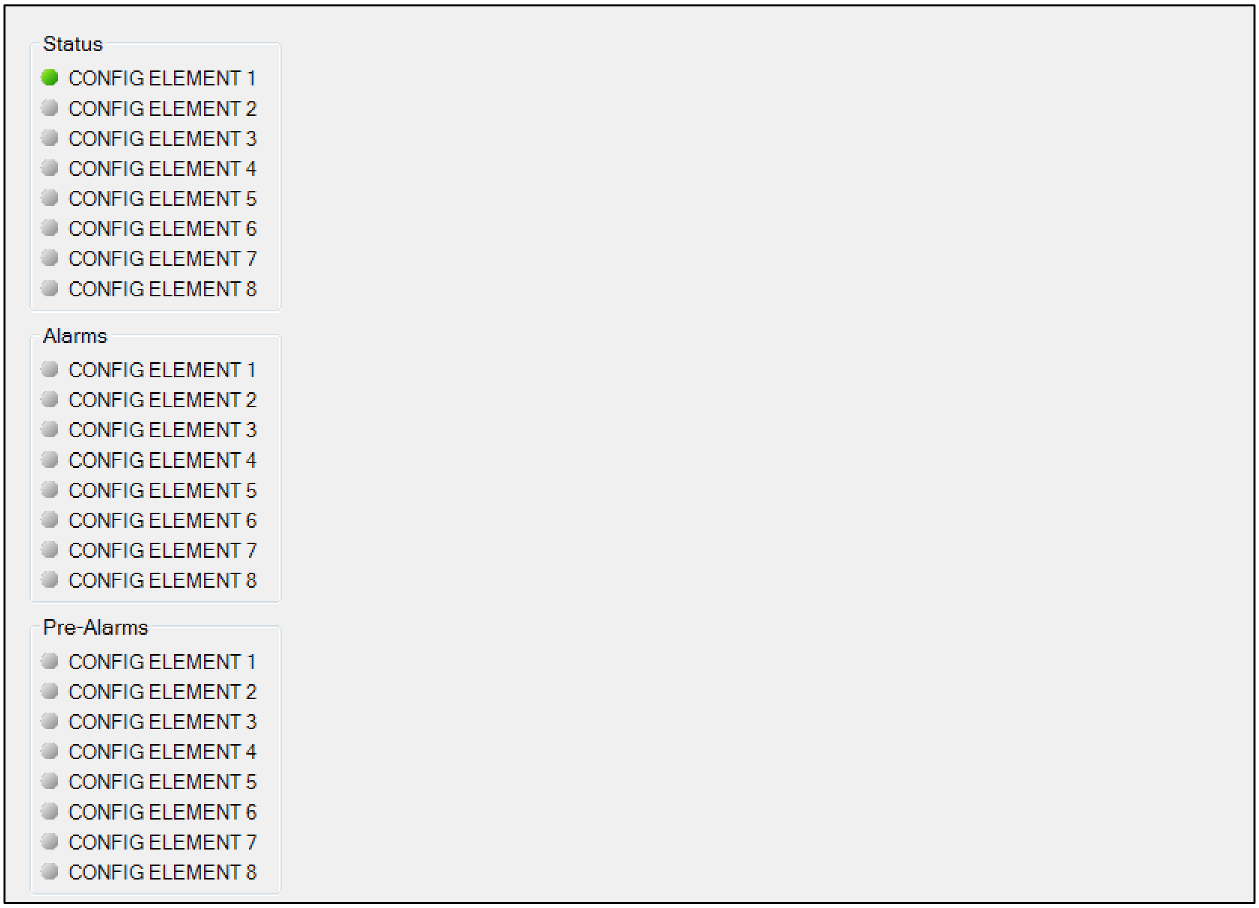


Figure 3-14. Metering Explorer, Outputs, Configurable Elements Screen

Control

Controls for stopping/starting the engine, opening/closing breakers, and opening/closing switches are accessed using BESTCOMS*Plus* through the *Metering Explorer*, *Control* screen. This set of controls is especially useful when commissioning the DGC-2020ES. The PC or laptop running BESTCOMS*Plus* must be connected to the DGC-2020ES via the USB port (see the *Communication* chapter in the *Configuration* manual for details). When running BESTCOMS*Plus* in *Live* mode, these buttons interact with the DGC-2020ES in real time. Otherwise, you will be prompted before the settings are sent.

Using the Metering Explorer in BESTCOMS*Plus,* open the *Control* branch. Refer to Figure 3-14.

Emergency Stop

The user has control to stop the generator in case of emergency by clicking on the *Emergency Stop* button.

Engine Control

The engine can be started and stopped by clicking on the *Start* and *Stop* buttons. This function requires a connection to a properly configured ECU via J1939 (CANBus).

Run, Auto, Off

The operating mode can be set to Run, Auto, or Off.

Generator and Mains Breakers

There are controls for opening and closing the generator breaker and mains breaker. The breaker is open when the corresponding indicator is green and closed when red. This function requires that the Generator and Mains breakers be configured.

Switches 1 through 4

Each of these switches can be opened or closed by clicking on the *Open* or *Close* buttons. The switch is closed when the corresponding indicator is red. These buttons control the virtual inputs found in BESTlogic*Plus* Programmable Logic. The number of the switch corresponds to the number of the virtual input it controls. See the *BESTlogicPlus* chapter in the *Configuration* manual for more information.

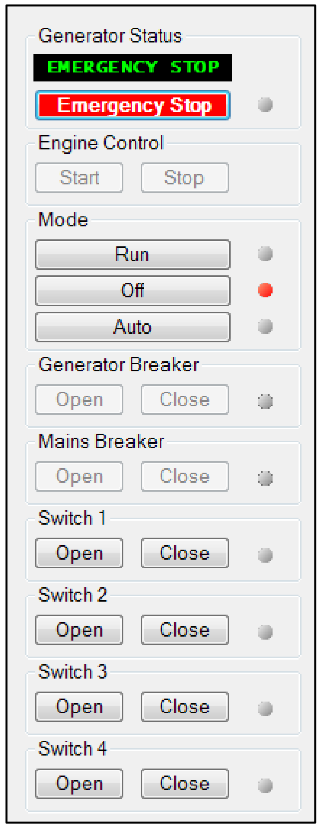


Figure 3-15. Metering Explorer, Control Screen

Mains Fail Transfer Status

The Mains Fail Transfer Status screen (Figure 3-15) displays the Mains Fail Transfer State and any timers relevant to the mains fail transfer process. These parameters are listed below.

Mains Fail Transfer State: The different mains fail transfer states are described below.

Power From Mains: Power is being supplied to the load from the mains bus.

Transfer Timer Active: Transfer Delay timer is actively counting.

Transferring to Gens: Load is being transferred to the generator bus.

Power From Gens: Power is being supplied to the load from the generator bus.

Return Timer Active: Return Delay timer is actively counting.

Transferring to Mains: Load is being transferred to the mains bus.

Disabled: DGC-2020ES is in the OFF or RUN operating mode or in the alarm state.

Remaining Transfer Delay: Displays the current timer value in seconds.

Remaining Return Delay: Displays the current timer value in seconds.

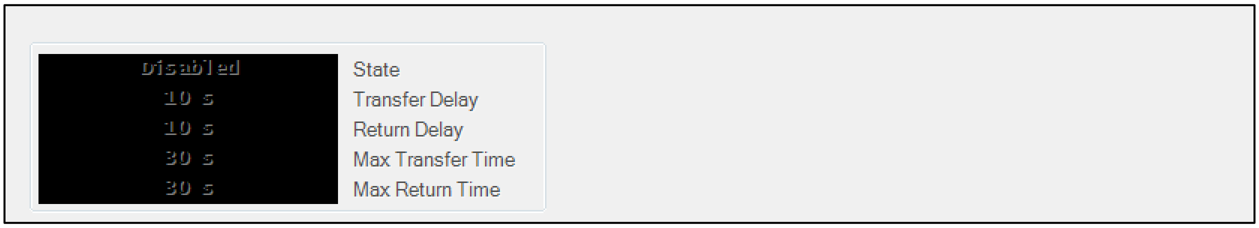


Figure 3-16. Metering, Mains Fail Transfer Status

Diagnostics

Sender Inputs

The Sender Inputs screen (Figure 3-16) displays the resistance level of the enabled senders.

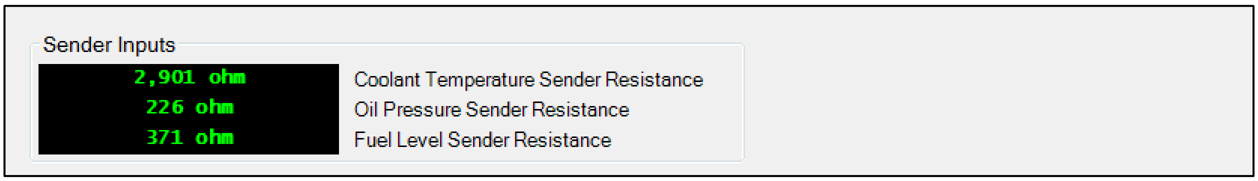


Figure 3-17. Metering, Diagnostics, Sender Inputs

Auto Export Metering

This function automatically exports metering data over a user-defined period when a DGC-2020ES connection is active. To display the Auto Export Metering screen, click the *Tools* pull-down menu from the upper menu bar and click *Auto Export Metering*. Specify the *Number of Exports* and the *Interval* between each export. Enter a filename for the metering data and a folder in which to save. The file is saved in .CSV (comma separated values) format. The first export is performed immediately after clicking the *Start* button. Click the *Filter* button to select specific metering screens.

4 • Alarms

The DGC-2020ES monitors ECU data, generator protection functions, and engine senders. An alarm or pre-alarm is annunciated when the monitored parameter exceeds its threshold settings.

When an alarm condition exists, the engine is stopped by opening the Fuel output contact. An existing pre-alarm condition is annunciated only.

When alarms are active, the front panel *Overview* screen is replaced by the *Active Alarms* screen. When only pre-alarms are active, the front panel *Overview* screen is alternated with the *Active Pre-Alarms* screen in one-second intervals. Active alarms and pre-alarms can be viewed through BESTCOMS*Plus*®.

The front panel Alarm LED is illuminated when alarms are active. When pre-alarms are active, the Alarm LED flashes in one-second intervals.

If programmed and enabled, the horn output is closed when alarms are active. When pre-alarms are active, the horn output toggles in one-second intervals.

Active alarms are also indicated on the optional remote display panel in the form of LEDs and an audible horn. Red alarm LEDs light and the horn sounds when the corresponding alarm setting is exceeded. If an active alarm condition is not annunciated by the remote display panel, the *Switch Not In Auto* LED lights and the horn sounds.

Alarm configuration is described in the *Configuration* manual.

A detailed list of alarms is provided in Table 4-1.

Table 4-1. Available Alarms

Name	Description
Alarms	
AUTO RESTART FAIL	Automatic Restart Failure
BATT CHRG FAIL	Battery Charger Fail
DEF SEVERE INDUCMT	DEF Severe Inducement
DIAG TRBL CODE	Diagnostic Trouble Code
ECU SHUTDOWN	ECU Shutdown
EMERGENCY STOP	Emergency Shutdown
EXHAUST SYSTEM ERR	Exhaust System Error
FUEL LEAK DETECT	Fuel Leak Detected
GEN TRANSFER FL	Transfer Fail
GLBL ALARM	Global Alarm
GLBL SNDR FAIL	Global Sender Fail
HI COOLANT TMP	High Coolant Temp
LOST ECU COMM	Loss of ECU Communication
LOW COOL LEVEL	Low Coolant Level
LOW FUEL LEVEL	Low Fuel Level
LOW OIL PRES	Low Oil Pressure
MAINS FL TR FAILED	Mains Fail Transfer Failed
MTU COMBINED RED	MTU Combined Red
OVERCRANK	Overcrank
OVERSPEED	Overspeed
UNEXPECTED SHUTDN	Unexpected Shutdown

Name	Description
Contact Expansion Module	
CEM COMM FAIL	CEM Communication Failure
CEM HW MISMATCH	CEM Hardware Mismatch
MULTIPLE CEM	Duplicate CEMs
Pre-alarms	
BATT CHRG FAIL	Battery Charger Fail
BATT OVERVOLT	Battery Overvoltage
BUS REV ROT	Reverse Bus Rotation
CEM COMM FAIL	CEM Communication Failure
CHECKSUM FAIL	Checksum Failure
DEF CONSUMPT ERROR	DEF Consumption Error
DEF FLUID LOW	DEF Fluid Low
DEF INDUCEMENT	DEF Inducement
DEF INDUCMT O-RIDE	DEF Inducement Override
DEF LOW SEVERE	DEF Low Severe
DEF QUALITY POOR	DEF Quality Poor
DEF PRESVR INDUCMT	DEF Pre-Severe Inducement
DEF SEVERE INDUCMT	DEF Severe Inducement
DEF TAMPERING	DEF Tampering
DEF WARNING	DEF Warning
DEF WARNING LVL2	DEF Warning Level 2
DIAG TRBL CODE	Active DTC
DPF REGEN INHBTD	DPF Regenerate Disabled
DPF REGEN REQD	DPF Regenerate Required
DPF SOOT HIGH	DPF Soot Level High
DPF SOOT LVL EXT HI	DPF Soot Level Severely High
DPF SOOT LVL MOD HI	DPF Soot Level Moderately High
LOW COOL LEVEL DTC	DTC Low Coolant Level
ENG KW OVRLD-1	Engine kW Overload 1
ENG KW OVRLD-2	Engine kW Overload 2
ENG KW OVRLD-3	Engine kW Overload 3
ESCAPE MODE	Escape Mode
EXHAUST SYSTEM ERR	Exhaust System Error
FUEL 1 LEAK	Fuel Filter 1 Leak
FUEL 2 LEAK	Fuel Filter 2 Leak
FUEL LEAK DETECT	Fuel Leak Detect
GEN REV ROT	Reverse Generator Rotation
GN BRK CL FL	Generator Breaker Close Failure
GN BRK OP FL	Generator Breaker Open Failure

Name	Description
HEATING FOR REGEN	Heating for Regeneration
HI COOLANT TMP	High Coolant Temp
HIGH EXHAUST TEMP	High Exhaust Temperature
HIGH FUEL LEVEL	High Fuel Level
LOST ECU COMM	Loss of ECU Communication
LOW BATT VOLT	Low Battery Voltage
LOW COOL LEVEL	Low Coolant Level
LOW COOL TMP	Low Coolant Temp
LOW FUEL LEVEL	Low Fuel Level
LOW OIL PRES	Low Oil Pressure
MN BKR CL FL	Mains Breaker Close Fail
MN BRK OP FL	Mains Breaker Open Fail
MF RETURN FL	Mains Fail Return Fail
MAINT INTERVAL	Maintenance Due
MPU FAIL	MPU Failure
MTU FAULT CODES	MTU Fault Code Active
MULTIPLE CEM	Duplicate CEM
REGEN ACTIVE	Regenerate Active
SERFLASH RD FAIL	Serial Flash Read Failure
SVCTOOL FRC REGEN	Service Tool Forced Regenerate
SWITCH FRC REGEN	Switch Forced Regenerate
TORQUE LIMIT	Torque Limit
TRQ LIMIT SEVERE	Torque Limit Severe
WEAK BATTERY	Weak Battery Voltage
Sender Fail	
COOLANT LEVEL	Coolant Level Sender Fail (from ECU)
COOL SNDR FAIL	Coolant Temp Sender Fail
FUEL LEVEL SNDR	Fuel Level Sender Fail
LOSS OF VOLT	Voltage Sensing Fail
OIL SNDR FAIL	Oil Pressure Sender Fail
SPD SNDR FAIL	Speed Sender Fail
Generator Protection	
27 UNDVOLT TRP	Undervoltage (27)
47 PHS IMBAL TRP	Phase Imbalance (47)
50 OVRCURR TRP	Overcurrent (50)
59 OVRVOLT TRP	Overvoltage (59)
81O OVRFREQ TRP	Frequency (81O)
81U UNDFREQ TRP	Frequency (81U)

Retrieving Alarm Information

Alarms can be viewed on the front panel display and through BESTCOMS*Plus*.

Front Panel Display

The lists of active alarms and pre-alarms can be viewed by navigating to Metering > Alarms-Status > Active Alarms *or* Active Pre-alarms. These lists are scrollable by using the *Up* and *Down* pushbuttons.

BESTCOMS*Plus*®

The status of each alarm and pre-alarm is displayed on the *Alarms* screen (Figure 4-1). This screen is found in the *Metering Explorer*. Alarms with a red indicator are active.

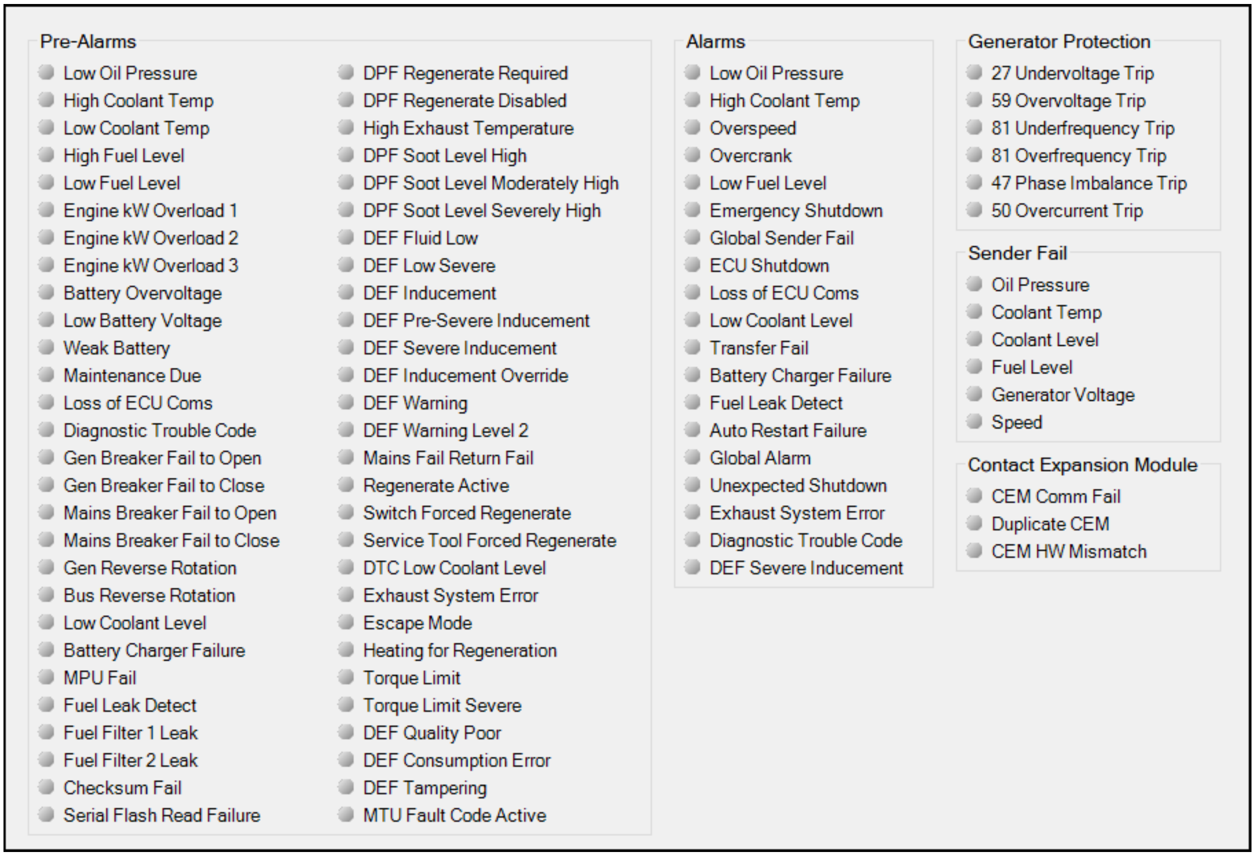


Figure 4-1. Metering Explorer, Alarms Screen

Resetting Alarms and Pre-Alarms

Most pre-alarms automatically reset when the alarm condition no longer exists. Pre-alarms that do not automatically reset are listed below:

- Weak Battery
- Breaker Fail to Open
- Breaker Fail to Close

These pre-alarms are reset by navigating to the Overview screen on the front panel display and holding the *Back* pushbutton for two seconds.

Alarms do not automatically reset. Manually reset alarms by pressing the *Off* pushbutton.

Horn

The audible horn can be silenced by simultaneously pressing the *Back* and *Edit* pushbuttons. This does not reset the alarm or pre-alarm causing the horn to annunciate.

Maintenance Interval

To reset the maintenance interval pre-alarm through the front panel, navigate to the Settings > System Params > System Settings > Maint Reset screen. Operator, Settings, or OEM access level is required to reset the maintenance interval pre-alarm. If the maintenance interval pre-alarm is not enabled, the *Maint Reset* parameter is not visible on the front panel.

To reset the maintenance interval pre-alarm by using BESTCOMS*Plus*, use the *Metering Explorer* to open the *Run Statistics* screen and click on the *Reset Maintenance Interval* button.

To reset the maintenance interval pre-alarm from the front panel, navigate to the *Overview* screen and hold the *Back* pushbutton for 12 seconds.

Checksum Failure

The checksum failure pre-alarm can be cleared by holding the *Back* pushbutton for two seconds while displaying the *Overview* screen. However, the pre-alarm will reoccur the next time the checksum is verified if the data is still corrupted. Some checksum calculations are done only on power-up, so this may not occur until the next time operating power is cycled.

If there are consistent checksum failure pre-alarms, attempt the following actions to correct the problem:

1. Load default settings by holding the *Up* and *Down* pushbuttons on the front panel while cycling power. After loading defaults, upload the settings file through BESTCOMS*Plus* if necessary.

Caution
Loading default settings will erase all custom settings. All reports and events will be cleared. It is recommended that all settings are downloaded and saved through BESTCOMS*Plus* before attempting to load defaults. Once defaults are loaded, the saved settings can then be uploaded.

2. If the problem persists, reload the firmware file through BESTCOMS*Plus*. See the *BESTCOMSPlus* chapter in the *Configuration* manual for more information.
3. Contact Basler Electric Technical Support.
4. The checksum failure pre-alarm can be disabled. This disables only the annunciation of the pre-alarm and does not correct any error conditions.

5 • MTU Fault Codes

A DGC-2020ES connected to a genset equipped with an MTU engine ECU tracks and displays the active fault codes issued by the MTU engine ECU. Active MTU fault codes can be viewed through BESTCOMS*Plus*® by using the Metering Explorer to expand the MTU tree or through the front panel display by navigating to METERING > ALARMS-STATUS > MTU FAULT CODES.

Each fault code is displayed with a fault description and the fault number. If the DGC-2020ES does not have descriptive information about a fault number that was received, the fault description will display as “NO TEXT AVAILABLE”. Fault codes displayed by the DGC-2020ES are listed in Table 5-1.

Table 5-1. MTU Fault Codes

Fault Code Number	String	Description
3	HI T FUEL	Fuel temperature too high (limit 1).
4	SS T FUEL	Fuel temperature too high (limit 2).
5	HI T CHRG AIR	Charge air temperature too high (limit 1).
6	SS T CHRG AIR	Air temperature too high (limit 2).
9	HI T INTERCOOLER	Coolant temperature of InterCooler too high (limit 1).
10	SS T INTERCOOLER	Coolant temperature of InterCooler too high (limit 2)
15	LO P LUBE OIL	Pressure of lube oil too low (limit 1).
16	SS P LUBE OIL	Pressure of lube oil too low (limit 2).
19	HI T EXHAUST A	Exhaust gas temperature (A-side) too high (limit 1).
20	SS T EXHAUST A	Exhaust gas temperature (A-side) too high (limit 2).
21	HIT T EXHAUST B	Exhaust gas temperature (B-side) too high (limit 1).
22	SS T EXHAUST B	Exhaust gas temperature (B-side) too high (limit 2).
23	LO COOLANT LEVEL	Coolant level too low (limit 1).
24	SS COOLANT LEVEL	Coolant level too low (limit 2).
25	HI P DIFF LUBE OIL	Differential pressure of oil filter too high (limit 1).
26	SS P DIFF LUBE OIL	Differential pressure of oil filter too high (limit 2).
27	HI LEVEL LEAKAGE FUEL	Level of leakage fuel too high (limit 1).
29	HI ETC IDLE SPD TOO HI	Idle speed of one of the switchable chargers too high.
30	SS ENGINE OVERSPEED	Engine overspeed (limit 2).
31	HI ETC1 OVERSPEED	Speed of basic charger too high (limit 1).
32	SS ETC1 OVERSPEED	Speed of basic charger too high (limit 2).
33	L1 P FUELFLT DIF	Differential pressure of fuel filter too high (limit 1).
36	HI ETC2 OVERSPEED	Speed of 1st switchable charger too high (limit 1).
37	SS ETC2 OVERSPEED	Speed of 1st switchable charger too high (limit 2).
38	AL ETC SPEED DEVIATION	Speed deviation between basic turbo charger and one of the switchable chargers.
39	AL ETC2 CUTIN FAIL	Switching of charger ETC2 failed.
44	LO LEVEL INTRCLR	Coolant level of intercooler too low (limit 1).
45	FAULT L2 LEVEL INTRCLR	Coolant level of intercooler too low (limit 2).
51	HI T LUBE OIL	Lube oil temperature too high (limit 1).
52	SS T LUBE OIL	Lube oil temperature too high (limit 2).
53	HI T INTAKE AIR	Air intake temperature high (Limit 1).
54	HIHI T INTAKE AIR	Air intake temperature high (Limit 2).
57	LO P COOLANT	Coolant pressure too low (limit 1).
58	SS P COOLANT	Coolant pressure too low (limit 2).
59	SS T COOLANT L3	Coolant temperature too high/too low (limit 3).

Fault Code Number	String	Description
60	SS T COOLANT L4	Coolant temperature too high/too low (limit 4).
61	HI P ADCRANK CS L1	Crankcase pressure too high (Limit 1). Abnormal continuous rise.
62	HI P ADCRANK CS L2	Crankcase pressure too high (Limit 2). Abnormal continuous rise.
63	HI P CRANKCASE	Crankcase pressure too high (limit 1).Abrupt rise.
64	SS P CRANK CASE	Crankcase pressure too high (limit 2). Abrupt rise.
65	LO P FUEL	Fuel supply pressure too low (limit 1).
66	SS P FUEL	Fuel supply pressure too low (limit 2).
67	HI T COOLANT	Coolant temperature too high (limit 1).
68	SS T COOLANT	Coolant temperature too high (limit 2).
69	L1 T EXTERN 1	Limit 1, out of range.
70	L2 T EXTERN 1	Limit 2, out of range.
71	L1 T EXTERN 2	Limit 1, out of range.
72	L2 T EXTERN 2	Limit 2, out of range.
73	L1 P EXTERN 1	Limit 1, out of range.
74	L2 P EXTERN 1	Limit 2, out of range.
75	L1 P EXTERN 2	Limit 1, out of range.
76	L2 P EXTERN 2	Limit 2, out of range.
77	LIM EXT CLNT LEV	Binary signal 1 Plant active.
78	LIM INTERCLR LEV	Binary signal 2 Plant active.
79	L BIN EXTERN 3	Binary signal 3 Plant active.
80	L BIN EXTERN 4	Binary signal 4 Plant active.
81	AL RAIL LEAKAGE	Rail pressure gradient too low for Start or too high for Stop.
82	HI P FUEL COMON RAIL	Rail pressure > setpoint value.
83	LO P FUEL COMMON RAIL	Rail pressure < setpoint value.
85	HI T UMBLASSEN	‘Umblasen’ temperature too high (limit 1).
86	SS T UMBLASSEN	‘Umblasen’ temperature too high (limit 2).
89	SS SPEED TOO LOW	Engine is being stalled. The engine speed of the normally operating engine dropped below the limit from parameter 2.2500.027 Limit Engine Speed Low without any stop request. For safety reason the engine is stopped when this event occurs.
90	SS IDLE SPEED LOW	Idle speed not reached.
91	SS RELEASE SPEED LO	Acceleration speed not reached.
92	SS STARTER SPEED LO	Starter speed not reached.
93	SS PREHT TMP	Preheat temperature too low (limit 2).
94	LO PREHT TMP	Preheat temperature too low (limit 1).
95	AL PRELUBE FAULT	Prelubrication fault.
99	DUMMY FAULT	Dummy fault - this is not a real fault, but is used on some ECUs to test the fault reporting mechanism.
100	EDM NOT VALID	Checksum fault EDM.
101	IDM NOT VALID	Checksum fault IDM.
102	INVLD FUEL CNS 1	Fuel consumption counter detect.
103	INVLD FUEL CNS 2	Consumption monitoring 2 not valid.
104	ENG HRS INVALID 1	Engine Hours Counter defect.
105	ENG HRS INVALID 2	Checksum fault.
106	ERR REC1 INVALID	Checksum fault.
107	ERR REC2 INVALID	Checksum fault.
118	LO ECU SUPPLY VOLTS	Power supply voltage too low (limit 1).
119	LOLO ECU SUPPLY VOLTS	Power supply voltage too low (limit 2).

Fault Code Number	String	Description
120	HI ECU SUPPLY VOLTS	Power supply voltage too high (limit 1).
121	HIHI ECU SUPPLY VOLTS	Power supply voltage too high (limit 2).
122	HI T ECU	Temperature of electronic too high (limit 1).
134	15v POSECU DEFCT	Internal electronic fault.
136	15V NEGECU DEFCT	Internal electronic fault.
137	L1 5V BUFFR TEST	Pressure-sensor fault, pressure-sensor wiring, or internal electronic fault.
138	SENSOR PWR DEFCT	Pressure-sensor fault, pressure-sensor wiring, or internal electronic fault.
139	L1 TE BUFFR TEST	Internal electronic fault.
140	TE BUF ECU DEFCT	Internal electronic fault.
141	AL POWER TOO HIGH	AL power too high.
142	MCR EXCEEDED 1 HR STR	AL MCR exceeded 1 hour.
143	BANK1 ECU DEFECT	Internal electronic fault.
144	BANK2 ECU DEFECT	Internal electronic fault.
145	15V GOODECU DFCT	Internal electronic fault.
147	AD TST1ECU DEFCT	Internal electronic fault.
149	AD TST2ECU DEFCT	Internal electronic fault.
151	AD TST3ECU DEFCT	Internal electronic fault.
170	MI MODULE FAIL	Module in maintenance indicator defect.
171	MI NOT ACTIVE	WI not active anymore.
172	TBO EXPIRED	TBO expired.
173	MODL WRITE LIMIT	EEPROM write limit reached.
176	AL LIFE DATA NA	No (fitting) LifeData-Backup-System is available within a delay time after ECU Reset.
177	AL LIFE DATA INCPLT	If the ADEC has to restore the LifeData from the backup-system and at least one checksum is wrong after the upload or the upload is incomplete, then this failure is set.
180	AL CAN1 NODE LOST	Connection to a node on CAN 1 lost.
181	AL CAN2 NODE LOST	Connection to a node on CAN 2 lost.
182	AL CAN WRONG PARAMS	Incorrect CAN parameter values have been entered.
183	AL CAN NO PU DATA	A CAN mode is selected which the communication is initialized aided of the PU data module. However, required PU data module is not present or is not valid.
184	AL CAN PUDATA ERR	During attempt to copy a received PU data module to Flash module, a program error occurred.
185	CAN LESS MAILBXS	CAN less mailboxes.
186	AL CAN1 BUS OFF	CAN controller 1 is in “Bus Off” state.
187	AL CAN1 ERR PASSV	CAN controller 1 has signaled a warning.
188	AL CAN2 BUS OFF	CAN controller 2 is in “Bus Off” state.
189	AL CAN2 ERROR PASSV	CAN controller 2 has signaled a warning.
190	AL EMU PARAM NO SUPPORT	EMU parameters are not supported.
198	AL COMB ALM YEL	Combined Yellow Alarm - a yellow alarm is a warning and does generally not result in engine shutdown.
201	SD T COOLANT	Coolant temperature-sensor defect.
202	SD T FUEL	Fuel temperature-sensor defect.
203	SD T CHARGE AIR	Charge air temperature-sensor defect.
205	SD T CLNT INTERC	Intercooler coolant temperature-sensor defect.
206	SD T EXHAUST A	Exhaust gas temperature-sensor on A-side defect.
207	SD T EXHAUST B	Exhaust gas temperature-sensor on B-side defect.
208	SD P CHARGE AIR	Charge air pressure-sensor defect.

Fault Code Number	String	Description
211	SD P LUBE OIL	Lube oil pressure-sensor defect.
212	SD P COOLANT	Coolant pressure-sensor defect.
213	SD P COOLANT INTRCOOLR	Intercooler coolant pressure-sensor defect.
214	SD P CRANKCASE	Crankcase pressure-sensor defect.
215	SD P HD	Rail pressure-sensor defect.
216	SD T LUBE OIL	Lube oil temperature-sensor defect.
219	SD T INTAKE AIR	Intake air temperature-sensor defect.
220	SD COOLANT LEVEL	Sensor for coolant level defect.
221	SD P DIFF LUBE OIL	Sensor for differential pressure of lube oil defect.
222	SL LVL LKG FUEL	Sensor for leakage level of fuel defect.
223	SD LVL INTERCLR	Sensor for coolant level of intercooler defect.
227	SD PRE FILT P LUBE OIL	Pressure sensor for lube oil before filter defect.
228	SD P FL PRE FILTR	Sensor defect on the fuel pre-filter pressure sensor.
229	AL SD CAM STOP	Sensor of Camshaft defect and sensor of crankshaft defect before.
230	SD CRANKSHFT SPD	Sensor defect on crankshaft.
231	SD CAMSHAFT SPD	Sensor defect on camshaft.
232	SD CHARGER1 SPEED	Speed-sensor of basic charger defect.
233	SD CHARGER2 SPEED	Speed-sensor of switching charger defect.
239	SD P DIFF FUEL	Sensor defect in the fuel filter differential pressure sensor.
240	SD P FUEL	Fuel pressure-sensor defect.
241	SD T UMBLASSEN	Temperature-sensor of recirculated charge air defect.
242	SD T COOLANT R	Redundant coolant temperature-sensor defect.
244	SD P LUBE OIL R	Redundant pressure sensor for lube oil defect.
245	SD POWER SUPPLY	Internal ECU error.
246	SD T ELECTRONIC	Internal ECU fault.
249	SD CAN STOP	Missing data CAN.
250	SD CAN SPD DEMND	Missing data CAN.
251	SD CAN UP DOWN	Missing data CAN.
252	SD CAN NOTCH POS	Missing data CAN.
253	SD CAN OVERRIDE	Missing data CAN.
254	SD CAN TST OVRSP	Missing data CAN.
255	SD CAN ENGAGE SIG	Missing data CAN.
256	SD CAN CYL CUTOUT	Missing data CAN.
257	SD CAN LOCAL	Missing data CAN.
258	SD CAN RCS ENGAGE	Missing data CAN.
259	SD CAN RCS CYL CT	Missing data CAN.
260	SD 15V POS SPPLY	Internal ECU fault.
261	15V POS SPPLY	Internal ECU fault.
262	SD 5V BUFFR TEST	Internal ECU fault.
263	SD TE BUFFR TEST	Internal ECU fault.
264	SD BANK 1 TEST	Internal ECU fault.
265	SD BANK 2 TEST	Internal ECU fault.
266	SD SPD DEMAND AN	Analog speed demand defect.
267	SD SPDMTEST BNCH	Short circuit, cable breakage.
268	SD SPINUT	Analog spinning value defect.
269	SD LOAD ANLG FLT	Filtered analog load pulse signal not available.

Fault Code Number	String	Description
270	SD FREQUENCY INPUT	Frequency input defect.
271	SD T EXTERN 1	Missing data CAN.
272	SD T EXTERN 2	Missing data CAN.
273	SD P EXTERN 1	Missing data CAN.
274	SD P EXTERN 2	Missing data CAN.
275	SD EXT CLNT LVL	Missing data CAN.
276	SD INTERCLER LVL	Missing data CAN.
277	SD BIN EXT3	Missing data CAN.
278	SD BIN EXT4	Missing data CAN.
279	SD CANRES TRIPFL	Missing data CAN.
280	SD CAN ALRM RST	Missing data CAN.
281	SD ADTEST1 SPPLY	Internal ECU fault.
282	SD ADTEST 2 SPPLY	Internal ECU fault.
283	SD ADTEST3 SPPLY	Internal ECU fault.
284	SD CAN LAMP TEST	Missing data CAN.
285	SD CAN IDLE RQ SR	Missing data CAN.
286	SD CAN IDLE REQ	Missing data CAN.
287	SD CAN IDLE REQ	Missing data CAN.
288	SD CAN TRBOSW LCK	Missing data CAN.
301	TIMING CYLNDR A1	Error in timing of injector cylinder A1: timing value too low/high.
302	TIMING CYLNDR A2	Error in timing of injector cylinder A2: timing value too low/high.
303	TIMING CYLNDR A3	Error in timing of injector cylinder A3: timing value too low/high.
304	TIMING CYLNDR A4	Error in timing of injector cylinder A4: timing value too low/high.
305	TIMING CYLNDR A5	Error in timing of injector cylinder A5: timing value too low/high.
306	TIMING CYLNDR A6	Error in timing of injector cylinder A6: timing value too low/high.
307	TIMING CYLNDR A7	Error in timing of injector cylinder A7: timing value too low/high.
308	TIMING CYLNDR A8	Error in timing of injector cylinder A8: timing value too low/high.
309	TIMING CYLNDR A9	Error in timing of injector cylinder A9: timing value too low/high.
310	TIMING CYLNDR A10	Error in timing of injector cylinder A10: timing value too low/high.
311	TIMING CYLNDR B1	Error in timing of injector cylinder B1: timing value too low/high.
312	TIMING CYLNDR B2	Error in timing of injector cylinder B2: timing value too low/high.
313	TIMING CYLNDR B3	Error in timing of injector cylinder B3: timing value too low/high.
314	TIMING CYLNDR B4	Error in timing of injector cylinder B4: timing value too low/high.
315	TIMING CYLNDR B5	Error in timing of injector cylinder B5: timing value too low/high.
316	TIMING CYLNDR B6	Error in timing of injector cylinder B6: timing value too low/high.
317	TIMING CYLNDR B7	Error in timing of injector cylinder B7: timing value too low/high.
318	TIMING CYLNDR B8	Error in timing of injector cylinder B8: timing value too low/high.
319	TIMING CYLNDR B9	Error in timing of injector cylinder B9: timing value too low/high.
320	TIMING CYLNDR B10	Error in timing of injector cylinder B10: timing value too low/high.
321	WIRING CYLNDR A1	Short circuit in injector cable of cylinder A1.
322	WIRING CYLNDR A2	Short circuit in injector cable of cylinder A2.
323	WIRING CYLNDR A3	Short circuit in injector cable of cylinder A3.
324	WIRING CYLNDR A4	Short circuit in injector cable of cylinder A4.
325	WIRING CYLNDR A5	Short circuit in injector cable of cylinder A5.
326	WIRING CYLNDR A6	Short circuit in injector cable of cylinder A6.
327	WIRING CYLNDR A7	Short circuit in injector cable of cylinder A7.
328	WIRING CYLNDR A8	Short circuit in injector cable of cylinder A8.

Fault Code Number	String	Description
329	WIRING CYLNDR A9	Short circuit in injector cable of cylinder A9.
330	WIRING CYLNDR A10	Short circuit in injector cable of cylinder A10.
331	WIRING CYLNDR B1	Short circuit in injector cable of cylinder B1.
332	WIRING CYLNDR B2	Short circuit in injector cable of cylinder B2.
333	WIRING CYLNDR B3	Short circuit in injector cable of cylinder B3.
334	WIRING CYLNDR B4	Short circuit in injector cable of cylinder B4.
335	WIRING CYLNDR B5	Short circuit in injector cable of cylinder B5.
336	WIRING CYLNDR B6	Short circuit in injector cable of cylinder B6.
337	WIRING CYLNDR B7	Short circuit in injector cable of cylinder B7.
338	WIRING CYLNDR B8	Short circuit in injector cable of cylinder B8.
339	WIRING CYLNDR B9	Short circuit in injector cable of cylinder B9.
340	WIRING CYLNDR B10	Short circuit in injector cable of cylinder B10.
341	OPN LD CYLNDR A1	Open load in injector cable of cylinder A1.
342	OPN LD CYLNDR A2	Open load in injector cable of cylinder A2.
343	OPN LD CYLNDR A3	Open load in injector cable of cylinder A3.
344	OPN LD CYLNDR A4	Open load in injector cable of cylinder A4.
345	OPN LD CYLNDR A5	Open load in injector cable of cylinder A5.
346	OPN LD CYLNDR A6	Open load in injector cable of cylinder A6.
347	OPN LD CYLNDR A7	Open load in injector cable of cylinder A7.
348	OPN LD CYLNDR A8	Open load in injector cable of cylinder A8.
349	OPN LD CYLNDR A9	Open load in injector cable of cylinder A9.
350	OPN LD CYLNDR A10	Open load in injector cable of cylinder A10.
351	OPN LD CYLNDR B1	Open load in injector cable of cylinder B1.
352	OPN LD CYLNDR B2	Open load in injector cable of cylinder B2.
353	OPN LD CYLNDR B3	Open load in injector cable of cylinder B3.
354	OPN LD CYLNDR B4	Open load in injector cable of cylinder B4.
355	OPN LD CYLNDR B5	Open load in injector cable of cylinder B5.
356	OPN LD CYLNDR B6	Open load in injector cable of cylinder B6.
357	OPN LD CYLNDR B7	Open load in injector cable of cylinder B7.
358	OPN LD CYLNDR B8	Open load in injector cable of cylinder B8.
359	OPN LD CYLNDR B9	Open load in injector cable of cylinder B9.
360	OPN LD CYLNDR B10	Open load in injector cable of cylinder B10.
361	AL POWER STAGE LOW	Internal error of electronic.
362	AL POWER STAGE HIGH	Internal error of electronic.
363	AL STOP POWER STAGE	Internal error of electronic.
364	AL STOP POWER STAGE 2	Internal error of electronic.
365	AL MV WIRING GND	Cable line error.
371	AL WIRING TO 1	Short circuit or open load on transistor output 1 (TO 1).
372	AL WIRING TO 2	Short circuit or open load on transistor output 2 (TO 2).
373	AL WIRING TO 3	Short circuit or open load on transistor output 3 (TO 3).
374	AL WIRING TO 4	Short circuit or open load on transistor output 4 (TO 4).
381	AL WIRING TOP 1	Short circuit or open load on transistor output plant 1 (TOP 1).
382	AL WIRING TOP 2	Short circuit or open load on transistor output plant 2 (TOP 2).
383	AL WIRING TOP 3	Short circuit or open load on transistor output plant 3 (TOP 3).
384	AL WIRING TOP 4	Short circuit or open load on transistor output plant 4 (TOP 4).
385	AL WIRING TOP 5	Short circuit or open load on transistor output plant 5 (TOP 5).
386	AL WIRING TOP 6	Short circuit or open load on transistor output plant 6 (TOP 6).

Fault Code Number	String	Description
390	AL MCR EXCEEDED	DBR/MCR Function: MCR (Maximum Continuous Rating) in exceeded.
392	HI T COOLNT R	Redundant coolant temperature too high (limit 1).
393	SS T COOLNT R	Redundant coolant temperature too high (limit 2).
394	LO P LUBE OIL R	Redundant pressure of lube oil too low (limit 1).
395	SS P LUBE OIL R	Redundant pressure of lube oil too low (limit 2).
396	TD T COOLANT	Maximum deviation of T-Coolant sensors.
397	TD P LUBE OIL	Maximum deviation of P-Oil sensors.
399	AL INTERFACE ECU	Interface ECU.
400	AL OPN LD DIGIN 1	Open load on digital input 1.
401	AL OPN LD DIGIN 2	Open load on digital input 2.
402	AL OPN LD DIGIN 3	Open load on digital input 3.
403	AL OPN LD DIGIN 4	Open load on digital input 4.
404	AL OPN LD DIGIN 5	Open load on digital input 5.
405	AL OPN LD DIGIN 6	Open load on digital input 6.
406	AL OPN LD DIGIN 7	Open load on digital input 7.
407	AL OPN LD DIGIN 8	Open load on digital input 8.
408	AL OPN LD E STOP	Open load on input for emergency stop.
410	LO U PDU	Power driver voltage (injectors) too low (limit 1).
411	LOLO U PDU	Power driver voltage (injectors) too low (limit 2).
412	HI U PDU	Power driver voltage (injectors) too high (limit 1).
413	HIHI U PDU	Power driver voltage (injectors) too high (limit 2).
414	HI L WATER FUEL PREFILT	Water level of fuel prefilter too high (limit 1).
415	LO P COOLANT INTRCOOLR	Coolant pressure of InterCooler too low (limit 1).
416	SS P COOLANT INTRCOOLR	Coolant pressure of InterCooler too low (limit 2).
417	SD L WATER FUEL PREFILT	Water level-sensor of fuel prefilter defect.
418	SD INTAKE AIR B	Sensor defect of the Intake Air B temperature sensor.
419	SD PRE_ENG T COOL	Sensor defect in the Coolant Temperature Sensor before engine coolant intake.
420	AL L1 AUX 1	Input of Aux 1 injured limit 1.
421	AL L2 AUX 1	Input of Aux 1 injured limit 2.
422	SD T CHRG AIR B	Sensor defect in the Charge Air B Temperature Sensor.
423	LO P COOLANT DIFF	Low Coolant Differential Pressure.
424	AL L1 AUX 2	Auxiliary 2 Alarm Level 1 Alarm.
425	AL L2 AUX 2	Auxiliary 2 Alarm Level 2 Alarm.
426	SD AIR MASS A	Sensor defect in Air Mass Sensor A.
427	SD AIR MASS B	Sensor defect in Air Mass Sensor B.
428	AL L1 T AUX 1	Temperature input of Aux 1 injured limit 1.
429	HI P COOLANT	High Coolant Pressure.
430	LO PRE ENG P COOLNT	Low Pre-Engine Coolant Pressure (Limit 1).
431	SS PRE ENG P COOLNT	Low Pre-Engine Coolant Pressure (Limit 2).
432	AL L1 T AUX2	Auxiliary Temperature 2 Level 1 Alarm.
433	AL L2 T AUX2	Auxiliary Temperature 2 Level 2 Alarm.
434	HI PRE ENG T COOLNT	High Pre-Engine Coolant Temperature (Limit 1).
435	SS PRE ENG T COOLNT	High Pre-Engine Coolant Temperature (Limit 2).
436	AL L1 P AUX 2	Auxiliary Pressure 2 Level 1 Alarm.
437	AL L2 P AUX 2	Auxiliary Pressure 2 Level 2 Alarm.

Fault Code Number	String	Description
438	LO P FUEL RAIL 2 STR	Low pressure on fuel rail 2.
439	HI P FUEL RAIL 2 STR	Hi pressure on fuel rail 2.
440	AL L1 P AUX 1	Pressure input of Aux 1 injured limit 1.
441	AL RAIL 2 LEAKAGE STR	Alarm fuel rail 2 leak detected.
442	AL L2 P AUX 1	Pressure input of Aux 1 injured limit 2.
443	HI P CHG MIX DIFF	High Charge Mix Differential Pressure.
444	SD U PDU	Sensor defect of Injector Power driver unit.
445	SD P AMBIENT AIR	Ambient air pressure-sensor defect.
446	SD P HD2	Sensor Defect In HD 2 Pressure Sensor.
447	HIHI P CHG MIX DIFF	Charge Mixture Differential Pressure High (Limit 2).
448	HI P CHARGE AIR	Pressure of charge air too high (limit 1).
449	SS P CHARGE AIR	Pressure of charge air too high (limit 2).
450	SD IDLE END TRQ IN	Input of Idle/End-Torque defect
451	HI T CHARGE MIX	High Charge Mixture Temperature (Limit 1).
452	HI HI T CHARGE MIX	High Charge Mixture Temperature (Limit 2).
453	LO T CHARGE MIX	Low Charge Mixture Temperature.
454	SS PWR RED ACT	Power Reduction is activated.
455	AL L1 AUX1 PLANT	Input of Aux 1 (plant) injured limit 1.
456	AL L2 AUX1 PLANT	Input of Aux 1 (plant) injured limit 2.
457	LO T INTAKE AIR	Low Intake Air Temperature (Limit 1).
458	LO LO T INTAKE AIR	Low Intake Air Temperature (Limit 2).
459	SD P CLNT B ENG	Sensor Defect In the Coolant Before Engine Pressure Sensor.
460	HI T EXHAUST EMU	Exhaust gas temperature of EMU too high (limit 1).
461	LO T EXHAUST EMU	Exhaust gas temperature of EMU too low (limit 1).
462	HI T COOLANT EMU	Coolant temperature of EMU injured limit 1.
463	SD AUX 2	Sensor defect on Aux 2.
464	SD P AUX 1	Analog input for pressure Aux 1 defect.
465	SD P AUX 2	Sensor Defect in the Auxiliary 2 Pressure Sensor.
466	SD T AUX 2	Sensor Defect in the Auxiliary 2 Temperature Sensor.
467	AL L2 T AUX 1	Temperature input of Aux 1 injured limit 2.
468	SD T AUX 1	Analog input for Temperature Aux 1 defect.
469	SD AUX 1	Analog input for Aux 1 defect.
470	SD T ECU	ECU temperature-sensor defect.
471	SD COIL CURRENT	Coil Current sensor defect.
472	AL STOP SD	Engine stop, because critical channel has sensor defect.
473	AL WIRING PWM CM2	Open load or short circuit on channel PWM CM2.
474	AL WIRING FREQ OUT	Open load or short circuit on frequency output (FO) channel.
475	AL CR TRIG ENG ST	Released in case of an engine stop in order to trigger the crash recorder.
476	AL CRASH REC ERR	Initial error of crash recorder.
477	WRT MISTK BIN VAL	Binary Data Write Error.
478	AL COMB ALM YEL	Combined Alarm YELLOW (Plant).
479	AL COMB ALM RED	Combined Alarm RED (Plant).
480	AL EXT ENG PROT	External Engine Protection function active.
481	SD COIL CURRENT 2	Sensor Defect In Coil Current 2 Sensor.
482	SD T EXHAUST C	Sensor Defect In Exhaust System C Temperature Sensor.
483	SD T EXHAUST D	Sensor Defect In Exhaust System D Temperature Sensor.
484	HI T EXHAUST C	High Exhaust C Temperature (Limit 1).

Fault Code Number	String	Description
485	SS T EXHAUST C	High Exhaust C Temperature (Limit 2).
486	HI T EXHAUST D	High Exhaust D Temperature.
487	SS T EXHAUST D	Shutdown due to High Exhaust D Temperature.
488	HI ETC 3 OVERSPD	High Turbo Charger ETC 3 Overspeed (Limit 1).
489	SS ETC 3 OVERSPD	High Turbo Charger ETC 3 Overspeed (Limit 2).
490	HI ETC 4 OVERSPD	High Turbo Charger ETC 4 Overspeed (Limit 1).
491	SS ETC 4 OVERSPD	High Turbo Charger ETC 4 Overspeed (Limit 2).
492	HI ETC 4 CUTIN FAIL	High Turbo Charger ETC 4 Cut In Failure (Limit 1).
493	HI ETC 3 CUTIN FAIL	High Turbo Charger ETC 3 Cut In Failure (Limit 2).
494	SD THROTL A FDBK	Sensor Defect In Throttle A Feedback Sensor.
495	SD THROTL B FDBK	Sensor Defect In Throttle B Feedback Sensor.
496	SD P CHARGE MIX A	Sensor Defect In Charge Mix A Pressure Sensor.
497	SD P CHARGE MIX B	Sensor Defect In Charge Mix B Pressure Sensor.
498	SD P CHRG MIX DIFF	Sensor Defect In Charge Mix Differential Pressure Sensor.
499	SD P CHARGE MIX	Sensor Defect In Charge Mix Pressure Sensor.
500	AL WIRING POM STARTER 1	A wiring fault has been detected in the connection of starter 1 of POM.
501	AL WIRING POM STARTER 2	A wiring fault has been detected in the connection of starter 2 of POM.
502	AL OPEN LD POM ALTRNATR	An open load on POM's alternator output has been detected.
503	AL BATT NOT CHARGING	Battery is not being charged by alternator.
504	AL CAN POM NODE LOST	POM is missing on CAN bus.
505	AL NEW POM FOUND	New POM found.
506	AL LOW STARTER VOLTS	Battery voltage is too low for starting.
507	AL POM ERROR	A general POM error has been detected.
508	AL WRONG POM ID	POM sends a different identification number (ID) than expected.
509	AL CHECK POM FUSE	Check POM fuse.
510	AL OVERRIDE APPLIED	Override applied.
511	HIHI P CHG MIX A	Hi Charge Air Mix A Pressure (Limit 2).
512	HIHI P CHG MIX B	Hi Charge Air Mix B Pressure (Limit 2).
513	SD P COOLNT DIFF	Sensor Defect In Coolant Differential Pressure Sensor.
514	WRITE ERR FLASH	Write Error Occurred when writing data to Flash Memory.
515	STARTER NOT ENGAGED	Starter of POM could not be engaged.
516	OILNIVEAU CAL ERR	Remote Oil Level Watchman Calibration Error.
517	SD CHG MX PR THRT	Sensor Defect In Charge Pre-Throttle Mix Pressure Sensor.
518	SD THROT BYPASS FDBK	Sensor Defect In Throttle Feedback Bypass Sensor.
519	OIL LVL CAL ERROR	Oil Level Calibration Error.
520	SD P IN AIR AFT FLT A	Sensor Defect In Intake Air After Filter A Pressure Sensor.
521	SD P OIL MID VAL	Lube Oil Pressure Middle Value (Limit 2).
522	SD P IN AIR AFT FLT B	Sensor Defect In Intake Air After Filter B Pressure Sensor.
523	SD T COOL RED MIDVL	Coolant Temperature Mid value (Limit 2).
524	SS ENG OVRSPD MIDVL	Engine Speed Middle Value too high (Limit 2).
525	SD P LUBE OIL R2	Sensor Defect In Lube Oil Pressure (R2) Sensor.
526	SD T COOL OIL R2	Sensor Defect In Oil Coolant Temperature (R2) Sensor.
527	TD ENG SPD SNS DEV	Engine Speed Sensor Deviation.
528	SD ENG SPD SENSR 3	Sensor Defect in Engine Speed Third Sensor.
529	SS T COOL RED 2	Coolant Temperature Red 2 Alarm (Limit 2).

Fault Code Number	String	Description
530	SS P LUBE OIL RED 2	Lube Oil Pressure Red 2 Alarm (Limit 2).
531	AL WIRING PWM CM1	PWM CM1 Wiring Issue.
532	AL WIRING PWM1	PWM 1 Wiring Issue.
533	AL WIRING PWM2	PWM 2 Wiring Issue.
534	HIHI POWER DIFF	Power Difference High (Limit 2).
535	LOLO POWER DIFF	Power Difference Low (Limit 2).
536	AL WIRING PWM1 CM1	PWM CM1 Wiring Issue.
537	SD P VNTRI DLTA SD A	Sensor Defect In Venturi Side A Delta Pressure Sensor.
538	SD P VNTRI DLTA SD B	Sensor Defect In Venturi Side B Delta Pressure Sensor.
539	SD P EGR VNTRI STATIC	Sensor Defect In EGR Venturi Static Pressure Sensor.
540	SD T EGR	Sensor Defect In EGR Temperature Sensor.
541	AL L1 T EGR	EGR Temperature (Limit 1) Alarm.
542	AL L2 T EGR	EGR Temperature (Limit 2) Alarm.
543	MULTIPLE FDH SLAVES	There is more than one device which is configured as Backup for FDH-Functionality.
544	CONFIGURATION CHANGED	Gets active in case of changing system configuration e.g. by changing ECU- or SAM-Device. Remains until undo procedure or data is transferred by a valid maintenance case. Is cancelled automatically.
545	AL L1 P EXT PLNT1	External Plant 1 Pressure Alarm (Limit 1).
546	AL L1 P EXT PLNT2	External Plant 2 Pressure Alarm (Limit 1).
547	AL L1 T EXT PLNT1	External Plant 1 Temperature Alarm (Limit 1).
548	AL L1 T EXT PLNT2	External Plant 2 Temperature Alarm (Limit 1).
549	AL PWR CUTOFF DET	Power Cutoff Detected.
550	SS ENG OVRSP RED2	Engine Overspeed Red2 (Limit 1) Alarm.
551	SS ENG OVRSPD CAMSFT	Engine Overspeed Camshaft (Limit 1) Alarm.
552	AL GAS CTRL CHK FLT	Gas Control Check Fault Alarm.
553	AL AUX DEVICES FLT	Auxiliary Devices Alarm.
554	AL IGNITION FAULT	Ignition Fault Alarm.
555	AL CALL FIELD SERVICE	Gets active in case of completing a maintenance-case which manipulates Engine-Parameters. Remains also after switching on-off ECU until a valid release code is entered via Display- and Button-Control of SAM-Device. Release Code is available via Internet by a special procedure.
556	AL GAS VALVE FLT	Gas Valve Fault Alarm.
557	AL ENG SPD COLL. FLT	Engine Speed Collapse Fault Alarm.
558	AL WIRING PWM CM2	PWM CM2 Wiring Issue.
559	AL MIX THRT A FLT	Throttle A Mixture Fault Alarm.
560	AL MIX THRT B FLT	Throttle B Mixture Fault Alarm.
561	AL LIM EXT PLNT BIN1	External Plant Bin 1 Limit Alarm.
562	AL LIM EXT PLNT BIN2	External Plant Bin 2 Limit Alarm.
563	AL LIM EXT PLNT BIN3	External Plant Bin 3 Limit Alarm.
564	AL LIM EXT PLNT BIN4	External Plant Bin 4 Limit Alarm.
565	L1 P AFTER AIR FLT A	Intake A Air Pressure After Filter (Limit 1).
566	L2 P AFTER AIR FLT A	Intake A Air Pressure After Filter (Limit 2).
567	L1 P AFTER AIR FLT B	Intake B Air Pressure After Filter (Limit 1).
568	L2 P AFTER AIR FLT B	Intake B Air Pressure After Filter (Limit 2).
569	AL SAM MSG DATA FLT	SAM Module Missing Data Fault.
570	L1 CAN MAX TIMG RETRD	Maximum Timing Retard from CAN (Limit 1).
571	L2 CAN MAX TIMG RETRD	Maximum Timing Retard from CAN (Limit 2).
572	L3 CAN MAX TIMG RETRD	Maximum Timing Retard from CAN (Limit 3).

Fault Code Number	String	Description
573	SD P DIFF STR VS VRD	Sensor Defect in Pressure Differential Sensor Pitot Tube vs. Pressure.
574	SD M AIR EGR BEF CLR	Sensor Defect In Air Mass Sensor before EGR Cooler.
575	SD M INTAKE AIR	Sensor Defect In Intake Air Mass Sensor.
576	AL ESCM OVERRIDE STR	Exceeding of the corrected current MCR - odr DBR/MCR value.
577	SD T LUBE OIL PAN	Sensor Defect In Oil Pan Lube Oil Temperature Sensor.
578	AL L1 T LUBOIL PAN	Lube Oil Pan Temperature (Limit 1).
579	AL MD CANRQ IDLE SPD	MD Idle Speed Request over Can Bus.
580	AL CAN SPD LIMIT	MD Speed Limitation From Can Bus.
581	AL PWM CM3	PWM CM3 Alarm.
582	AL EMERG STOP FL	Emergency Stop Failed Alarm.
583	AL BRKR CLOSED	Circuit Breaker Closed Alarm.
584	AL CAN STRTCLR FL	Start Clearance from Can Bus Fail Alarm.
585	AS MOTORSTRT BL	Engine Start Blocked Alarm.
586	LO P OIL REFILL PMP	Refill Pump Lower Oil Pressure.
587	AL WIRING PWM CM4	PWM CM4 Wiring Issue.
588	SD P OIL REFILL PUMP	Sensor Defect In Refill Pump Oil Pressure Sensor.
589	SD T EGR SIDE B	Side B EGR Temperature Alarm.
590	SD P DLTA EXHAUST A	Sensor Defect In Exhaust A Pressure Delta Sensor.
591	SD P EGRB VNTRI STATC	Sensor Defect In Side B EGR Venturi Static Pressure Sensor.
592	AS P DLTA EXH B	Sensor Defect In Exhaust B Pressure Delta Sensor.
593	SD OIL T J1939	Sensor Defect in Lube Oil Pan Temperature Sensor.
594	AL L1 PRV 1 DEFECT STR	Yellow alarm pressure relief valve first rail.
595	AL L2 PRV 1 DEFECT STR	Red alarm pressure relief valve first rail.
596	DEVELOP PR SET	Develop PR Set Alarm.
597	AL WIRING PWM CM5	PWM CM5 Wiring Issue.
598	AL L1 PRV 2 DEFECT STR	Yellow alarm pressure relief valve second rail.
599	AL L2 PRV 2 DEFECT STR	Red alarm pressure relief valve second rail.
600	SD T EXG A+B	Sensor Defect In Exhaust A Plus B Temperature Sensor.
601	SD ETC1 + EC2	Turbo Charger Speed Sensors 1 and 2 Faulty.
602	AK CAB ENG STRT LOCK	Engine Start Lock from Can Alarm.
603	SD AIR HUMIDITY	Sensor Defect In Air Humidity Sensor.
604	AL HUT CHGSPD MAX	HUT Speed Change Maximum Limit Alarm.
605	AL HUT DEV TOO HI	HUT DEV too high limit alarm.
606	AL DBL NODES LOST 1+2	Nodes Lost on Can1 and Can2 Alarm.
607	AL MD CAN STOP	MD Can Stop Alarm.
608	AL WIRING PWM CM6	PWM CM6 Wiring Issue.
609	AL WIRING PWM CM7	PWM CM7 Wiring Issue.
610	AL WIRING SUCK RESTRCT 1 STR	Open load or short circuit on PWM HP fuel control block channel.
611	AL WIRING SUCK RESTRCT 2 STR	Open load or short circuit on PWM HP fuel control block channel 2.
612	AL WIRING PRESS CTRL VLV 1 STR	Open load or short circuit on PWM pressure regulating valve channel.
613	AL WIRING PRESS CTRL VLV 2 STR	Open load or short circuit on PWM pressure regulating valve channel 2.
614	L1 P FUEL SEC FLTDIFF	Secondary Filter Fuel Pressure Limit 1 Alarm.
615	AL EIL PROTECTION STR	Alarm for Protection Module in response to faulty or manipulated EIL.
616	AL EIL ERROR STR	EIL Error.

Fault Code Number	String	Description
617	LO ACTUAL HU VAL	HU Actual Value Low (Limit 1).
618	LOLO ACTUAL HU VAL	HU Actual Value Low (Limit 2).
619	HI ACTUAL HU VAL	HU Actual Value High (Limit 1).
620	HIHI ACTUAL HU VAL	HU Actual Value High (Limit 2).
621	LO NOX VALUE	NO_X Value Low (Limit 1).
622	LOLO NOX VALUE	NO_X Value Low (Limit 2).
623	HI NOX VALUE	NO_X Value High (Limit 1).
624	HIHI NOX VALUE	NO_X Value High (Limit 2).
625	SD P FUEL ADD SEC FLT	Sensor Defect in Pressure Sensor that meters Fuel Pressure Before supplemental Filter.
626	AL WIRING PWM CM8	PWM CM8 Wiring Issue.
627	AL WIRING PWM CM9	PWM CM9 Wiring Issue.
628	AL WIRING PWM CM10	PWM CM10 Wiring Issue.
629	EGR THOTTLE A DFCT	EGR Throttle EGR Defect.
630	EGR THOTTLE B DFCT	EGR Throttle EGR Defect.
631	AL BYPASS THROT DFCT	Bypass Throttle Defect.
632	AL DISPNS THRTL DFCT	Dispenser Throttle Defect.
633	SD P AMBAIR HDT2800	Sensor Defect in Ambient HD2800 Air Pressure Sensor.
634	SD T AMBAIR HDT2800	Sensor Defect in Ambient HD2800 Air Temperature Sensor.
635	SD H AMBAIR HDT2800	Sensor Defect in Ambient HD2800 Air Humidity Sensor.
636	SD OIL LVL J1939	Sensor Defect in J1939 Lube Oil Level Sensor.
637	SD OIL T J1939	Sensor Defect in J1939 Lube Oil Temperature Sensor.
638	AL WIRING PWM SIG1	PWM SIG1 Wiring Issue.
639	AL WIRING PWM SIG2	PWM SIG2 Wiring Issue.
640	SD SM NOX O2 FACTR	Sensor Defect In Smart NOX Oxidation Factor Sensor.
641	AS SYS WATCHDG RST	System Restart by Watchdog Detected.
642	SD ELCT ENG PWR AI2	Sensor Defect In Engine Power AI2 Electronic Sensor.
643	SP P FUEL BOF	Sensor Defect in BOF Fuel Pressure Sensor.
644	AL L1 P FUEL BOF	BOF Fuel Pressure Limit 1.
645	AL L2 P FUEL BOF	BOF Fuel Pressure Limit 2.
646	AL KNOCK INTNSTY	Knock Intensity Too High.
647	SD P EXH LAMBDA	Sensor Defect in Exhaust Lambda Pressure Sensor.
648	SD P CHRG AIR B	Sensor Defect In Charge Air B Pressure Sensor.
649	AL REQ ANGL THRT A	Throttle A Angle Alarm.
650	AL REQ ANGL THRT B	Throttle B Angle Alarm.
651	AL PREHT ERROR	Preheating Error Alarm.
652	AL GET COM LOST	GET Communications Lost.
653	AL IX92X COMM LOST	IC92X Communications Lost.
654	AL FSERIES COMM LOST	F Series Communications Lost.
655	AL TECJET COMM LOST	TECJET Communications Lost.
656	AL PROACT A COMM LST	PROACT A Communications Lost.
657	AL PROACT B COMM LST	PROACT B Communications Lost.
658	AL NOXA COMM LOST	NO_X A Communications Lost.
659	AL NOXB COMM LOST	NO_X B Communications Lost.
660	AL PHYTRNA COM LST	PHYTRON A Communications Lost.
661	AL PHYTRNB COM LST	PHYTRON B Communications Lost.
662	SD SMRT NOX HTR	Sensor Defect in Smart NO_X Heater Element Sensor.

Fault Code Number	String	Description
663	SD SMRT NOX CONC.	Sensor Defect in Smart NO_X Concentration Sensor.
664	AL OIL REFILL ERR	Oil Refill Error.
665	AL GET YELLOW	GET Yellow Alarm.
666	AL IC92X YELLOW	IC92X Yellow Alarm.
667	AL FSERIES YELLOW	F Series Yellow Alarm.
668	AL TECJET YELLOW	TECJET Yellow Alarm.
669	AL PROACTA YELLOW	PROACT A Yellow Alarm.
670	AL PROACTB YELLOW	PROACT B Yellow Alarm.
671	AL NOXA YELLOW	NOX A Yellow Alarm.
672	AL NOXB YELLOW	NOX B Yellow Alarm.
673	AL PHYA YELLOW	PHYTRON A Yellow Alarm.
674	AL PHYB YELLOW	PHYTRON B Yellow Alarm.
675	AL GET RED	GET Red Alarm.
676	AL IC92X RED	IC92X Red Alarm.
677	AL FSERIES RED	F Series Red Alarm.
678	AL TECJET RED	TECJET Red Alarm.
679	AL PROACTA RED	PROACT A Red Alarm.
680	AL PROACTB RED	PROACT B Red Alarm.
681	AL NOXA RED	NOX A Red Alarm.
682	AL NOXB RED	NOX B Red Alarm.
683	AL PHYA RED	PHYTRON A Red Alarm.
684	AL PHYB RED	PHYTRON B Red Alarm.
685	AL LUBE OIL MIN	Lube Oil Minimum.
686	AL LUBE OIL MAX	Lube Oil Maximum.
687	AL LUBEOIL LVL SW	Lube Oil Level Switch is Faulty.
688	LO OIL REFILL	Low Oil Refill.
689	HI OIL REFILL	High Oil Refill.
690	AL LUBEOIL LVL LO	Lube Oil Level Low.
691	HI LUBEOIL LVL REFILL	Lube Oil Refill Level High.
692	AL ECU PWR OFF ON REQ STR	ECU configuration changed, switch power off/on.
693	AL MB VALVE ERR	MB Valve Error.
694	SD T GAS	Sensor Defect in Gas Temperature Sensor.
695	AL EGR FAILURE	EGR Failure Alarm.
696	AL SMARTCONCT USB ERR STR	Alarm configuration parameter.
697	AL SMARTCONCT RS485 ERR STR	Alarm configuration parameter.
698	AL SD STOP BUTTON STR	Channel signals open load or internal error.
700	AL SD START BUTTON STR	Channel signals open load.
701	AL SD UP BUTTON STR	Channel signals open load.
702	AL SD DN BUTTON STR	Channel signals open load or internal error.
703	AL SD EXT SPEED DMD SW STR	Channel signals open load.
704	AL SD SPEED DMD INCREASE STR	Channel signals open load or internal error.
705	AL SD BINARY SPD DMD LMT STR	Channel signals open load or internal error.

Fault Code Number	String	Description
706	AL SD DROOP 2 SWITCH STR	Channel signals open load or internal error.
707	AL SD FREQUENCY SWITCH STR	Channel signals open load or internal error.
709	AL SD OVERRIDE BUTTON STR	Channel signals open load or internal error.
710	AL SD ALARM RESET STR	Channel signals open load or internal error.
711	AL SD CYLINDER CUTOUT STR	Channel signals open load or internal error.
712	AL SD RQST BIN OUT TST STR	Channel signals open load or internal error.
713	AL SD EXT ENGINE PROTECTN STR	Channel signals open load or internal error.
714	AL SD PRELUBE SIGNAL STR	Channel signals open load.
715	AL SD EXT INC IDLE BIN STR	Channel signals open load.
716	AL SD EXT INC IDLE BIN BRK STR	Channel signals open load.
717	AL SD RQST PLANT DBR STR	Channel signals open load.
718	INTK AIR THRTL DFCT	Intake Air Throttle Defect.
719	AL T GAS L1	Gas Temperature Limit Alarm (Limit 1).
720	AL T GAS L2	Gas Temperature Limit Alarm (Limit 2).
721	AL T GAS L3	Gas Temperature Limit Alarm (Limit 3).
722	AL T GAS L4	Gas Temperature Limit Alarm (Limit 4).
723	SD T EXH BEF DOC A	Sensor Defect Exhaust Temperature Sensor before DOC.
724	SD T EXH BEF DPF A	Sensor Defect Exhaust Temperature Sensor before DPF.
725	SD T EXH AFTR DPF A	Sensor Defect Exhaust Temperature Sensor after DPF
726	SD P DELTA EXH DPF A	Sensor Defect in DPF Exhaust Pressure Delta Sensor.
727	L1 DELTA T_NT INTRCLR	NT Intercooler NT Temperature (Limit 1) Alarm.
728	L2 DELTA T_NT INTRCLR	NT Intercooler NT Temperature (Limit 2) Alarm.
729	L1 T EXH BEF DOC	Exhaust Temperature Before DOC (Limit 1) Alarm.
730	L2 T EXH BEF DOC	Exhaust Temperature Before DOC (Limit 2) Alarm.
731	L2 T EXH BEF DPF	Exhaust Temperature Before DPF (Limit 1) Alarm.
732	L2 T EXH BEF DPF	Exhaust Temperature Before DPF (Limit 2) Alarm.
733	L1 T EXH AFTR DPF	Exhaust Temperature After DPF (Limit 1) Alarm.
734	L2 T EXH AFTR DPF	Exhaust Temperature After DPF (Limit 2) Alarm.
735	L1 P_DPF DIFF	DPF Exhaust Pressure Difference Alarm (Limit 1) Alarm.
736	L2 P_DPF DIFF	DPF Exhaust Pressure Difference Alarm (Limit 2) Alarm.
737	L1 P_DPF NORM DIFF	DPF Normal Difference Pressure (Limit 1) Alarm.
738	L2 P_DPF NORM DIFF	DPF Normal Difference Pressure (Limit 2) Alarm.
739	L3 P_DPF NORM DIFF	DPF Normal Difference Pressure (Limit 3) Alarm.
740	L4 P_DPF NORM DIFF	DPF Normal Difference Pressure (Limit 4) Alarm.
741	DPF RIGOROUS TM ABORT	DPF Rigorous TM Aborted Alarm.
742	DPF PER RIGOROUS TM	DPF Periodic Rigorous TM Alarm.
743	DPF RIG TM SUPPR	DPF Rigorous TM Suppressed Alarm.
744	DPF FLASH READ ERR	DPF Flash Memory Read Error Alarm.
745	AL EMISSN FLT	Emission Fault Alarm.
746	AL EMISSN FLT2	Emission Fault 2 Alarm.

Fault Code Number	String	Description
747	SD P INTK AIRFLT DIFF	Sensor Defect in the Intake Air Filter Differential Pressure Sensor.
748	SD T EXH BEF SCR F1	Sensor Defect in Exhaust Temperature Sensor Before SCR Filter 1.
749	SD T EXH BEF SCR F2	Sensor Defect in Exhaust Temperature Sensor Before SCR Filter 2.
750	SD T EXH AFTR SCR F1	Sensor Defect in Exhaust Temperature Sensor After SCR Filter 1.
751	SD T EXH AFTR SCR F2	Sensor Defect in Exhaust Temperature Sensor After SCR Filter 2.
752	SD DEF TANK LVL	Sensor Defect in DEF Tank Level Sensor.
753	SD T RM TANK	Sensor Defect in RM Tank Temperature Sensor.
754	SD BOSCH LSU LMBDA SNS	Sensor Defect In Bosch LSU Lambda Sensor.
755	SELCTD MODE NOT VLD	Selected Mode Not Valid Alarm.
756	NO VLD MODE SW SGNL	No Valid Mode Switch Alarm.
757	AL LIM T COOL LT FAN	Coolant LT Fan Limit (Limit 1) Alarm.
758	DEF NOZZLE DAMG	DEF Nozzle Damage Alarm.
759	L1 T FUEL B ENGINE	Fuel Temperature Before Engine too high (Limit 1) Alarm.
760	L2 T FUEL B ENGINE	Fuel Temperature Before Engine too high (Limit 2) Alarm.
761	SD T FUEL B ENGINE	Sensor Defect In Sensor metering Fuel Temperature Before Engine Alarm.
762	AL SMRT CNCT LOST	Smart Connect Lost Alarm.
763	AL OL ASO FLP FDBK B	OL ASO Flap B Feedback Alarm.
764	ASO FLP B CLSD A FL	ASO Flap B Closed A Failed Alarm.
765	AL OL ASO FLP FDBK A	OL ASO Flap A Feedback Alarm.
766	ASO FLP A CLSD B FL	ASO Flap A Closed B Failed Alarm.
767	ASP FLAPS CLOSED	ASO Flaps Closed Alarm.
768	ST T EXH V HPTURBN A1	Sensor Defect In Exhaust V HP Turbine A1 Temperature Sensor.
769	SD T EXH AFTR ENG	Sensor Defect In Exhaust Temperature After Engine Sensor.
770	SD T SEA WATER PUMP	Sensor Defect In Sea Water After Pump Temperature Sensor.
771	SD T FUEL B	Sensor Defect In Fuel Temperature B Sensor.
772	SD LVL OIL REFILL TNK	Sensor Defect In Refill Tank Oil Level Sensor.
773	SD P FUEL RTN PATH	Sensor Defect In Return Path Fuel Pressure Sensor.
774	SD P FUEL BEFR ENG	Sensor Defect In Fuel Pressure Before Engine Sensor.
775	SD P SCHM AFT LVL PMP	Sensor Defect In After Level Pump Oil Pressure Sensor.
776	SD P SCHM AT HPPUMP A	Sensor Defect In Oil Pressure at HP Pump A Sensor.
777	SD P SCHM AT HPPUMP B	Sensor Defect In Oil Pressure at HP Pump B Sensor.
778	ASO FLPS OPN FL TO CLS	ASO Flaps Open, Failed to Close Alarm.
779	WRONG NOX SNSR E1	NO_X Sensor E1 Wrong Position Alarm.
780	WRONG NOX SNSR E2	NO_X Sensor E2 Wrong Position Alarm.
781	WRONG NOX SNSR E3	NO_X Sensor E3 Wrong Position Alarm.
782	SD P LUBOIL ETC A	Turbo Charger A Lube Oil Pressure Too High.
783	SD T EXH BEFR SCR F3	Sensor Defect In Before SCR Exhaust Temperature Sensor.
784	SD T EXH AFTR SCR F3	Sensor Defect In After SCR Exhaust Temperature Sensor.
785	L1 P OIL BEF HD PMP A	Oil Pressure Before HD PUMP A (Limit 1) Alarm.
786	L1 P OIL BEF HD PMP B	Oil Pressure Before HD PUMP B (Limit 1) Alarm.
787	L1 P OILNIV PUMP	Oil Pressure in Oil Niveaux Pump (Limit 1) Alarm.
788	ETC SPD FL DETECT	Turbo Charger Speed Failure Detected.
789	WRONG POS TMP SNS E1	Temperature Sensor E1 Wrong Position Alarm.
790	WRONG POS TMP SNS E2	Temperature Sensor E2 Wrong Position Alarm.
791	WRONG POS TMP SNS E3	Temperature Sensor E3 Wrong Position Alarm.
792	L1 P CHARGE AIR B	Charge Air B Pressure (Limit 1) Alarm.
793	L2 P CHARGE AIR B	Charge Air B Pressure (Limit 2) Alarm.

Fault Code Number	String	Description
794	L1 P FL BEFR ENGN	Fuel Pressure Before Engine (Level 1) Alarm.
795	L1 P FUEL RTN	Fuel Pressure in Return Path (Limit 1) Alarm.
796	HI T CHARGE AIR B	High Charge Air B Temperature (Limit 1) Alarm.
797	HIHI T CHRG AIR B	High Charge Air B Temperature (Limit 2) Alarm.
798	L1T EXH BEF HPTRBN A1	Exhaust Temperature Before HP Turbine A1 (Limit 1) Alarm.
799	L2T EXH BEF HPTRBN A1	Exhaust Temperature Before HP Turbine A1 (Limit 2) Alarm.
800	L1 T EXH AFTR ENGINE	Exhaust Temperature After Engine (Limit 1) Alarm.
801	L1T RAW WATR AFTR PMP	Raw Water After Pump Temperature (Limit 1) Alarm.
802	L1T FUEL BEFR ENGINE	Fuel Temperature Before Engine (Limit 1) Alarm.
803	HI T FUEL B	High Fuel B Temperature (Limit 1) Alarm.
804	SS T FUEL B	High Fuel B Temperature (Limit 2) Alarm.
805	LO OIL LVL REFILL	Refill Oil Level Low Alarm.
806	SD CHARGR 3 SPD	Sensor Defect In Turbo Charger 3 Speed Sensor.
807	SD CHARGR 4 SPD	Sensor Defect In Turbo Charger 4 Speed Sensor.
808	SD CHARGR 5 SPD	Sensor Defect In Turbo Charger 5 Speed Sensor.
809	SD F1 NOX BEFOR SCR	Sensor Defect In F1 NO_X Before SCR sensor.
810	NO COMS F1NOX BF SCR	Communications Lost with F1 NO_X Before SCR sensor.
811	SD F1 NOX AFTR SCR	Sensor Defect In F1 NO_X After SCR sensor.
812	NO COMS F1NOX AF SCR	F1 NO_X After SCR Communications lost alarm.
813	SD F2 NOX BEFOR SCR	Sensor Defect In F2 NO_X Before SCR sensor.
814	NO COMS F2NOX BF SCR	F2 NO_X Before SCR Communications lost alarm.
815	SD F2 NOX AFTR SCR	Sensor Defect In F2 NO_X After SCR sensor.
816	NO COMS F2NOX AF SCR	F2 NO_X After SCR Communications lost alarm.
817	SD F3 NOX BEFOR SCR	Sensor Defect In F3 NO_X Before SCR sensor.
818	NO COMS F3NOX BF SCR	F3 NO_X Before SCR Communications lost alarm.
819	SD F3 NOX AFTR SCR	Sensor Defect In F3 NO_X After SCR sensor.
820	NO COMS F3NOX AF SCR	F3 NO_X After SCR Communications lost alarm.
821	HI ETC1 IDLE SPEED	Turbo Charger 1 Speed at Idle Too High.
822	HI ETC2 IDLE SPEED	Turbo Charger 2 Speed at Idle Too High.
823	HI ETC3 IDLE SPEED	Turbo Charger 3 Speed at Idle Too High.
824	HI ETC4 IDLE SPEED	Turbo Charger 4 Speed at Idle Too High.
825	HI ETC5 IDLE SPEED	Turbo Charger 5 Speed at Idle Too High.
826	AL ETC1 SPD DEVTN	Turbo Charger 1 Speed Deviation.
827	AL ETC2 SPD DEVTN	Turbo Charger 2 Speed Deviation.
828	AL ETC3 SPD DEVTN	Turbo Charger 3 Speed Deviation.
829	AL ETC4 SPD DEVTN	Turbo Charger 4 Speed Deviation.
830	AL ETC5 SPD DEVTN	Turbo Charger 5 Speed Deviation.
831	AL ETC JOB ROTATN	Turbo Charger Job Rotation Alarm.
832	EIL DIFF ENG NUMBR	EIL Different Engine Number Alarm.
833	AL EMISSION WRN	Emission Warning Alarm.
834	AL GAS PATH WRN	Gas Path Warning Alarm.
835	AL GAST PATH FLT	Gas Path Fault Alarm.
836	AL SPEED DMD FAIL	Speed Demand Failure Alarm.
837	BYPASS VLV DEFCT	Bypass Valve Defect Alarm.
838	AL ASH VOLUME	Ash Volume Alarm.
839	ECU NT CLS ECO FLAP A	ASO Flap A not closed by ECU Alarm.
840	ECU NT CLS ECO FLAP B	ASO Flap B not closed by ECU Alarm.

Fault Code Number	String	Description
841	SD P GASLN COM RL	Sensor Defect in Gasoline Common Rail Pressure Sensor.
842	AL ACT FL VLV POS L1	ACT Fuel Valve Position (Limit 1) Alarm.
843	SD T CHRG AIR BEF EGR	Sensor Defect in Charge Air Before EGR Temperature Sensor.
844	HI T CHRG AIR BEF EGR	Charge Air Before EGR High Temperature (Limit 1) Alarm.
845	HIHI T CHRGAIR BF EGR	Charge Air Before EGR High Temperature (Limit 2) Alarm.
846	HI T CHRG AIR DIFF AB	Charge Air Differential AB High Temperature (Limit 1) Alarm.
847	HIHI T CHRG AIR DF AB	Charge Air Differential AB High Temperature (Limit 2) Alarm.
848	AL REL HUMIDTY L1	Relative Humidity (Limit 1) Alarm.
849	AL IBT FUNCT ACTV	IBT Function Active Alarm.
850	SD ALIVE FIP	Sensor Defect in ALIVE FIP sensor.
851	AL EXT STRT HD HI	External Start and HD Too High Alarm.
852	MAX BLNK SH TM EXP	Max Blank Shot Time Expired Alarm.
853	HSB1 COMMS LOST	HSB1 Communications Lost Alarm.
854	HSB1 ACUTATR DEFCT	HSB1 Actuator Defect Alarm.
855	BYPASS THR2 DEFCT	Bypass Throttle 2 Defect Alarm.
856	SD P LUBOIL ETC B	Sensor Defect In Turbo Charger Oil Pressure Sensor.
857	NOX ATO1 SENSR DEFCT	NO_X ATO 1 Sensor Defect Alarm.
858	L1 P LUBOIL ETC B	Turbo Charger B Oil Pressure Low (Limit 1).
859	HSB2 COMMS LOST	HSB2 Communications Lost Alarm.
860	HSB2 ACUTATR DEFCT	HSB2 Actuator Defect Alarm.
861	DEF IN PIPE S_ACT SYS	DEF in DEF Pipe in ACT system Alarm.
862	DEF TNK HT SNS_ACT SD	DEF Tank ACT Sensor Defect.
863	HSB3 COMMS LOST	HSB3 Communications Lost Alarm.
864	HSB3 ACUTATR DEFCT	HSB3 Actuator Defect Alarm.
865	HSB4 COMMS LOST	HSB4 Communications Lost Alarm.
866	HSB4 ACUTATR DEFCT	HSB4 Actuator Defect Alarm.
867	L1 P LUBOIL ETC A	Turbo Charger A Oil Pressure Low (Limit 1).
868	L2 P LUBOIL ETC A	Turbo Charger A Oil Pressure Low (Limit 2).
869	L2 P LUBOIL ETC B	Turbo Charger B Oil Pressure Low (Limit 2).
870	AL MB VLV DEFCT 2	MB Valve Defect 2 Alarm.
871	NOX ATO1 COMS LOST	NOX ATO 1 Communications Lost Alarm.
872	EGR A REF LEARN FAIL	EGR Reference Learning Algorithm Failure Alarm.
873	DEF TNK LVL EMPTY	DEF Tank Level Empty Alarm.
874	SCR FAIL	SCR Failure Alarm.
875	ADBLUE TANK LOW	ADBLUE (DEF) Tank Level Low Alarm.
876	EGR B REF LEARN FAIL	EGR B Reference Learning Algorithm Failure Alarm.
877	BYP A REF LEARN FAIL	Bypass A Reference Learning Algorithm Failure Alarm.
878	BYPASS B FAST LRN FL	Bypass B Fast Learn Algorithm Failure Alarm.
879	DISPNSR REF LRN FL	Dispenser Reference Learn Algorithm Failure Alarm.
880	INTAKEAIR REF LRN FL	Intake Air Reference Learn Algorithm Failure Alarm.
881	AL UREA QLTY RELEASE	Urea Quality Release Alarm.
882	SCR F1 SU REVLTN RNG	SCR F1 SU Revolution Range Alarm.
883	SCR F2 SU REVLTN RNG	SCR F2 SU Revolution Range Alarm.
884	SCR F1 SU ADBLUE QNTY	SCR F1 SU ADBLUE Quantity.
885	SCR F2 SU ADBLUE QNTY	SCR F2 SU ADBLUE Quantity.
886	SCR ADBLUE PRESSR	SCR ADBLUE Pressure Alarm.
887	SCR SU PRIME REQUEST	SCR SU Priming Request Alarm.

Fault Code Number	String	Description
888	SCR SU ADBLUE PRESSR	SCR SU ADBLUE Pressure Alarm.
889	SD T LUBEOIL ETC	Sensor Defect In Turbo Charger Oil Temperature Sensor.
890	L2 T LUBEOIL ETC	Lube Oil Temperature Too High (Limit 2).
891	AL TURNING ACTIVATED	Turning Activation Alarm.
892	FLO1 SPPLYUNT1 COM LS	Lost Communications with Air Flow 1 Supply Unit 1.
893	FLO1 SPPLYUNT2 COM LS	Lost Communications with Air Flow 1 Supply Unit 2.
894	FLO2 SPPLYUNT1 COM LS	Lost Communications with Air Flow 2 Supply Unit 1.
895	FLO2 SPPLYUNT2 COM LS	Lost Communications with Air Flow 2 Supply Unit 2.
896	FLO3 SPPLYUNT1 COM LS	Lost Communications with Air Flow 3 Supply Unit 1.
897	FLO3 SPPLYUNT2 COM LS	Lost Communications with Air Flow 3 Supply Unit 2.
898	TRICAN COMMS LOST	Communications Lost on TRICAN network.
899	OLT COMMS LOST	Communications to OLT Lost.
900	SCRF3 SU REV RNG	SCR F3 SU Revolution Range Alarm.
901	SCRF3 SU ADBLUE QTY	SCR F3 SU Adblue Quantity Low.
902	HI TCOOL CYL HEAD	High Cylinder Head Coolant Temperature (Limit 1).
903	SD TCOOL CYL HEAD	Sensor Defect in Cylinder Head Coolant Temperature Sensor.
904	SS TCOOL CYL HEAD	High Cylinder Head Coolant Temperature (Limit 2).
905	ADBLUE EXP CNS FL	ADBLUE Expected Consumption Failure Alarm.
906	ADBLUE BALANCE FL	ADBLUE Balance Failed Alarm.
907	NOX RAW EMISSN FL	NO_X Raw Gas Emission Failed Alarm.
908	APPRCH NOX DOS STP FL	Approach NO_X Dosing Stop Failed Alarm.
909	SCR TEXH BTW FLOWS FL	Exhaust Temperature Between SCR Flows Failed Alarm.
910	EXP TEXH BFR SCR FL	Expected Exhaust Temperature Before SCR Failure Alarm.
911	EXP TEXH AFT SCR FL	Expected Exhaust Temperature After SCR Failure Alarm.
912	SCR F1 TEXH BFR GRDNT	SCR F1 Exhaust Temperature Before Gradient Alarm.
913	SCR F2 TEXH BFR GRDNT	SCR F2 Exhaust Temperature Before Gradient Alarm.
914	SCR F3 TEXH BFR GRDNT	SCR F3 Exhaust Temperature Before Gradient Alarm.
915	SCR F1 TEXH AFT GRDNT	SCR F1 Exhaust Temperature After Gradient Alarm.
916	SCR F2 TEXH AFT GRDNT	SCR F2 Exhaust Temperature After Gradient Alarm.
917	SCR F3 TEXH AFT GRDNT	SCR F3 Exhaust Temperature After Gradient Alarm.
918	L1 T LUBEOIL ETC	Turbo Charger Lube Oil Temperature High (Limit 1).
919	ENERGY CNTR DEFCT	Energy Counter Defect Alarm.
920	L1 TEXH BFR SCRF1	Exhaust Temperature Before SCR F1 (Limit 1) Alarm.
921	L2 TEXH BFR SCRF1	Exhaust Temperature Before SCR F1 (Limit 2) Alarm.
922	L1 TEXH AFT SCRF1	Exhaust Temperature After SCR F1 (Limit 1) Alarm.
923	L2 TEXH AFT SCRF1	Exhaust Temperature After SCR F1 (Limit 2) Alarm.
924	L1 TEXH BFR SCRF2	Exhaust Temperature Before SCR F2 (Limit 1) Alarm.
925	L2 TEXH BFR SCRF2	Exhaust Temperature Before SCR F2 (Limit 2) Alarm.
926	L1 TEXH AFT SCRF2	Exhaust Temperature After SCR F2 (Limit 1) Alarm.
927	L2 TEXH AFT SCRF2	Exhaust Temperature After SCR F2 (Limit 2) Alarm.
928	L1 TEXH BFR SCRF3	Exhaust Temperature Before SCR F3 (Limit 1) Alarm.
929	L2 TEXH BFR SCRF3	Exhaust Temperature Before SCR F3 (Limit 2) Alarm.
930	L1 TEXH AFT SCRF3	Exhaust Temperature After SCR F3 (Limit 1) Alarm.
931	L2 TEXH AFT SCRF3	Exhaust Temperature After SCR F3 (Limit 2) Alarm.
932	AL MIC5 YELLOW	MIC 5 Yellow Alarm.
933	AL MIC5 RED	MIC 5 Red Alarm.
934	AL MIC5 COMM LOST	MIC 5 Comms Lost Alarm.

Fault Code Number	String	Description
935	LO F1 TEXH BFR SCR	F1 Exhaust Temperature before SCR Too Low Alarm.
936	LO F2 TEXH BFR SCR	F2 Exhaust Temperature before SCR Too Low Alarm.
937	LO F3 TEXH BFR SCR	F3 Exhaust Temperature before SCR Too Low Alarm.
938	LO F1 TEXH AFT SCR	F1 Exhaust Temperature after SCR Too Low Alarm.
939	LO F2 TEXH AFT SCR	F2 Exhaust Temperature after SCR Too Low Alarm.
940	LO F3 TEXH AFT SCR	F3 Exhaust Temperature after SCR Too Low Alarm.
941	LO SCR OPRATING T	SCR Operating Temperature Too Low Alarm.
942	CATLY CONV LO F1	Catalytic Conversion Too Low F1 Alarm.
943	CATLY CONV LO F2	Catalytic Conversion Too Low F2 Alarm.
944	CATLY CONV LO F3	Catalytic Conversion Too Low F3 Alarm.
945	L1 L VOLTAGE ASO	Low ASO Voltage (Limit 1) Alarm.
946	L2 L VOLTAGE ASO	Low ASO Voltage (Limit 2) Alarm.
947	INVALD LSI CHANL CFG	Invalid LSI Channel Configuration Alarm.
948	AL ESI ACTIVATED	ESI Activated Alarm.
949	SD VOLTAGE ASO	Sensor Defect in ASO Voltage Sensor.
950	SCR SU FLT S EXST F1	SCR SU Fault S F1 Exists alarm.
951	ETC0 CUTIN FAIL	Turbo Charger 0 Cut In Failure.
952	ETC1 CUTIN FAIL	Turbo Charger 1 Cut In Failure.
953	LAMBDA VALUE INVALID	Lambda Value Invalid Alarm.
954	NOX VALUE INVALID	NO_X Value Invalid Alarm.
955	THRML MANGMT ACTV	Thermal Management Active Alarm.
956	P5 CNTVAR LIM MN ACTV	P5 Control Variable Minimum Limit Active Alarm.
957	P5 CV MAX BOI MN ACT	P5 Control Variable Max BOI Minimum Active Alarm.
958	LMDA CTLVR LMT MN ACT	Lambda Control Variable Minimum Limit Active Alarm.
959	LMDA CV MX BOI MN ACT	Lambda Control Variable Max BOI Minimum Active Alarm.
960	NOXP5 MN BOI MX ACTV	NO_X P5 Minimum BOI Maximum Active.
961	NOXP5 MX BOI MN ACTV	NO_X P5 Maximum BOI Minimum Active.
962	GPS LMDA CV MAX ACTV	GPS Lambda Control Variable Maximum Active Alarm.
963	GPS P5 CV MAX ACTV	GPS P5 Control Variable Maximum Active Alarm.
964	GPS P5 CV MIN ACTV	GPS P5 Control Variable Minimum Active Alarm.
965	SCR SU FLT S EXIST F2	SCR SU Fault S F2 Exists Alarm.
966	SCR SU FLT S EXIST F3	SCR SU Fault S F3 Exists Alarm.
967	SCR SU PRIM REQ F1	SCR SU Priming Request F1 Alarm.
968	SCR SU PRIM REQ F2	SCR SU Priming Request F2 Alarm.
969	SCR SU PRIM REQ F3	SCR SU Priming Request F3 Alarm.
970	SD P EXHAUST	Sensor Defect in Exhaust Pressure Sensor.
971	COLD ENGINE ALARM	Cold Engine Alarm.
972	MIC5 SINGATURE DIFF	MIC5 Signature Difference Alarm.
973	AL CHECKSUM IIG	IIG Check Sum Alarm.
974	AL CAN3 BUS OFF	Can3 Bus Off Alarm.
975	CAN3 ERR PASSIVE	Can3 Error Passive Alarm.
976	AL CAN4 BUS OFF	Can4 Bus Off Alarm.
977	CAN4 ERR PASSIVE	Can4 Error Passive Alarm.
978	HI ETC5 OVERSPEED	Turbo Charger 5 Overspeed (Limit 1).
979	SS ETC5 OVERSPEED	Turbo Charger 5 Overspeed (Limit 2).
980	ADBLUE TEMP HI F1	ADBLUE (DEF) Temperature Too High F1 Alarm.
981	ADBLUE TEMP HI F2	ADBLUE (DEF) Temperature Too High F2 Alarm.

Fault Code Number	String	Description
982	ADBLUE TEMP HI F3	ADBLUE (DEF) Temperature Too High F3 Alarm.
983	STOP ON TRIG CRSHRECR	Stop on Crash Recorder Trigger Alarm.
984	NOX ATO2 SNSR DEFCT	NOX ATO2 Sensor Defect Alarm.
985	NOX ATO2 SNS COM LOST	NOX ATO 2 Communications Lost Alarm.
1000	SD LVL DEF TNK B	Sensor Defect In DEF Tank B Level Sensor.
1001	SD LVL COOL WTR	Sensor Defect In Coolant Water Level Sensor.
1002	SD LVL HYD OIL	Sensor Defect In Hydraulic Oil Level Sensor.
1003	L1 LVL COOL WTR	Coolant Water Level (Limit 1) Alarm.
1004	L2 LVL COOL WTR	Coolant Water Level (Limit 2) Alarm.
1005	L1 LVL HYD OIL	Hydraulic Oil Level (Limit 1) Alarm.
1006	L2 LVL HYD OIL	Hydraulic Oil Level (Limit 2) Alarm.
1007	L1 LVL LUBEOIL J1939	J1939 Lube Oil Level (Limit 1) Alarm.
1008	L2 LVL LUBEOIL J1939	J1939 Lube Oil Level (Limit 2) Alarm.
1009	SD P FLTR MONITR	Sensor Defect In Fuel Filter Pressure Sensor.
1010	L1 P FLTR MONITR	Fuel Filter Pressure (Limit 1) Alarm.
1011	DEF TANK LVL LO	DEF Tank Level Low Alarm.
1012	MIC5 PARM DNLOAD ACTV	MIC5 Parameter Download Active Alarm.
1013	HI DELTA NOX AB	HI Delta NO_X A-B (Limit 1) Alarm.
1014	HIHI DLTA NOX AB	HI Delta NO_X A-B (Limit 2) Alarm.
1015	TTL BKDN NOX SNRS	NOX Sensors Total Breakdown alarm.
1016	REDUND LOSS NOX SNRS	NOX Sensors Redundancy Loss Alarm.
1017	HI DELTA P5 FOR NOX	High Delta P5 for NO_X Alarm.
1018	F1 DEF CONSUMPT ERROR	F1 DEF Consumption Error Alarm.
1019	F1 DEF BALANCE ERROR	F1 DEF Balance Error Alarm.
1020	F1 RAW GAS EMSN ERROR	F1 Raw Gas Emission Error Alarm.
1021	F1 NOX ANNHRG ERROR	F1 NO_X Approaching Error Condition Alarm.
1022	TEX BEF SCR BET F1&F2	Exhaust Temperature Before SCR Between F1 and F2 Alarm.
1023	TEX AFT SCR BET F1&F2	Exhaust Temperature After SCR Between F1 and F2 Alarm.
1024	LOLO P FUEL COMM RL A	Fuel Common Rail A Low Fuel Pressure (Limit 2) Alarm.
1025	LOLO P FUEL COMM RL B	Fuel Common Rail B Low Fuel Pressure (Limit 2) Alarm.
1026	IAP COMMS LOST	IAP Communications Lost Alarm.
1027	ENGN COLD ACTIV	Engine Cold Active Alarm.
1028	F1EXP TEX BFR SCR ERR	F1 Expected Exhaust Temperature Before SCR Error Alarm.
1029	IAP MISSNG ENERG DATA	IAP Missing Energization Data Error.
1030	LO P CRANK CASE	Low Crankcase Pressure (Limit 1) Alarm.
1031	LOLO P CRK CASE	Low Crankcase Pressure (Limit 2) Alarm.
1032	INJ DRIFT LMT1 CYL A1	Cylinder A1 Injector Drift Limit 1 Alarm.
1033	INJ DRIFT LMT1 CYL A2	Cylinder A2 Injector Drift Limit 1 Alarm.
1034	INJ DRIFT LMT1 CYL A3	Cylinder A3 Injector Drift Limit 1 Alarm.
1035	INJ DRIFT LMT1 CYL A4	Cylinder A4 Injector Drift Limit 1 Alarm.
1036	INJ DRIFT LMT1 CYL A5	Cylinder A5 Injector Drift Limit 1 Alarm.
1037	INJ DRIFT LMT1 CYL A6	Cylinder A6 Injector Drift Limit 1 Alarm.
1038	INJ DRIFT LMT1 CYL A7	Cylinder A7 Injector Drift Limit 1 Alarm.
1039	INJ DRIFT LMT1 CYL A8	Cylinder A8 Injector Drift Limit 1 Alarm.
1040	INJ DRIFT LMT1 CYL A9	Cylinder A9 Injector Drift Limit 1 Alarm.
1041	INJ DRFT LMT1 CYL A10	Cylinder A10 Injector Drift Limit 1 Alarm.
1042	INJ DRIFT LMT1 CYL B1	Cylinder B1 Injector Drift Limit 1 Alarm.

Fault Code Number	String	Description
1043	INJ DRIFT LMT1 CYL B2	Cylinder B2 Injector Drift Limit 1 Alarm.
1044	INJ DRIFT LMT1 CYL B3	Cylinder B3 Injector Drift Limit 1 Alarm.
1045	INJ DRIFT LMT1 CYL B4	Cylinder B4 Injector Drift Limit 1 Alarm.
1046	INJ DRIFT LMT1 CYL B5	Cylinder B5 Injector Drift Limit 1 Alarm.
1047	INJ DRIFT LMT1 CYL B6	Cylinder B6 Injector Drift Limit 1 Alarm.
1048	INJ DRIFT LMT1 CYL B7	Cylinder B7 Injector Drift Limit 1 Alarm.
1049	INJ DRIFT LMT1 CYL B8	Cylinder B8 Injector Drift Limit 1 Alarm.
1050	INJ DRIFT LMT1 CYL B9	Cylinder B9 Injector Drift Limit 1 Alarm.
1051	INJ DRFT LMT1 CYL B10	Cylinder B10 Injector Drift Limit 1 Alarm.
1052	INJ DRIFT LMT2 CYL A1	Cylinder A1 Injector Drift Limit 2 Alarm.
1053	INJ DRIFT LMT2 CYL A2	Cylinder A2 Injector Drift Limit 2 Alarm.
1054	INJ DRIFT LMT2 CYL A3	Cylinder A3 Injector Drift Limit 2 Alarm.
1055	INJ DRIFT LMT2 CYL A4	Cylinder A4 Injector Drift Limit 2 Alarm.
1056	INJ DRIFT LMT2 CYL A5	Cylinder A5 Injector Drift Limit 2 Alarm.
1057	INJ DRIFT LMT2 CYL A6	Cylinder A6 Injector Drift Limit 2 Alarm.
1058	INJ DRIFT LMT2 CYL A7	Cylinder A7 Injector Drift Limit 2 Alarm.
1059	INJ DRIFT LMT2 CYL A8	Cylinder A8 Injector Drift Limit 2 Alarm.
1060	INJ DRIFT LMT2 CYL A9	Cylinder A9 Injector Drift Limit 2 Alarm.
1061	INJ DRFT LMT2 CYL A10	Cylinder A10 Injector Drift Limit 2 Alarm.
1062	INJ DRIFT LMT2 CYL B1	Cylinder B1 Injector Drift Limit 2 Alarm
1063	INJ DRIFT LMT2 CYL B2	Cylinder B2 Injector Drift Limit 2 Alarm.
1064	INJ DRIFT LMT2 CYL B3	Cylinder B3 Injector Drift Limit 2 Alarm.
1065	INJ DRIFT LMT2 CYL B4	Cylinder B4 Injector Drift Limit 2 Alarm.
1066	INJ DRIFT LMT2 CYL B5	Cylinder B5 Injector Drift Limit 2 Alarm.
1067	INJ DRIFT LMT2 CYL B6	Cylinder B6 Injector Drift Limit 2 Alarm.
1068	INJ DRIFT LMT2 CYL B7	Cylinder B7 Injector Drift Limit 2 Alarm.
1069	INJ DRIFT LMT2 CYL B8	Cylinder B8 Injector Drift Limit 2 Alarm.
1070	INJ DRIFT LMT2 CYL B9	Cylinder B9 Injector Drift Limit 2 Alarm.
1071	INJ DRFT LMT2 CYL B10	Cylinder B10 Injector Drift Limit 2 Alarm.
1072	F1EXP TEX AFT SCR ERR	F1 Expected Exhaust Temperature After SCR Error Alarm.
1073	F1GRD TEX BFR SCR ERR	F1 Exhaust Temperature Gradient Before SCR Error Alarm.
1074	F1GRD TEX AFT SCR ERR	F1 Exhaust Temperature Gradient After SCR Error Alarm.
1075	F1 T DEF TOO HI	F1 DEF Temperature Too High Alarm.
1076	LO F1 TEXH BFR SCR	F1 Exhaust Temperature before SCR Too Low Alarm.
1077	LO F1 TEXH AFT SCR	F1 Exhaust Temperature after SCR Too Low Alarm.
1078	F2 DEF CONSMPT ERR	F2 DEF Consumption Error Alarm.
1079	F2 DEF BALNC ERR	F2 DEF Balance Error Alarm.
1080	F2 RAW GAS EMISN ERR	F2 Raw Gas Emission Error Alarm.
1081	F2 NOX ANNHRG ERROR	F2 NO_X Approaching Error Condition Alarm.
1082	F2EXP TEX BFR SCR ERR	F2 Expected Exhaust Temperature Before SCR Error Alarm.
1083	F2EXP TEX AFT SCR ERR	F2 Expected Exhaust Temperature After SCR Error Alarm.
1084	F2GRD TEX BFR SCR ERR	F2 Exhaust Temperature Gradient Before SCR Error Alarm.
1085	F2GRD TEX AFT SCR ERR	F2 Exhaust Temperature Gradient After SCR Error Alarm.
1086	F2 T DEF TOO HI	F2 DEF Temperature Too High Alarm.
1087	LO F2 TEXH BFR SCR	F2 Exhaust Temperature before SCR Too Low Alarm.
1088	LO F2 TEXH AFT SCR	F2 Exhaust Temperature after SCR Too Low Alarm.

6 • Diagnostic Trouble Codes

Diagnostic engine information is obtained from a compatible engine control unit (ECU). The DGC-2020ES will receive an unsolicited message of a currently active diagnostic trouble code (DTC). Previously active DTCs are available upon request. Active and previously active DTCs can be cleared on request. Table 6-1 lists the diagnostic information that the DGC-2020ES obtains over the CAN interface.

Table 6-1. Diagnostic Information Obtained Over the CAN Interface

Parameter	Transmission Repetition Rate
Active diagnostic trouble code	1 s
Lamp status	1 s
Previously active diagnostic trouble code	On request
Request to clear active DTCs	On request
Request to clear previously active DTCs	On request

DTCs are reported in coded diagnostic information that includes the Suspect Parameter Number (SPN), Failure Mode Identifier (FMI), and Occurrence Count (OC). All parameters have an SPN and are used to display or identify the items for which diagnostics are being reported. The FMI defines the type of failure detected in the subsystem identified by an SPN. The reported problem may not be an electrical failure but a subsystem condition needing to be reported to an operator or technician. The OC contains the number of times that a fault has gone from active to previously active.

For certain DTCs, if the DGC-2020ES recognizes a pair of SPN and FMI numbers, it displays a single string as listed in Table 6-2. If the DGC-2020ES recognizes an SPN in Table 6-2, but the FMI does not match the FMI in Table 6-2, then it displays the string from Table 6-2 corresponding to the table entry where the FMI is # and a second string corresponding to the FMI number listed in Table 6-3. For example, if the DGC-2020ES receives SPN 29 and FMI 13, it displays ACCEL PEDAL 2 POSITN and OUT OF CALIBRATION. If the DGC-2020ES does not have descriptive information about an SPN and FMI that was received, the description will display as “NO TEXT AVAILABLE”.

Table 6-2. DTCs Displayed by the DGC-2020ES

SPN	FMI	String Displayed	Description
27	#	EGR1 VALVE POSITN	EGR1 Valve Position
28	#	ACCEL PEDAL 3 POSITN	accelerator pedal 3 position
28	3	Throttle Volt HI	Throttle Voltage High
28	4	Throttle Volt LO	Throttle Voltage Low
28	14	Throttle Volt OOR	Throttle Input Voltage Out of Range
29	3	Throttle Volt HI	Throttle Voltage High
29	4	Throttle Volt LO	Throttle Voltage Low
29	14	Throttle Volt OOR	Throttle Input Voltage Out of Range
29	#	ACCEL PEDAL 2 POSITN	accelerator pedal 2 position
51	#	ENG THROTTLE POSITN	Engine Throttle Position
52	#	INTERCOOLER TEMP	Engine Intercooler Temperature
52	15	INTERCOOLER TEMP HI	Engine Intercooler Temperature is above the HIGH threshold
69	#	2 SPEED AXLE SWITCH	Two Speed Axle Switch
70	#	PARKING BRAKE SWITCH	Parking Brake Switch
84	#	VEHICLE SPEED	vehicle speed signal
91	#	ACCEL POSITION	Accelerator Position

SPN	FMI	String Displayed	Description
91	3	Thr Pos Sns Volt HI	Throttle Position Sensor Input Voltage (High)
91	4	Thr Pos Sns Volt LO	Throttle Position Sensor Input Voltage (Low)
91	14	Thr Pos Sns Volt OOR	Throttle Voltage (Out of Range)
94	#	FUEL DELIVERY PRESS	Fuel Delivery Pressure
94	1	FUEL DELIV PRS LO LO	Engine Fuel Delivery Pressure is below the LOW LOW threshold
94	3	Fuel Pmp Prs Volt HI	Fuel Pump Pressure Input Voltage (High)
94	4	Fuel Pmp Prs Volt LO	Fuel Pump Pressure Input Voltage (Low)
94	17	Fuel Pressure LO	Fuel Supply Pressure (Low Least Severe)
95	#	FUEL FLT DF PRS	Fuel Filter Differential Pressure
96	#	FUEL LEVEL	Fuel Level
97	#	Water in Fuel	Water in Fuel
97	3	Water In Fl Volt HI	Water In Fuel Signal Voltage High
97	4	Water In Fl Volt LO	Water In Fuel Signal Voltage Low
97	16	Water in Fuel	Water In Fuel Detected
98	#	ENG OIL LEVEL	Engine Oil Level
99	#	OIL FILTER DIFF PRESS	oil filter differential pressure parameter
100	#	ENG OIL PRESS	Engine Oil Pressure
100	1	ENG OIL PRESS LO LO	Engine Oil Pressure is below the LOW LOW threshold
100	3	Oil Prs Snsr Volt HI	Oil Pressure Sensor Input Voltage (High)
100	4	Oil Prs Snsr Volt LO	Oil Pressure Sensor Input Voltage (Low)
100	17	ENG OIL PRESS LO	Engine Oil Pressure is below the LOW threshold
100	18	Oil Prs Snsr Volt MLO	Oil Pressure Sensor Input Voltage (Moderately Low)
100	31	Oil Pressure INVLD	Oil Pressure (Invalid)
101	#	CRANKCASE PRESSURE	crankcase pressure
102	#	INTK MNFLD1 PRESSURE	intake manifold 1 pressure
102	2	Manifld Air Prs INVD	Manifold Air Pressure Invalid
102	3	Mnfld AirP SnsVlt HI	Manifold Air Pressure Sensor Input Voltage High
102	4	Mnfld AirP SnsVlt LO	Manifold Air Pressure Sensor Input Voltage Low
103	#	TURBO CH1 SPEED	Turbo Speed
103	0	Trbo Overspd Severe	Turbo Overspeed (Most Severe)
103	2	Trbo Speed MisMatch	Turbo Speed (Mismatch)
103	5	Trbo Spd Sns Curr LO	Turbo Speed Sensor Current (Low)
103	6	Trbo Spd Sns Curr HI	Turbo Speed Sensor Current (High)
103	8	Trbo Speed INVLD	Turbo Speed (Invalid)
103	31	Trbo Speed MISSING	Turbo Speed (Missing)
104	#	TRBO CH OIL PRESS	Turbocharger Oil Pressure
105	#	INTAK MNFLD TMP	Intake Manifold Temperature
105	0	EGR Mixed Air Tmp HI	Exhaust Gas Recirculation Mixed Air High (Least Severe)
105	3	EGR Air Temp Vlt HI	Exhaust Gas Recirculation Mixed Air Temp Voltage (High)
105	4	EGR Air Temp Vlt LO	Exhaust Gas Recirculation Mixed Air Temp Voltage (Low)
105	15	EGR Mixed Air Tmp HI	Exhaust Gas Recirculation Mixed Air High (Least Severe)
105	16	EGR MxdAir Tmp MHI	Exhaust Gas Recirculation Mixed Air Temp (Moderately High)

SPN	FMI	String Displayed	Description
106	#	INTAKE AIR PRESSR	Intake Air Pressure
107	#	AIR FLTR DIF PRS	Air Filter Differential Pressure
107	0	Air Filt Restricted	Air Filter Restriction (High)
108	#	BAROMETRIC PRESS	Barometric Pressure
108	2	Barometrc Prs INVLD	Barometric Pressure (Invalid)
108	31	Barometrc Prs ERR	Barometric Pressure (Error)
109	#	COOLANT PRESS	Coolant Pressure
109	1	ENG COOLNT PRS LO LO	Engine Coolant Pressure is below the LOW LOW threshold
109	17	ENG COOLANT PRS LO	Engine Coolant Pressure is below the LOW threshold
110	#	COOLANT TEMP	Engine Coolant Temperature
110	0	ENG COOLNT TMP HI HI	Engine Coolant Temperature is above the HIGH HIGH threshold
110	3	Cool Tmp Sns Volt HI	Coolant Temp Sensor Input Voltage (High)
110	4	Cool Tmp Sns Volt LO	Coolant Temp Sensor Input Voltage (Low)
110	15	ENG COOLANT TEMP HI	Engine Coolant Temperature is above the HIGH threshold
110	16	Cool Temp MHI	Coolant Temp Sensor Input (Moderately High)
110	17	Cool Temp LO	Coolant Temp Sensor Input (Low Least Severe)
111	1	Coolnt Lvl LO	Coolant Level (Low)
111	17	ENG COOLANT LVL LO	Engine Coolant Level is below the LOW threshold
111	#	LOW COOL LEVEL	Low Coolant Level string used in event log and/or Alarm and Pre-alarm annunciation
157	#	INJ RAIL PRS	Fuel Injection Rail Pressure
157	3	Fuel Rail Prs Vlt HI	Fuel Rail Pressure Input Voltage (High)
157	4	Fuel Rail Prs Vlt LO	Fuel Rail Pressure Input Voltage (Low)
157	10	Fuel Rail Prs LOSS	Fuel Rail Pressure Loss Detected
157	17	Fuel Rl Prs NOT DEV	Fuel Rail Pressure Not Developed
158	#	BATTERY VOLTAGE	Battery Voltage
158	#	KEY SW BATT VOLTAGE	key switch battery potential
158	0	KSW BATT VOLTS HI HI	Key Switch Battery Potential is above the HIGH HIGH threshold
158	1	KSW BATT VOLTS LO LO	Key Switch Battery Potential is below the LOW LOW threshold
158	15	KSW BATT VOLTS HI	Key Switch Battery Potential is above the HIGH threshold
158	17	KSW BATT VOLTS LO	Key Switch Battery Potential is below the LOW threshold
161	#	TR INPUT SHAFT SPD	Transmission Input Shaft Speed
167	#	CHARGING SYSTM VOLT	Charging System Voltage
168	#	LOW BATT VOLT	Low Battery Voltage string used in event log and/or Alarm and Prealarm annunciation
171	#	AMB AIR TEMP	Ambient Air Temperature
172	#	AIR INLET TEMP	Air Inlet Temperature
173	#	EXHAUST GAS TEMP	Exhaust Gas Temperature
174	#	FUEL TEMP	Fuel Temperature
174	0	Fuel Temp EXT HI	Fuel Temp (Extremely High)
174	3	Fuel Tmp Sns Volt HI	Fuel Temp Sensor Input Voltage (High)
174	4	Fuel Tmp Sns Volt LO	Fuel Temp Sensor Input Voltage (Low)

SPN	FMI	String Displayed	Description
174	16	Fuel Temp MHI	Fuel Temp (Moderately High)
175	#	ENG OIL TEMP	Engine Oil Temperature
176	#	TRBO CH OIL TEMP	Turbo Charger Oil Temperature
188	#	IDLE SPEED	Idle Speed parameter
188	17	SPEED AT IDLE LO	Engine Idle speed is below the LOW threshold
189	#	RATED SPEED	Engine Rated Speed
189	0	Engine Spd DERATE	Engine Speed Derate
190	0	Engine OvrSpd EXTRM	Engine Overspeed (Extreme)
190	1	ENGINE SPEED LOW	Engine speed is below the LOW threshold
190	16	Engine OvrSpd MODRT	Engine Overspeed (Moderate)
190	17	SPEED AT IDLE LO	Engine Idle speed is below the LOW threshold
190	#	ENGINE SPEED	Engine Speed
191	#	TR OUTPUT SHAFT SPD	Transmission Output Shaft Speed
237	2	VIN Data MisMatch	VIN Data Mismatch with other controllers
247	#	ENGINE HOURS	Engine Run Time in Hours
250	#	TOTAL FUEL USED	Total Fuel Usage
354	#	RELATIVE HUMIDITY	Relative Humidity
412	#	EGR GAS TEMP	Exhaust Gas Recirculation Valve Gas Temperature
412	0	EGR Temp EXT HI	Exhaust Gas Recirculation Temp (Extremely High)
412	3	EGR Temp In Vlt HI	Exhaust Gas Recirculation Temp Input Voltage (High)
412	4	EGR Temp In Vlt LO	Exhaust Gas Recirculation Temp Input Voltage (Low)
412	16	EGR Temp MHI	Exhaust Gas Recirculation Temp (Moderately High)
441	#	AUX TEMP 1	Aux Temperature 1
442	#	AUX TEMP 2	Aux Temperature 2
443	#	BATTERY VOLT 2	Battery Voltage 2
444	#	AUX PRESSURE2	Auxiliary Pressure 2
515	#	DESIRED SPEED	speed demand desired from the engine.
520	#	RETARDER % TORQUE	retarder % torque
523	#	TRANS CURRNT GEAR	Transmission Current Gear
524	#	TRANS SELECTD GEAR	Transmission Selected Gear
558	#	ACCEL PEDAL IDLE SW	Accelerator Pedal Idle Switch
559	#	ACCEL PEDAL KICKDN SW	Accelerator Pedal Kickdown Switch
563	#	ABS ACTIVE	Antilock Brake System (ABS) active
573	#	TRQCNV LOCKUP ENGAGD	Transmission Torque Converter Lockup Engaged
574	#	TR SHIFT IN PROGRESS	Transmission Shift in Process
596	#	CRUISE CNTL ENABLE SW	Cruise Control Enable Switch
597	#	BRAKE SWITCH	Brake Switch
598	#	CLUTCH SWITCH	Clutch Switch
599	#	CRUISE CNTL SET SW	Cruise Control Set Switch
600	#	CRUISE CNTL COAST SW	Cruise Control Coast (Decelerate) Switch
601	#	CRUISE CNTL RESUME SW	Cruise Control Resume Switch
602	#	CRUISE CNTL ACCEL SW	Cruise Control Accelerate Switch

SPN	FMI	String Displayed	Description
609	#	CONTROLLER #2	Controller Number 2
611	#	SYS DIAGNST CODE 1	System Diagnostic Code 1
611	0	LOSS OF VOLTAGE SENSING	Loss of Voltage Sensing from Voltage Regulator over CAN Bus
611	3	Inj Short to PWR	Injector Wiring Shorted to Power
611	4	Inj Short to GND	Injector Wiring Shorted to Ground
612	14	EDM FAULT	Exciter Diode Monitor Fault Status from Voltage Regulator over CAN Bus
620	#	5 VOLT SUPPLY	5 Volt Supply
623	#	RED STOP LAMP	Red Stop Lamp
624	#	DIAGNOSTIC LAMP	Diagnostic Lamp
624	#	COMBINED YELLOW	a Yellow Alarm from the Engine ECU
625	#	PROP COMM NETWK 1	Proprietary Communications Network 1
627	1	Inj Spply Vlt Problm	Injector Supply Voltage Problem
627	16	ECU Power Volt HI	ECU Power High Voltage
627	18	ECU Power Volt LO	ECU Power Low Voltage
627	13	ECU ERROR	ECU Error
628	#	PROGRAM MEMORY	Program Memory
629	#	CONTROLLER #1	Controller 1
630	#	ECU INTERNAL ERROR	ECU Internal Error
630	#	ECU INTERNAL ERROR	ECU Internal Error
632	#	FUEL SHUTOFF 1	Fuel shutoff 1 control
632	5	FUEL SHUTOFF OPEN/SHORT	Fuel shutoff is shorted or open
632	7	FUEL PRESSURE LOW	Fuel pressure is low
632	12	FUEL SHUTOFF MALFUNCTN	Fuel shutoff is shorted or open
633	#	THROTTLE ACT 1 CNTL	Throttle Actuator 1 Control
636	#	ENG POSITION SENSOR	Engine Position Sensor
636	2	Pump Pos Sns Noisy	Pump Position Sensor Input Noise
636	5	Pump Pos Sns Curr LO	Pump Position Sensor Current (Low)
636	6	Pump Pos Sns Curr HI	Pump Position Sensor Current (High)
636	8	Pump Pos Sns In MSNG	Pump Position Sensor Input Missing
636	10	Pump Pos Sns In ERR	Pump Position Sensor Input Pattern Error
637	2	Crank Pos Sns Noisy	Crank Position Input Noise
637	5	Crank Pos Sns Curr LO	Crank Position Sensor Current (Low)
637	6	Crank Pos Sns Curr HI	Crank Position Sensor Current (High)
637	7	Crnk/Pmp Pos Tmg OOS	Crank/Pump Position Timing Moderately Out of Sync
637	8	Crank Pos Sns MSNG	Crank Position Missing
637	10	Crank Pos Sns In ERR	Crank Position Input Pattern Error
639	#	J1939 NETWORK 1	J1939 Network number 1
641	4	Trbo Actuator ERR	Turbo Actuator Error
641	12	ECU/Trbo Comm ERR	ECU/Turbo Communication Error

SPN	FMI	String Displayed	Description
641	13	TrboAct Lrnd Val ERR	Turbo Actuator Learned Value Error
641	16	Trbo Act Temp MHI	Turbo Actuator Temp (Moderately High)
645	#	J1939 NETWORK 1	J1939 Network number 1
651	2	Cyl 1 EUI PN INVLD	Cylinder #1 EUI Part Number (Invalid)
651	5	Cyl 1 EUI Ckt OPEN	Cylinder #1 EUI Circuit (Open)
651	6	Cyl 1 EUI Ckt SHORT	Cylinder #1 EUI Circuit (Shorted)
651	7	Cyl 1 EUI Ckt MECH FL	Cylinder #1 EUI Circuit (Mechanical Failure)
651	13	Cyl 1 EUI QR INVLD	Cylinder #1 EUI Circuit QR Code (Invalid)
651	#	CYLINDER 1 INJECTOR	Cylinder 1 Injector
652	2	Cyl 2 EUI PN INVLD	Cylinder #2 EUI Part Number (Invalid)
652	5	Cyl 2 EUI Ckt OPEN	Cylinder #2 EUI Circuit (Open)
652	6	Cyl 2 EUI Ckt SHORT	Cylinder #2 EUI Circuit (Shorted)
652	7	Cyl 2 EUI Ckt MECH FL	Cylinder #2 EUI Circuit (Mechanical Failure)
652	13	Cyl 2 EUI QR INVLD	Cylinder #2 EUI Circuit QR Code (Invalid)
652	#	CYLINDER 2 INJECTOR	Cylinder 2 Injector
653	2	Cyl 3 EUI PN INVLD	Cylinder #3 EUI Part Number (Invalid)
653	5	Cyl 3 EUI Ckt OPEN	Cylinder #3 EUI Circuit (Open)
653	6	Cyl 3 EUI Ckt SHORT	Cylinder #3 EUI Circuit (Shorted)
653	7	Cyl 3 EUI Ckt MECH FL	Cylinder #3 EUI Circuit (Mechanical Failure)
653	13	Cyl 3 EUI QR INVLD	Cylinder #3 EUI Circuit QR Code (Invalid)
653	#	CYLINDER 3 INJECTOR	Cylinder 3 Injector
654	2	Cyl 4 EUI PN INVLD	Cylinder #4 EUI Part Number (Invalid)
654	5	Cyl 4 EUI Ckt OPEN	Cylinder #4 EUI Circuit (Open)
654	6	Cyl 4 EUI Ckt SHORT	Cylinder #4 EUI Circuit (Shorted)
654	7	Cyl 4 EUI Ckt MECH FL	Cylinder #4 EUI Circuit (Mechanical Failure)
654	13	Cyl 4 EUI QR INVLD	Cylinder #4 EUI Circuit QR Code (Invalid)
654	#	CYLINDER 4 INJECTOR	Cylinder 4 Injector
655	2	Cyl 5 EUI PN INVLD	Cylinder #5 EUI Part Number (Invalid)
655	5	Cyl 5 EUI Ckt OPEN	Cylinder #5 EUI Circuit (Open)
655	6	Cyl 5 EUI Ckt SHORT	Cylinder #5 EUI Circuit (Shorted)
655	7	Cyl 5 EUI Ckt MECH FL	Cylinder #5 EUI Circuit (Mechanical Failure)
655	13	Cyl 5 EUI QR INVLD	Cylinder #5 EUI Circuit QR Code (Invalid)
655	#	CYLINDER 5 INJECTOR	Cylinder 5 Injector
656	2	Cyl 6 EUI PN INVLD	Cylinder #6 EUI Part Number (Invalid)
656	5	Cyl 6 EUI Ckt OPEN	Cylinder #6 EUI Circuit (Open)
656	6	Cyl 6 EUI Ckt SHORT	Cylinder #6 EUI Circuit (Shorted)
656	7	Cyl 6 EUI Ckt MECH FL	Cylinder #6 EUI Circuit (Mechanical Failure)
656	13	Cyl 6 EUI QR INVLD	Cylinder #6 EUI Circuit QR Code (Invalid)
656	#	CYLINDER 6 INJECTOR	Cylinder 6 Injector
657	#	CYLINDER 7 INJECTOR	Cylinder 7 Injector
658	#	CYLINDER 8 INJECTOR	Cylinder 8 Injector
659	#	CYLINDER 9 INJECTOR	Cylinder 9 Injector
660	#	CYLINDER 10 INJECTOR	Cylinder 10 Injector

SPN	FMI	String Displayed	Description
661	#	CYLINDER 11 INJECTOR	Cylinder 11 Injector
662	#	CYLINDER 12 INJECTOR	Cylinder 12 Injector
663	#	CYLINDER 13 INJECTOR	Cylinder 13 Injector
664	#	CYLINDER 14 INJECTOR	Cylinder 14 Injector
665	#	CYLINDER 15 INJECTOR	Cylinder 15 Injector
666	#	CYLINDER 16 INJECTOR	Cylinder 16 Injector
667	#	CYLINDER 17 INJECTOR	Cylinder 17Injector
668	#	CYLINDER 18 INJECTOR	Cylinder 18 Injector
669	#	CYLINDER 19 INJECTOR	Cylinder 19 Injector
670	#	CYLINDER 20 INJECTOR	Cylinder 20 Injector
671	#	CYLINDER 21 INJECTOR	Cylinder 21 Injector
672	#	CYLINDER 22 INJECTOR	Cylinder 22 Injector
673	#	CYLINDER 23 INJECTOR	Cylinder 23 Injector
674	#	CYLINDER 24 INJECTOR	Cylinder 24 Injector
675	#	ENG GLOW PLUG LAMP	Glow Plug Lamp
676	#	ENG GLOW PLUG RELAY	Engine Glow Plug Relay
677	#	ENGINE START RELAY	Engine Start Relay
697	#	AUX PWM DRIVER 1	Auxiliary PWM Driver 1
698	#	AUX PWM DRIVER 2	Auxiliary PWM Driver 2
699	#	AUX PWM DRIVER 3	Auxiliary PWM Driver 3
700	#	AUX PWM DRIVER 4	Auxiliary PWM Driver 4
701	#	AUX I/O 1	Auxiliary I/O 1
702	#	AUX I/O 2	Auxiliary I/O 2
703	#	AUX I/O 3	Auxiliary I/O 3
704	#	AUX I/O 4	Auxiliary I/O 4
705	#	AUX I/O 5	Auxiliary I/O 5
706	#	AUX I/O 6	Auxiliary I/O 6
707	#	AUX I/O 7	Auxiliary I/O 7
708	#	AUX I/O 8	Auxiliary I/O 8
709	#	AUX I/O 9	Auxiliary I/O 9
710	#	AUX I/O 10	Auxiliary I/O 10
711	#	AUX I/O 11	Auxiliary I/O 11
712	#	AUX I/O 12	Auxiliary I/O 12
713	#	AUX I/O 13	Auxiliary I/O 13
714	#	AUX I/O 14	Auxiliary I/O 14
715	#	AUX I/O 15	Auxiliary I/O 15
716	#	AUX I/O 16	Auxiliary I/O 16
723	#	SPEED SENSOR #2	Engine Speed Sensor #2
724	#	O2 SENSOR	O2 Sensor
729	#	INTAKE HEATER #1	Intake Air Heater #1
730	#	INTAKE HEATER #2	Intake Air Heater #2
731	#	KNOCK SENSOR #1	Knock Sensor 1
855	#	HEATER CIRCUIT 2	UEGO Heater Circuit #02

SPN	FMI	String Displayed	Description
870	#	HEATER REGEN SYSTM	Heater Regeneration System
898	2	REQ SPD DATA ERRATIC	Speed Demand Data is erratic
898	9	Spd/Trq Msg INVLD	Vehicle Speed/Torque Message Invalid
898	#	ENGINE REQSTED SPEED	Engine Requested Speed
904	#	FRONT AXLE SPEED	Front Axle Speed
920	#	AUDIBLE ALARM	Audible Alarm
923	#	PWM OUTPUT	Engine PWM Output
924	#	AUX OUT #1	Auxiliary Output 1
925	#	AUX OUT #2	Auxiliary Output 2
926	#	AUX OUT #3	Auxiliary Output 3
966	31	ENGINE TST MD SW ON	Engine Test Mode Switch On
970	2	Aux Eng SD SW INVLD	Auxiliary Engine Shutdown Switch (Invalid)
970	31	Aux Eng SD SW ACTV	Auxiliary Engine Shutdown Switch Active
971	31	Eng Derate SW ACTV	External Engine Derate Switch Active
973	#	ENG RETARDR SELECTN	Engine Retarder Selection
974	#	REMOTE ACCEL PEDAL	Remote Accelerator Pedal
975	#	FAN SPEED	Engine Fan Speed
977	#	FAN DRIVE STATE	Fan Drive State
986	#	REQSTD FAN SPEED	Requested Fan Speed
1004	#	TRIP VEH IDLE FL USED	Trip Vehicle Idle Fuel Used
1005	#	TRIP CRUISE FL USED	Trip Cruise Fuel Used
1015	#	TRIP AVG LOAD FACTOR	Trip Average Load Factor
1072	#	ENG BRAKE OUTPUT 1	Engine Brake Output 1
1072	#	ENG COMPR BRK OUTPUT1	Engine (Compression) Brake Output 1
1073	#	ENG COMPR BRK OUTPUT2	Engine (Compression) Brake Output 2
1074	#	ENG EXHAUST BRAKE OUT	Engine Exhaust Brake Output
1075	5	Fuel TR Pump Curr LO	Fuel Transfer Pump Current (Low)
1075	6	Fuel TR Pump Curr HI	Fuel Transfer Pump Current (High)
1075	12	Fuel TR Pump ERR	Fuel Transfer Pump (Error)
1079	#	SENSOR SUPPLY VOLTS 1	Sensor Supply Voltage 1
1080	3	Snsr Supp 1 Volt LO	Sensor Supply 1 Voltage (Low)
1080	4	Snsr Supp 1 Volt HI	Sensor Supply 1 Voltage (High)
1080	#	SENSOR SUPPLY VOLTS 2	Sensor Supply Voltage 2
1081	#	ENG WAIT TO START LMP	Engine Wait to Start Lamp
1083	#	AUX I/O 1	Auxiliary I/O 1
1084	#	AUX I/O 2	Auxiliary I/O 2
1109	31	Eng Shutdown WARNING	Engine Shutdown Warning
1109	#	EPS SHUTDN APPROACHG	Indicates that Engine Protective System Shutdown Is Approaching
1110	31	Eng Prot Shutdown	Engine Protection Shutdown
1127	#	TURBOCHG1 BOOST PRS	Turbo Charger 1 Boost Pressure
1128	#	TURBOCHG2 BOOST PRS	Turbo Charger 2 Boost Pressure
1129	#	TURBOCHG3 BOOST PRS	Turbo Charger 3 Boost Pressure

SPN	FMI	String Displayed	Description
1130	#	TURBOCHG4 BOOST PRS	Turbo Charger 4 Boost Pressure
1131	#	INTK MNFLD2 TEMP	Intake Manifold 2 Temperature
1132	#	INTK MNFLD3 TEMP	Intake Manifold 3 Temperature
1133	#	INTK MNFLD4 TEMP	Intake Manifold 4 Temperature
1136	#	ECU TEMP	ECU Temperature
1136	0	ECU Temp EXT HI	ECU Temperature (Extremely High)
1136	15	ENG ECU TEMP HI	ECU Temperature has exceeded the HIGH level
1136	16	ECU Temp MHI	ECU Temperature (Moderately High)
1168	#	TRBO CH2 OIL PRESS	Turbo Charger 2 Oil Pressure
1169	#	TURBO CH2 SPEED	Turbo 2 Speed
1170	#	TURBO CH3 SPEED	Turbo 3 Speed
1171	#	TURBO CH4 SPEED	Turbo 4 Speed
1172	3	Trbo Cmp Tmp Volt HI	Turbo Compressor Inlet Temp Input Voltage (High)
1172	4	Trbo Cmp Tmp Volt LO	Turbo Compressor Inlet Temp Input Voltage (Low)
1172	16	Trbo Cmp In Tmp MHI	Turbo Compressor Inlet Temp (Moderately High)
1180	0	Trbo Trbn Tmp EXT HI	Turbo Turbine Inlet Temp (Extremely High)
1180	16	Trbo Trbn In Tmp MHI	Turbo Turbine Inlet Temp (Moderately High)
1184	#	TURBOCHG1 OUTLET TEMP	Turbo Charger 1 Outlet Temperature
1185	#	TURBOCHG2 OUTLET TEMP	Turbo Charger 2 Outlet Temperature
1186	#	TURBOCHG3 OUTLET TEMP	Turbo Charger 3 Outlet Temperature
1187	#	TURBOCHG4 OUTLET TEMP	Turbo Charger 4 Outlet Temperature
1188	#	TRBO WST GT ACT1 POS	Turbo Waste Gate Actuator 1 Position
1189	#	TRBO WST GT ACT2 POS	Turbo Waste Gate Actuator 2 Position
1192	#	TRBO WSTGT ACT AIR PR	Engine Turbocharger Waste gate Actuator Control Air Pressure
1203	#	INTRCOOLER COOLNT PRS	Intercooler Coolant Pressure
1204	#	ELECTRICAL LOAD	Electrical Load
1208	#	PRE FLT OIL PRESSR	Oil Pressure Before Oil Filter
1209	#	EXH PRESSURE	Exhaust Pressure
1213	#	MALFUNC LAMP	the malfunction indicator lamp status that is broadcast by ECU as part of diagnostic trouble code information
1227	#	TEST LIMIT MAX	Caption Indicating Test Limit Maximum
1231	#	J1939 NETWORK 2	J1939 Network number 2
1235	#	J1939 NETWORK 3	J1939 Network number 3
1237	#	ENG SHUTDN ORIDE SW	Engine Shutdown Override Switch
1237	31	AL OVERRIDE ON	Alarm Override is On
1239	#	FUEL LEAKAGE1	Fuel Leakage 1 Parameter
1240	#	FUEL LEAKAGE2	Fuel Leakage 2 Parameter
1247	#	ENGINE POWER	Engine Power
1268	#	IGNITION COIL 1	Engine Ignition Coil 1
1269	#	IGNITION COIL 2	Engine Ignition Coil 2
1270	#	IGNITION COIL 3	Engine Ignition Coil 3

SPN	FMI	String Displayed	Description
1271	#	IGNITION COIL 4	Engine Ignition Coil 4
1272	#	IGNITION COIL 5	Engine Ignition Coil 5
1273	#	IGNITION COIL 6	Engine Ignition Coil 6
1274	#	IGNITION COIL 7	Engine Ignition Coil 7
1275	#	IGNITION COIL 8	Engine Ignition Coil 8
1276	#	IGNITION COIL 9	Engine Ignition Coil 9
1277	#	IGNITION COIL 10	Engine Ignition Coil 10
1278	#	IGNITION COIL 11	Engine Ignition Coil 11
1279	#	IGNITION COIL 12	Engine Ignition Coil 12
1280	#	IGNITION COIL 13	Engine Ignition Coil 13
1281	#	IGNITION COIL 14	Engine Ignition Coil 14
1282	#	IGNITION COIL 15	Engine Ignition Coil 15
1283	#	IGNITION COIL 16	Engine Ignition Coil 16
1284	#	IGNITION COIL 17	Engine Ignition Coil 17
1285	#	IGNITION COIL 18	Engine Ignition Coil 18
1286	#	IGNITION COIL 19	Engine Ignition Coil 19
1287	#	IGNITION COIL 20	Engine Ignition Coil 20
1288	#	IGNITION COIL 21	Engine Ignition Coil 21
1289	#	IGNITION COIL 22	Engine Ignition Coil 22
1290	#	IGNITION COIL 23	Engine Ignition Coil 23
1291	#	IGNITION COIL 24	Engine Ignition Coil 24
1321	#	STARTER LKOUT RLY DRV	Engine Starter Solenoid Lockout Relay Driver Circuit
1322	#	MULTI CYL MISFIRE	Misfire detected on multiple engine cylinders
1323	#	MISFIRE CYLINDER 1	Misfire detected on a single engine cylinder
1324	#	MISFIRE CYLINDER 2	Misfire detected on a single engine cylinder
1325	#	MISFIRE CYLINDER 3	Misfire detected on a single engine cylinder
1326	#	MISFIRE CYLINDER 4	Misfire detected on a single engine cylinder
1327	#	MISFIRE CYLINDER 5	Misfire detected on a single engine cylinder
1328	#	MISFIRE CYLINDER 6	Misfire detected on a single engine cylinder
1329	#	MISFIRE CYLINDER 7	Misfire detected on a single engine cylinder
1330	#	MISFIRE CYLINDER 8	Misfire detected on a single engine cylinder
1331	#	MISFIRE CYLINDER 9	Misfire detected on a single engine cylinder
1332	#	MISFIRE CYLINDER 10	Misfire detected on a single engine cylinder
1333	#	MISFIRE CYLINDER 11	Misfire detected on a single engine cylinder
1334	#	MISFIRE CYLINDER 12	Misfire detected on a single engine cylinder
1335	#	MISFIRE CYLINDER 13	Misfire detected on a single engine cylinder
1336	#	MISFIRE CYLINDER 14	Misfire detected on a single engine cylinder
1337	#	MISFIRE CYLINDER 15	Misfire detected on a single engine cylinder
1338	#	MISFIRE CYLINDER 16	Misfire detected on a single engine cylinder
1339	#	MISFIRE CYLINDER 17	Misfire detected on a single engine cylinder
1340	#	MISFIRE CYLINDER 18	Misfire detected on a single engine cylinder
1341	#	MISFIRE CYLINDER 19	Misfire detected on a single engine cylinder
1342	#	MISFIRE CYLINDER 20	Misfire detected on a single engine cylinder

SPN	FMI	String Displayed	Description
1343	#	MISFIRE CYLINDER 21	Misfire detected on a single engine cylinder
1344	#	MISFIRE CYLINDER 22	Misfire detected on a single engine cylinder
1345	#	MISFIRE CYLINDER 23	Misfire detected on a single engine cylinder
1346	#	MISFIRE CYLINDER 24	Misfire detected on a single engine cylinder
1347	#	FUEL PUMP ASSY #1	Fuel Pump Pressurizing Assembly #1
1347	3	Pump Ctrl Vlv Curr HI	Pump Control Valve Current (High)
1347	5	Pmp Ctrl Vlv C MSMCH	Pump Control Valve Current (Mismatch)
1347	7	Fuel Rl Prs Ctrl ERR	Fuel Rail Pressure Control (Error)
1348	#	FUEL PUMP ASSY #2	Fuel Pump Pressurizing Assembly #2
1349	#	INJ RAIL PRS2	Injection Metering Rail 2 Pressure
1350	#	TIME SINCE LST SERVC	Time Since Last Service
1352	#	KNOCK LVL CYL 1	Engine Cylinder 1 Knock Level
1353	#	KNOCK LVL CYL 2	Engine Cylinder 2 Knock Level
1354	#	KNOCK LVL CYL 3	Engine Cylinder 3 Knock Level
1355	#	KNOCK LVL CYL 4	Engine Cylinder 4 Knock Level
1356	#	KNOCK LVL CYL 5	Engine Cylinder 5 Knock Level
1357	#	KNOCK LVL CYL 6	Engine Cylinder 6 Knock Level
1358	#	KNOCK LVL CYL 7	Engine Cylinder 7 Knock Level
1359	#	KNOCK LVL CYL 8	Engine Cylinder 8 Knock Level
1380	#	OIL RESVR LEVEL	Oil Reservoir Level
1384	#	J1939 COMANDED SHUTDN	J1939 Commanded Shutdown
1385	#	AUX TEMP 1	Aux Temperature 1
1386	#	AUX TEMP 2	Aux Temperature 2
1387	#	AUX PRESSURE1	Auxiliary Pressure 1
1388	#	AUX PRESSURE2	Auxiliary Pressure 2
1390	#	FUEL VALVE1 INLET PRS	Fuel Valve 1 Inlet Pressure
1391	#	FUEL VALVE 1 DIFF PRS	Engine Fuel Valve 1 Differential Pressure
1442	#	FUEL VALVE1 POSITN	Engine Fuel Valve 1 Position
1485	#	ECU MAIN RELAY	ECM Main Relay
1557	#	FAN 2 DRIVE STATE	Fan 2 Drive State
1569	31	Fuel Derate	Fuel Derate
1623	#	TACOGRPH OUT SHFT SPD	Tachograph Output Shaft Speed
1624	#	TACOGRPH VEHICLE SPD	Tachograph Vehicle Speed
1633	#	CRUISE CNTL PAUSE SW	Cruise Control Pause Switch
1634	#	CALIB VERIFICATN NMBR	Calibration Verification Number
1636	#	INTK MNFD1 TMP HI RES	Intake Manifold 1 Air Temperature (High Resolution)
1638	#	HYDRAULIC TEMP	Hydraulic Temperature
1639	#	FAN SPEED	Fan Speed
1639	1	Fan Speed Zero	Fan Speed Detected (Zero)
1639	16	Fan Speed HI	Fan Speed Detected (High)
1639	18	Fan Speed LO	Fan Speed Detected (Low)
1675	#	STARTER MODE	Engine Starter Mode
1692	#	INTKMNFLD1 DESIRD PR	Engine Intake Manifold Desired Absolute Pressure

SPN	FMI	String Displayed	Description
1695	#	EGO SNSR FUEL CORRCTN	Exhaust Gas Oxygen Sensor Fueling Correction
1716	#	RETRDR SEL NON ENGINE	Retarder Selection non-engine
1761	#	DEF 1 TANK LEVEL	Diesel Exhaust Fluid 1 Tank Level
1908	#	AUX VLV0 STATE CMD	Aux Valve 0 State Command
2000	13	Security Violation	Security Violation
2005	9	TSC CAN Msg NT RCV	TSC CAN Message Not Received
2030	9	AC Clutch Msg NT RCV	A/C Clutch Status CAN Message Not Received
2071	9	Tr Oil Can Msg NT RCV	Trans. Oil, Tier Size, Vehicle Speed CAN Message Not Received
2433	#	EXH GAS TMP RT MNFLD	Right Manifold Exhaust Gas Temperature
2434	#	EXH GAS TMP LFT MNFLD	Left Manifold Exhaust Gas Temperature
2436	#	GEN AVG FREQUENCY	Generator Average AC Frequency
2440	#	GEN LL VOLTAGE	Generator Line to Line Voltage
2452	#	GEN TOTAL POWER	Generator Total Real Power
2456	#	TRBO 1 OUT TMP HI HI	Turbocharger 1 outlet pressure is above the HIGH HIGH threshold
2602	#	HYDRAULIC OIL LVL	Hydraulic Oil Level
2629	0	TRBO 1 OUT TMP HI HI	Turbocharger 1 outlet pressure is above the HIGH HIGH threshold
2629	15	TURBO 1 OUT TMP HI	Turbocharger 1 outlet pressure is above the HIGH threshold
2630	0	EGR FrAir Tmp EXT HI	Exhaust Gas Recirculation Fresh Air Temp (Extremely High)
2630	3	EGR FrAir Tmp Vlt HI	Exhaust Gas Recirculation Fresh Air Temp Input Voltage (High)
2630	4	EGR FrAir Tmp Vlt LO	Exhaust Gas Recirculation Fresh Air Temp Input Voltage (Low)
2630	15	EGR FrAir Tmp HI	Exhaust Gas Recirculation Fresh Air Temp (High Least Severe)
2630	16	EGR FrAir Tmp MHI	Exhaust Gas Recirculation Fresh Air Temp (Moderately High)
2634	#	POWER RELAY	main Power Relay
2646	#	AUX OUT #4	Auxiliary Output 4
2647	#	AUX OUT #5	Auxiliary Output 5
2659	2	EGR Flo/Tmp MISMATCH	Exhaust Gas Recirculation Flow/Temp Mismatch
2659	15	EGR Flo Rt High	Exhaust Gas Recirculation Flow Rate (High Least Severe)
2659	17	EGR Flo Rt LO	Exhaust Gas Recirculation Flow Rate (Low Least Severe)
2790	16	Trbo Cmp Out Tmp HI	Turbo Compressor Outlet Temp (Moderately High)
2791	2	EGR Vlv Pos Invld	Exhaust Gas Recirculation Valve Position Invalid
2791	3	EGRVlv Pos In Vlt HI	Exhaust Gas Recirculation Valve Position Input Voltage (High)
2791	4	EGRVlv Pos In Vlt LO	Exhaust Gas Recirculation Valve Position Input Voltage (Low)
2791	13	EGR Vlv Control ERR	Exhaust Gas Recirculation Valve Control Error
2791	31	EGR Valve Cal ERR	Exhaust Gas Recirculation Valve Calibration Error
2791	#	EGR VALVE CONTROL	EGR Valve Control
2795	7	Trbo Act Pos MSMATCH	Turbo Actuator Position Mismatch
2797	#	INJECTOR GROUP 1	Engine Injector Group 1
2798	#	INJECTOR GROUP 2	Engine Injector Group 2
2899	#	START ENABL DEV 1 CFG	Engine Start Enable Device 1 Configuration
2950	#	INTK VALVE ACUATOR 1	Intake Valve Actuator 1

SPN	FMI	String Displayed	Description
2951	#	INTK VALVE ACUATOR 2	Intake Valve Actuator 2
2980	#	FUEL PRESSR	Fuel Pressure
3031	#	DEF TEMP	DEF Temperature
3050	#	CATALYST SYSTM MONITR	Catalyst 1 System Monitor
3056	#	EGO SENSOR MONITOR 1	Exhaust Gas Oxygen Sensor 1 Monitor
3057	#	EGO SENSOR MONITOR 2	Exhaust Gas Oxygen Sensor 2 Monitor
3217	#	AFTR TRT 1 INTK O2	Aftertreatment 1 Intake O_2
3218	#	AFT1 INTK SNSPWR IN RG	Aftertreatment 1 Intake Gas Sensor Power In Range
3219	#	AFT1 INTK SNSR AT TMP	Aftertreatment 1 Intake Gas Sensor at Temperature
3220	#	AFT1 INTK NOX STBL	Aftertreatment 1 Intake NO_X Reading Stable
3221	#	AFT1 INTK WR O2 STBL	Aftertreatment 1 Intake Wide-Range Percent O_2 Reading Stable
3222	#	AFT1 INTK SNS HTR FMI	Aftertreatment 1 Intake Gas Sensor Heater Preliminary FMI
3224	#	AFT1 INTK NOXSNSR FMI	Aftertreatment 1 Intake NO_X Sensor Preliminary FMI
3225	#	AFT1 INTK O2 SNSR FMI	Aftertreatment 1 Intake O_2 Sensor Preliminary FMI
3226	#	AFT 1 OUTLET NOX	Aftertreatment 1 Outlet Nox
3227	#	AFT 1 OUT OXYGN %	Aftertreatment 1 Outlet Percent O2
3232	#	AFT1 OUT SNS HTR FMI	Aftertreatment 1 Outlet Gas Sensor Heater Preliminary FMI
3234	#	AFT1 OUT NOX SNSR FMI	Aftertreatment 1 Outlet NO_X Sensor Preliminary FMI
3242	#	AFT1 DPF IN TEMP	Aftertreatment1 DPF Intake Temperature
3246	#	AFT1 DPF OUT TEMP	Aftertreatment 1 DPF Outlet Temperature
3250	#	DPF INTRMED GAS TEMP	Aftertreatment 1 Diesel Particulate Filter Intermediate Gas Temperature
3251	#	AFT1 DPF DIFF PRESSR	Aftertreatment 1 DPF Differential Pressure
3256	#	AFTR TRT 2 INTK O2	Aftertreatment 2 Intake Percent O_2
3257	#	AFT2 INTK SNSPWR IN RG	Aftertreatment 2 Intake Gas Sensor Power In Range
3260	#	AFT2 INTK WR O2 STBL	Aftertreatment 2 Intake Wide-Range Percent O2 Reading Stable
3261	#	AFT2 INTK SNS HTR FMI	Aftertreatment 2 Intake Gas Sensor Heater Preliminary FMI
3264	#	AFT2 INTK O2 SNSR FMI	Aftertreatment 2 Intake O2 Sensor Preliminary FMI
3271	#	AFT2 OUT SNS HTR FMI	Aftertreatment 2 Outlet Gas Sensor Heater Preliminary FMI
3361	#	AFT1 CTLYST DOSE UNIT	Aftertreatment 1 SCR Catalyst Dosing Unit
3363	#	AFT1 SCR TANK HTR	Aftertreatment 1 SCR Tank Heater
3380	#	FIELD VOLTAGE	Field Voltage
3381	#	FIELD CURRENT	Field Current
3464	#	THROTTLE ACT 1 CNTL	Throttle Actuator 1 Control
3465	#	THROTTLE ACT 2 CNTL	Throttle Actuator 2 Control
3468	#	FUEL TEMP 2	Fuel Temperature 2
3485	#	AFT1 SUPPLY AIR PRESS	Aftertreatment 1 Supply Air Pressure
3509	#	SENSOR SUPPLY VOLTS 1	Sensor Supply Voltage 1
3510	#	SENSOR SUPPLY VOLTS 2	Sensor Supply Voltage 2
3511	#	SNSR SUPPLY VOLT 3	Sensor Supply Voltage 3
3512	#	SNSR SUPPLY VOLT 4	Sensor Supply Voltage 4
3513	#	SNSR SUPPLY VOLT 5	Sensor Supply Voltage 5

SPN	FMI	String Displayed	Description
3514	#	SNSR SUPPLY VOLT 6	Sensor Supply Voltage 6
3515	#	DEF TEMP	DEF Temperature
3516	#	DEF CONCENTRATION	Aftertreatment 1 SCR Catalyst Reagent Concentration
3517	#	DEF TANK 2 LVL %	Diesel Exhaust Fluid Tank 2 Level %
3520	#	DEF QUALITY	Aftertreatment 1 SCR Catalyst Reagent Properties Preliminary FMI
3563	#	INTK MNFLD1 PRESSURE	Intake Manifold 1 Pressure
3597	#	ECU SUPPLY VOLTAGE 1	ECU Power Supply Voltage 1
3598	#	ECU SUPPLY VOLTAGE 2	ECU Power Supply Voltage 2
3599	#	ECU SUPPLY VOLTAGE 3	ECU Power Supply Voltage 3
3601	#	FUEL VLV LK TEST CTL	Engine Fuel Shutoff Valve Leak Test Control
3605	#	COOLANT PUMP CTL	Coolant Pump Control
3607	#	ENGINE SHUTDOWN	Engine Shutdown
3609	#	DPF INTAKE PRESSR 1	DPF Intake Pressure 1
3610	#	DPF OUTLET PRESSR 1	DPF Outlet Pressure 1
3611	#	DPF INTAKE PRESSR 2	DPF Intake Pressure 2
3612	#	DPF OUTLET PRESSR 2	DPF Outlet Pressure 2
3668	#	INTRCR CLNT LVL	Intercooler Coolant Level
3673	#	THROTTLE POSITION 2	Engine Throttle 2 Position
3695	#	REGEN INHIBIT SWITCH	Regenerate Inhibit Switch
3703	#	DPF RGN INH DUE TO SW	DPF Regeneration Inhibited Due to Inhibit Switch
3719	#	DPF SOOT LEVEL %	Soot level in the Diesel Particulate Filter
3719	0	DPF SOOT LVL EXT HI	Diesel Particulate Filter Soot Level High - Most Severe Level
3719	15	DPF SOOT LVL HI	Diesel Particulate Filter Soot Level High - Least Severe Level
3719	16	DPF SOOT LVL MOD HI	Diesel Particulate Filter Soot Level High - Moderately Severe Level
3720	#	DPF ASH LEVEL %	DPF Ash Level Percent
3822	#	EGR1 VLV 2 POSITION	Engine Exhaust Gas Recirculation 1 Valve 2 Position
3826	#	DEF AVG CONSUMPTION	DEF Average Consumption
3828	#	DEF CURRNT CONSUMPTN	DEF Current Consumption
3938	#	GOVERNING BIAS	Generator Governing Bias
4096	#	NOx HI DEF EMPTY	NOx Limits Exceeded Due to Diesel Exhaust Fluid Empty
4213	#	ENG CRNK WITHOUT_FUEL	Engine Crank Without Fuel
4257	#	INJECTOR GROUP 3	Injector Group 3
4332	#	DEF SYSTEM STATE	DEF System State
4334	#	DEF ABSOLUTE PRESSR	DEF Absolute Pressure
4335	#	DEF DOSING AIR ABS PR	DEF Dosing Air Assist Absolute Pressure
4336	#	AFT1 DOSE AIR ASSTVLV	Aftertreatment 1 SCR Dosing Air Assist Valve
4348	#	AFT1 REQ DOSING QTY	Aftertreatment 1 Requested Dosing Reagent Quantity
4354	#	AFT1 DEF LINE HTR	Aftertreatment 1 SCR Catalyst Reagent Line Heater 1
4360	#	AFTTRT1 INTK GAS TMP	Aftertreatment 1 Catalyst Intake Gas Temperature
4363	#	AFTTRT1 OUT GAS TMP	Aftertreatment 1 Catalyst Outlet Gas Temperature
4364	#	SCR CNVRSN EFFICIENCY	SCR Conversion Efficiency
4375	#	AFTTRT1 PUMP DRV %	Aftertreatment 1 Catalyst Pump Drive Percentage

SPN	FMI	String Displayed	Description
4401	#	AFT2 REQ DOSING QTY	Aftertreatment 2 Requested Dosing Reagent Quantity
4413	#	AFTTRT2 INTK GAS TMP	Aftertreatment 2 Catalyst Intake Gas Temperature
4415	#	AFTTRT2 OUT GAS TMP	Aftertreatment 2 Catalyst Outlet Gas Temperature
4441	#	AFTTRT2 PUMP DRV %	Aftertreatment 2 Catalyst Pump Drive Percentage
4490	#	SPECIFIC HUMIDITY	Specific Humidity
4755	#	AFT1 CTLYST DIFF PRS	Aftertreatment 1 Gas Oxidation Catalyst Differential Pressure
4765	#	AFTTRT1 INTK GAS TMP	Aftertreatment 1 Catalyst Intake Gas Temperature
4794	#	AFT1 CTLYST SYS MSSNG	Aftertreatment 1 SCR Catalyst System Missing
4809	#	AFT1 DEF WARM IN TMP	Aftertreatment 1 Warm Up Diesel Oxidation Catalyst Inlet Temperature
4810	#	AFT1 DEF WARM OUT TMP	Aftertreatment 1 Warm Up Diesel Oxidation Catalyst Outlet Temperature
4990	#	BATT CHARGER	Battery Charger
5078	#	AMBER WARNING	Engine Amber Warning Lamp Command
5246	#	SCR INDUCMT SEVERITY	Selective Catalytic Reduction Inducement Severity Level
5264	#	EGR2 VALVE 1 CONTROL	Engine Exhaust Gas Recirculation 2 Valve 1 Control
5422	#	CHG AIR B PRESSURE	Charge Air B Pressure
5571	#	FUEL RTN PRESSURE	Fuel Return Path Pressure
10029	0	PURGE TIMEOUT ERROR	Purge did not complete within the maximum allowed time
516098	#	KNOCK SENSR 2	Knock Sensor 2
516131	#	PROPANE/GAS LOCKOFF	Propane/Natural Gas Lockoff
520555	#	UEGO INRC	Manufacturer Assignable SPN – Contact Engine Manufacturer for details.
520556	#	EXH GAS SENSR 2	Exhaust Gas Sensor 2
520700	#	TSC1 MESSAGE	Torque/Speed Control 1 Message - Manufacturer Assignable SPN – Contact Engine Manufacturer for details.
520707	#	DIAG TOOL CAN NETWK 1	Diagnostic Tool CAN Bus Network #1 - Manufacturer Assignable SPN – Contact Engine Manufacturer for details.
520708	#	OHECS MESSAGE	Manufacturer Assignable SPN – Contact Engine Manufacturer for details.
520709	#	GTACP MESSAGE	Manufacturer Assignable SPN – Contact Engine Manufacturer for details.
520710	#	GC2 MESSAGE	Manufacturer Assignable SPN – Contact Engine Manufacturer for details.
520711	#	EBC1 MESSAGE	Manufacturer Assignable SPN – Contact Engine Manufacturer for details.
520712	#	ACS MESSAGE	Manufacturer Assignable SPN – Contact Engine Manufacturer for details.
520713	#	INTER ECU COMM MSG	Inter-ECU Communications Message - Manufacturer Assignable SPN – Contact Engine Manufacturer for details.
520714	#	CCVS MESSAGE	Manufacturer Assignable SPN – Contact Engine Manufacturer for details.
520837	1	STARTER SPEED LO LO	Starter Speed is below the LOW LOW threshold
520838	1	RUN UP SPEED LO LO	Run Up Speed is below the LOW LOW threshold
522192	12	MTU ENGINE BAD	Component failure of the MTU engine control ECU
523212	#	ENGPRT CAN MSG	Proprietary MTU CAN Message
523216	#	PREHTENCMD CAN MSG	Proprietary MTU CAN Message

SPN	FMI	String Displayed	Description
523218	#	RxCCVS CAN MSG	Proprietary MTU CAN Message
523222	#	TC01 CAN MSG	Proprietary MTU CAN Message
523238	#	SWTOUT CAN MSG	Proprietary MTU CAN Message
523239	#	DECV1 CAN MSG	Proprietary MTU CAN Message
523240	#	FUNMODCTL CAN MSG	Proprietary MTU CAN Message
523350	#	CYL BANK 1 INJECTORS	Cylinder Bank 1 Injectors
523351	#	CYL BANK 1 INJECTORS	Cylinder Bank 1 Injectors
523352	#	CYL BANK 2 INJECTORS	Cylinder Bank 2 Injectors
523353	#	CYL BANK 2 INJECTORS	Cylinder Bank 2 Injectors
523354	#	ECU ERROR	ECU Error
523355	#	ECU ERROR	ECU Error
523370	#	RAIL PRESSURE	Rail Pressure
523420	#	ECU ERROR	ECU Error
523450	#	MULTI STATE SWITCH 1	Multi State Switch 1
523451	#	MULTI STATE SWITCH 2	Multi State Switch 2
523452	#	MULTI STATE SWITCH 3	Multi State Switch 3
523470	#	RAIL PRESSURE LMT VLV	Rail Pressure Limit Valve
523490	#	ECU ERROR	ECU Error
523500	#	CAN MSG TIMEOUT	Can Message Timeout has occurred
523550	#	ECU ERROR	ECU Error
523561	#	INJECTN PERIOD CYL 1	Single Cylinder Injection Period
523562	#	INJECTN PERIOD CYL 2	Single Cylinder Injection Period
523563	#	INJECTN PERIOD CYL 3	Single Cylinder Injection Period
523564	#	INJECTN PERIOD CYL 4	Single Cylinder Injection Period
523565	#	INJECTN PERIOD CYL 5	Single Cylinder Injection Period
523566	#	INJECTN PERIOD CYL 6	Single Cylinder Injection Period
523567	#	INJECTN PERIOD CYL 7	Single Cylinder Injection Period
523568	#	INJECTN PERIOD CYL 8	Single Cylinder Injection Period
523600	#	ECU ERROR	ECU Error
523601	#	ECU ERROR	ECU Error
523602	#	FAN SPEED	Engine Fan Speed
523604	#	RXENGTMP CAN MSG	CAN Message
523605	#	TSC1-AE MSG MISSING	CAN Message
523606	#	TSC1-AR MSG MISSING	CAN Message
523607	#	TSC1-DE MSG MISSING	CAN Message
523608	#	TSC1-DR MSG MISSING	CAN Message
523609	#	TSC1-PE MSG MISSING	CAN Message
523610	#	TSC1-VE MSG MISSING	CAN Message
523611	#	TSC1-VR MSG MISSING	CAN Message
523612	#	ECU ERROR	ECU Error
523613	#	RAIL PRESSURE	Rail Pressure
523615	#	METERING UNIT VALVE	Metering Unit Valve
523617	#	ECU ERROR	ECU Error

Table 6-3. DTCs Displayed by the DGC-2020ES (FMI Strings)

FMI	String Displayed	Description
0	DATA HI MOST SEVERE	Data is higher than expected at the most severe level
1	DATA LO MOST SEVERE	Data is lower than expected at the most severe level
2	DATA ERRATIC OR BAD	Data is erratic, intermittent, or incorrect
3	VOLTS HI OR SHORTED	Measured voltage is higher than expected or shorted to a high source
4	VOLTS LO OR SHORTED	Measured voltage is lower than expected or shorted to a low source
5	CURRENT LO OR OPEN	Measured current is lower than expected or the circuit is open
6	CURRENT HI OR SHORTED	Measured current is higher than expected or shorted
7	MECHANICAL SYSTM ERR	Mechanical system error
8	FREQ OR PWM ERROR	Error in frequency, pulse width or period of any frequency or PWM signal is outside its predetermined limits
9	ABNORMAL UPDATE RATE	Update rate of parameter is abnormal
10	DATA RT OF CHG ERR	Rate of change of data is abnormal
11	FAILURE CAUSE UNKNOWN	String indicating failure cause is unknown
12	BAD INTELLIGNT DEVICE	Engine ECU is reporting that an intelligent device or component failure has been detected
13	OUT OF CALIBRATION	Device or parameter is out of calibration
14	CONSULT ENG MFG DATA	User should consult engine manufacturer's data
15	DATA HI LST SEVERE	Data is higher than expected at the least severe level
16	DATA HI MODERATE SVR	Data is higher than expected at a moderately severe level
17	DATA LO LST SEVERE	Data is lower than expected at the least severe level
18	DATA LO MODERATE SVR	Data is lower than expected at a moderately severe level
19	NETWORK DATA ERR	String Indicating Network Data contained an error indication
20	DATA DRIFTED HI	Data has drifted to a value higher than the maximum valid value.
21	DATA DRIFTED LO	Data has drifted to a value lower than the minimum valid value.
22	FMI RESERVED BY SAE	This FMI is reserved by the Society of Automotive Engineers.
23	FMI RESERVED BY SAE	This FMI is reserved by the Society of Automotive Engineers.
24	FMI RESERVED BY SAE	This FMI is reserved by the Society of Automotive Engineers.
25	FMI RESERVED BY SAE	This FMI is reserved by the Society of Automotive Engineers.
26	FMI RESERVED BY SAE	This FMI is reserved by the Society of Automotive Engineers.
27	FMI RESERVED BY SAE	This FMI is reserved by the Society of Automotive Engineers.
28	FMI RESERVED BY SAE	This FMI is reserved by the Society of Automotive Engineers.
29	FMI RESERVED BY SAE	This FMI is reserved by the Society of Automotive Engineers.
30	FMI RESERVED BY SAE	This FMI is reserved by the Society of Automotive Engineers.
31	CONDTN EXST OR FMI NA	If the SPN refers to a parameter with status of ON or OFF, an FMI of 31 indicates ON. If the SPN refers to a parameter with a numeric value, an FMI of 31 indicates that there is no FMI to describe the parameter’s condition.

7 • Yanmar Fault Codes

The Yanmar fault codes are actually J1939 Diagnostic Trouble Codes with an additional Yanmar Fault Code designator.

The DGC-2020 obtains Yanmar diagnostic engine information from the Yanmar engine control unit (ECU). The DGC-2020 will receive an unsolicited message of a currently active diagnostic trouble code (DTC). Previously active DTCs are available upon request. Active and previously active DTCs can be cleared on request. Table 7-1 lists the diagnostic information that the DGC-2020 obtains over the CAN Bus interface.

Table 7-1. Diagnostic Information Obtained Over the CAN Bus Interface

Parameter	Transmission Repetition Rate
Active diagnostic trouble code	1 s
Lamp status	1 s
Previously active diagnostic trouble code	On request
Request to clear active DTCs	On request
Request to clear previously active DTCs	On request

DTCs are reported in coded diagnostic information that includes the Suspect Parameter Number (SPN), Failure Mode Identifier (FMI), and Occurrence Count (OC). All parameters have an SPN and are used to display or identify the items for which diagnostics are being reported. The FMI defines the type of failure detected in the subsystem identified by an SPN. The reported problem may not be an electrical failure but a subsystem condition needing to be reported to an operator or technician. The OC contains the number of times that a fault has gone from active to previously active.

For certain DTCs, if the DGC-2020 recognizes a pair of SPN and FMI numbers, it displays a single string as listed in Table 7-3. If the DGC-2020 recognizes an SPN in Table 7-3, but the FMI does not match the FMI in Table 7-3, then it displays the text string from Table 7-3 corresponding to the table entry where the FMI is # and a second text string corresponding to the FMI number listed in Table 7-2. For example, if the DGC-2020 receives SPN 29 and FMI 13, it displays ACCEL PEDAL 2 POSITN and OUT OF CALIBRATION. If the DGC-2020 does not have descriptive information about an SPN and FMI that was received, the description will display as “NO TEXT AVAILABLE”.

The Yanmar Fault Code designator consists of a letter and a four-digit number in the form LNNNN, where L is either a U or a P, and NNNN is a four-digit hexadecimal number. This code uniquely identifies the Yanmar fault information. Consult the Yanmar engine documentation or contact Yanmar to determine the corrected action that will remedy the fault.

Table 7-2. DTCs Displayed by the DGC-2020 (FMI Strings)

FMI	Text Displayed	Description
0	DATA HI MOST SEVERE	Data is higher than expected at the most severe level
1	DATA LO MOST SEVERE	Data is lower than expected at the most severe level
2	DATA ERRATIC OR BAD	Data is erratic, intermittent, or incorrect
3	VOLTS HI OR SHORTED	Measured voltage is higher than expected or shorted to a high source
4	VOLTS LO OR SHORTED	Measured voltage is lower than expected or shorted to a low source
5	CURRENT LO OR OPEN	Measured current is lower than expected or the circuit is open
6	CURRENT HI OR SHORTED	Measured current is higher than expected or shorted
7	MECHANICAL SYSTM ERR	Mechanical system error

FMI	Text Displayed	Description
8	FREQ OR PWM ERROR	Error in frequency, pulse width or period of any frequency or PWM signal is outside its predetermined limits.
9	ABNORMAL UPDATE RATE	Update rate of parameter is abnormal.
10	DATA RT OF CHG ERR	Rate of change of data is abnormal.
11	FAILURE CAUSE UNKNOWN	String indicating failure cause is unknown.
12	BAD INTELLIGNT DEVICE	Engine ECU is reporting that an intelligent device or component failure has been detected.
13	OUT OF CALIBRATION	Device or parameter is out of calibration.
14	CONSULT ENG MFG DATA	User should consult engine manufacturer's data.
15	DATA HI LST SEVERE	Data is higher than expected at the least severe level.
16	DATA HI MODERATE SVR	Data is higher than expected at a moderately severe level.
17	DATA LO LST SEVERE	Data is lower than expected at the least severe level.
18	DATA LO MODERATE SVR	Data is lower than expected at a moderately severe level.
19	NETWORK DATA ERR	String Indicating Network Data contained an error indication.
20	DATA DRIFTED HI	Data has drifted to a value higher than the maximum valid value.
21	DATA DRIFTED LO	Data has drifted to a value lower than the minimum valid value.
22	FMI RESERVED BY SAE	This FMI is reserved by the Society of Automotive Engineers.
23	FMI RESERVED BY SAE	This FMI is reserved by the Society of Automotive Engineers.
24	FMI RESERVED BY SAE	This FMI is reserved by the Society of Automotive Engineers.
25	FMI RESERVED BY SAE	This FMI is reserved by the Society of Automotive Engineers.
26	FMI RESERVED BY SAE	This FMI is reserved by the Society of Automotive Engineers.
27	FMI RESERVED BY SAE	This FMI is reserved by the Society of Automotive Engineers.
28	FMI RESERVED BY SAE	This FMI is reserved by the Society of Automotive Engineers.
29	FMI RESERVED BY SAE	This FMI is reserved by the Society of Automotive Engineers.
30	FMI RESERVED BY SAE	This FMI is reserved by the Society of Automotive Engineers.
31	CONDTN EXST OR FMI NA	If the SPN refers to a parameter with status of ON or OFF, an FMI of 31 indicates ON. If the SPN refers to a parameter with a numeric value, an FMI of 31 indicates that there is no FMI to describe the parameter's condition.

Table 7-3. DTCs with Yanmar Fault Code Designators Displayed by the DGC-2020

SPN	FMI	Text Displayed	Description	Yanmar Code
28	0	ACCEL PEDAL 3 POSITN	accelerator pedal 3 position	P1126
28	1	ACCEL PEDAL 3 POSITN	accelerator pedal 3 position	P1125
28	3	ACCEL PEDAL 2 POSITN	accelerator pedal 2 position	P0223
28	4	ACCEL PEDAL 2 POSITN	accelerator pedal 2 position	P0222
29	3	ACCEL PEDAL 3 POSITN	accelerator pedal 3 position	P0228
29	4	ACCEL PEDAL 3 POSITN	accelerator pedal 3 position	P0227
29	8	ACCEL PEDAL 2 POSITN	accelerator pedal 2 position	P1227
51	3	ENG THROTTLE POSITN	Engine Throttle Position	P02E9
51	4	ENG THROTTLE POSITN	Engine Throttle Position	P02E8
91	3	ACCEL POSITION	Accelerator Position	P0123
91	4	ACCEL POSITION	Accelerator Position	P0122
100	1	ENG OIL PRESS	Engine Oil Pressure	P1198
100	4	ENG OIL PRESS	Engine Oil Pressure	P1192
102	3	INTK MANFLD P SNS BAD	intake manifold pressure sensor malfunction	P0238
102	4	INTK MANFLD P SNS BAD	intake manifold pressure sensor malfunction	P0237
102	10	INTK MANFLD P SNS BAD	intake manifold pressure sensor malfunction	P1673

SPN	FMI	Text Displayed	Description	Yanmar Code
102	13	INTK MANFLD P SNS BAD	intake manifold pressure sensor malfunction	P0236
105	3	INTK MANFLD T SNS BAD	Intake Manifold Temperature Sensor Malfunction	P040D
105	4	INTK MANFLD T SNS BAD	Intake Manifold Temperature Sensor Malfunction	P040C
105	10	INTK MANFLD T SNS BAD	Intake Manifold Temperature Sensor Malfunction	P1676
108	3	ATMOSPHERIC P SNS BAD	Caption string indicating Atmospheric Pressure Sensor Malfunction	P2229
108	4	ATMOSPHERIC P SNS BAD	Caption string indicating Atmospheric Pressure Sensor Malfunction	P2228
108	10	ATMOSPHERIC P SNS BAD	Caption string indicating Atmospheric Pressure Sensor Malfunction	P1231
110	0	COOLANT TMP	Engine Coolant Temperature	P0217
110	3	COOLANT TMP SENSR BAD	Engine Coolant Temperature Sensor Malfunction	P0118
110	4	COOLANT TMP SENSR BAD	Engine Coolant Temperature Sensor Malfunction	P0117
110	10	COOLANT TMP SENSR BAD	Engine Coolant Temperature Sensor Malfunction	P1674
157	0	INJ RAIL PRS	Injector Rail Pressure	P0088
157	3	INJ RAIL PRS	Injector Rail Pressure	P0193
157	4	INJ RAIL PRS	Injector Rail Pressure	P0192
157	15	INJ RAIL PRS	Injector Rail Pressure	P0093
157	16	INJ RAIL PRS	Injector Rail Pressure	P000F
157	18	INJ RAIL PRS	Injector Rail Pressure	P0094
167	1	CHARGING SYSTM VOLT	Charging System Voltage	P1568
167	5	CHARGING SYSTM VOLT	Charging System Voltage	P1562
172	3	AIR INLET TEMP	Air Inlet Temperature	P0113
172	4	AIR INLET TEMP	Air Inlet Temperature	P0112
173	3	EXH MANFLD T SNS BAD	Exhaust Manifold Temperature Sensor Malfunction	P0546
173	4	EXH MANFLD T SNS BAD	Exhaust Manifold Temperature Sensor Malfunction	P0545
173	10	EXH MANFLD T SNS BAD	Exhaust Manifold Temperature Sensor Malfunction	P1677
174	0	FUEL TEMP	Fuel Temperature	P0168
174	3	FUEL TEMP	Fuel Temperature	P0183
174	4	FUEL TEMP	Fuel Temperature	P0182
190	0	ENGINE SPEED	Engine Speed	P0219
237	13	CAN 2	Can Bus 2	U3002
237	31	CAN 2	Can Bus 2	U0168
412	3	EGR GAS TMP SNSR BAD	EGR Gas Temperature Sensor Malfunction	P041D
412	4	EGR GAS TMP SNSR BAD	EGR Gas Temperature Sensor Malfunction	P041C
412	10	EGR GAS TMP SNSR BAD	EGR Gas Temperature Sensor Malfunction	P1675
630	12	EE PROM	the EEPROM memory inside the engine ECU	P0601
633	3	SCV (MPROP)	Proprietary caption text for YANMAR Diagnostic Trouble Codes	P0629

SPN	FMI	Text Displayed	Description	Yanmar Code
633	5	SCV (MPROP)	Proprietary caption text for YANMAR Diagnostic Trouble Codes	P0627
633	6	SCV (MPROP)	Proprietary caption text for YANMAR Diagnostic Trouble Codes	P1642
651	3	CYLINDER 4 INJECTOR	Cylinder 4 Injector	P1271
651	5	CYLINDER 4 INJECTOR	Cylinder 4 Injector	P0204
651	6	CYLINDER 4 INJECTOR	Cylinder 4 Injector	P0271
651	11	CYLINDER 4 INJECTOR	Cylinder 4 Injector	P1272
652	3	CYLINDER 3 INJECTOR	Cylinder 3 Injector	P1268
652	5	CYLINDER 3 INJECTOR	Cylinder 3 Injector	P0203
652	6	CYLINDER 3 INJECTOR	Cylinder 3 Injector	P0268
652	11	CYLINDER 3 INJECTOR	Cylinder 3 Injector	P1269
653	3	CYLINDER 2 INJECTOR	Cylinder 2 Injector	P1265
653	5	CYLINDER 2 INJECTOR	Cylinder 2 Injector	P0202
653	6	CYLINDER 2 INJECTOR	Cylinder 2 Injector	P0265
653	11	CYLINDER 2 INJECTOR	Cylinder 2 Injector	P1266
654	3	CYLINDER 1 INJECTOR	Cylinder 1 Injector	P1262
654	5	CYLINDER 1 INJECTOR	Cylinder 1 Injector	P0201
654	6	CYLINDER 1 INJECTOR	Cylinder 1 Injector	P0262
654	11	CYLINDER 1 INJECTOR	Cylinder 1 Injector	P1263
1209	3	EXH MANFLD P SNS BAD	Exhaust Manifold Pressure Sensor Malfunction	P0473
1209	4	EXH MANFLD P SNS BAD	Exhaust Manifold Pressure Sensor Malfunction	P0472
1209	10	EXH MANFLD P SNS BAD	Exhaust Manifold Pressure Sensor Malfunction	P1679
1209	13	EXH MANFLD P SNS BAD	Exhaust Manifold Pressure Sensor Malfunction	P0471
1485	2	ECU MAIN RELAY	ECU Main Relay	P068A
1485	7	ECU MAIN RELAY	ECU Main Relay	P068B
2791	0	EGR VALVE MALFUNCTN	Exhaust Gas Recirculation (EGR) Malfunction	P0404
2791	1	EGR VALVE MALFUNCTN	Exhaust Gas Recirculation (EGR) Malfunction	P1404
2791	7	EGR VALVE MALFUNCTN	Exhaust Gas Recirculation (EGR) Malfunction	P1409
2791	9	EGR VALVE MALFUNCTN	Exhaust Gas Recirculation (EGR) Malfunction	U0401
2791	12	EGR VALVE MALFUNCTN	Exhaust Gas Recirculation (EGR) Malfunction	P0403
2797	6	INJECTOR GROUP 1	Engine Injector Group 1	P1146
2798	6	INJECTOR GROUP 2	Engine Injector Group 2	P1149
2950	3	INTK THROTTL DRV CKT	Engine Intake Throttle Drive Circuit	P1658
2950	4	INTK THROTTL DRV CKT	Engine Intake Throttle Drive Circuit	P1659
2950	5	INTK THROTTL DRV CKT	Engine Intake Throttle Drive Circuit	P0660
2950	6	INTK THROTTL DRV CKT	Engine Intake Throttle Drive Circuit	P1660
2951	3	INTK THROTTL DRV CKT	Engine Intake Throttle Drive Circuit	P1661
2951	4	INTK THROTTL DRV CKT	Engine Intake Throttle Drive Circuit	P1662
3242	0	DPF INLET T SENSR BAD	Diesel Particulate Filter (DPF) Inlet Temperature Sensor Malfunction	P1436
3242	3	DPF INLET T SENSR BAD	Diesel Particulate Filter (DPF) Inlet Temperature Sensor Malfunction	P1428
3242	4	DPF INLET T SENSR BAD	Diesel Particulate Filter (DPF) Inlet Temperature Sensor Malfunction	P1427

SPN	FMI	Text Displayed	Description	Yanmar Code
3242	10	DPF INLET T SENSR BAD	Diesel Particulate Filter (DPF) Inlet Temperature Sensor Malfunction	P167E
3250	0	DPF INTRMED GAS TEMP	Diesel Particulate Filter (DPF) Intermediate Temperature Sensor Malfunction	P1426
3250	1	DPF INTRMD T SNS BAD	Diesel Particulate Filter (DPF) Intermediate Temperature Sensor Malfunction	P0420
3250	3	DPF INTRMD T SNS BAD	Diesel Particulate Filter (DPF) Intermediate Temperature Sensor Malfunction	P1434
3250	4	DPF INTRMD T SNS BAD	Diesel Particulate Filter (DPF) Intermediate Temperature Sensor Malfunction	P1435
3250	10	DPF INTRMD T SNS BAD	Diesel Particulate Filter (DPF) Intermediate Temperature Sensor Malfunction	P167A
3251	0	DPF DIFF PRS SNSR BAD	Diesel Particulate Filter (DPF) Differential Pressure Sensor Malfunction	P2452
3251	3	DPF DIFF PRS SNSR BAD	Diesel Particulate Filter (DPF) Differential Pressure Sensor Malfunction	P2455
3251	4	DPF DIFF PRS SNSR BAD	Diesel Particulate Filter (DPF) Differential Pressure Sensor Malfunction	P2454
3251	10	DPF DIFF PRS SNSR BAD	Diesel Particulate Filter (DPF) Differential Pressure Sensor Malfunction	P167B
3251	13	DPF DIFF PRS SNSR BAD	Diesel Particulate Filter (DPF) Differential Pressure Sensor Malfunction	P2453
3609	3	DPF HIGH PRS SNS BAD	Diesel Particulate Filter (DPF) High Pressure Sensor Malfunction	P1455
3609	4	DPF HIGH PRS SNS BAD	Diesel Particulate Filter (DPF) High Pressure Sensor Malfunction	P1454
3609	10	DPF HIGH PRS SNS BAD	Diesel Particulate Filter (DPF) High Pressure Sensor Malfunction	P167C
3695	14	REGEN INHIBITED	Text announcing that diesel particulate filter regeneration is disabled	P1425
3719	0	DPF SOOT LEVEL %	the level of soot in the Diesel Particulate Filter	P1424
3719	7	DPF SOOT LEVEL %	the level of soot in the Diesel Particulate Filter	P1446
3719	9	DPF SOOT LEVEL %	the level of soot in the Diesel Particulate Filter	P1445
3719	16	DPF SOOT LEVEL %	the level of soot in the Diesel Particulate Filter	P1421
3720	0	DPF ASH LEVEL %	the level of ash in the Diesel Particulate Filter	P1420
3720	16	DPF ASH LEVEL %	the level of ash in the Diesel Particulate Filter	P242F
4257	12	INJECTOR COMMON	Injector common	P0611
4795	31	DPF SUBSTRATE REMOVED	the substrate has been removed from the Diesel Particulate Filter (DPF)	P226D
522243	5	ENGINE START RELAY	Engine Start Relay	P0543
522243	6	ENGINE START RELAY	Engine Start Relay	P0541
522323	0	AIR CLEANER SWITCH	the Air Cleaner Switch	P1101
522329	0	OIL/WATER SEPARATOR	the Oil/Water Separator Device	P1151
522400	2	CRANKSHAFT SENSOR	Crankshaft Sensor	P0336
522400	5	CRANKSHAFT SENSOR	Crankshaft Sensor	P0337
522401	2	CAMSHAFT SENSOR	Camshaft Sensor	P0341
522401	5	CAMSHAFT SENSOR	Camshaft Sensor	P0342
522401	7	CAMSHAFT SENSOR	Camshaft Sensor	P1341
522571	3	SCV (MPROP)	Proprietary caption text for YANMAR Diagnostic Trouble Codes	P1641
522571	6	SCV (MPROP)	Proprietary caption text for YANMAR Diagnostic Trouble Codes	P1643

SPN	FMI	Text Displayed	Description	Yanmar Code
522572	6	SCV (MPROP)	Proprietary caption text for YANMAR Diagnostic Trouble Codes	P062A
522572	11	SCV (MPROP)	Proprietary caption text for YANMAR Diagnostic Trouble Codes	P1645
522573	0	DPF	Diesel Particulate Filter	P2463
522574	0	DPF	Diesel Particulate Filter	P1463
522575	7	DPF	Diesel Particulate Filter	P2458
522576	12	EE PROM	EEPROM memory inside the engine ECU	P160E
522577	11	DPF	Diesel Particulate Filter	P2459
522578	12	EE PROM	EEPROM memory inside the engine ECU	P160F
522579	12	EGR VALVE MALFUNCTN	Exhaust Gas Recirculation (EGR) Malfunction	P1405
522580	12	EGR VALVE MALFUNCTN	Exhaust Gas Recirculation (EGR) Malfunction	P0488
522581	7	EGR VALVE MALFUNCTN	Exhaust Gas Recirculation (EGR) Malfunction	P148A
522582	7	EGR VALVE MALFUNCTN	Exhaust Gas Recirculation (EGR) Malfunction	P049D
522583	1	EGR VALVE MALFUNCTN	Exhaust Gas Recirculation (EGR) Malfunction	P1410
522584	1	EGR VALVE MALFUNCTN	Exhaust Gas Recirculation (EGR) Malfunction	P1411
522585	12	ECU INTERNAL ERROR	ECU Internal Error	P1613
522588	12	ECU INTERNAL ERROR	ECU Internal Error	P1608
522589	12	ECU INTERNAL ERROR	ECU Internal Error	P1617
522590	12	ECU INTERNAL ERROR	ECU Internal Error	P1609
522591	12	ECU INTERNAL ERROR	ECU Internal Error	P1618
522592	12	ECU INTERNAL ERROR	ECU Internal Error	P1619
522596	9	CAN 2	Can Bus 2	U0292
522597	9	CAN 2	Can Bus 2	U1301
522599	9	CAN 2	Can Bus 2	U1292
522600	9	CAN 2	Can Bus 2	U1293
522601	9	CAN 2	Can Bus 2	U1294
522603	9	CAN 2	Can Bus 2	U1296
522605	9	CAN 2	Can Bus 2	U1298
522609	9	CAN 2	Can Bus 2	U1300
522610	9	EGR VALVE MALFUNCTN	Exhaust Gas Recirculation (EGR) Malfunction	U010B
522611	9	EXHAUST THROTTLE	Exhaust Throttle	U1107
522617	12	EGR VALVE MALFUNCTN	Exhaust Gas Recirculation (EGR) Malfunction	U1401
522618	9	CAN 2	Can Bus 2	U1302
522619	9	CAN 2	Can Bus 2	U1303
522623	7	ACCELERTN SNSR 1 / 2	Acceleration Sensor 1 or Acceleration Sensor 2	P1647
522624	7	ACCELERTN SNSR 1 / 2	Acceleration Sensor 1 or Acceleration Sensor 2	P1646
522744	4	ECU INTERNAL ERROR	ECU Internal Error	P1626
522746	12	EXHAUST THROTTLE	the Exhaust Throttle	P1438
522747	12	EXHAUST THROTTLE	the Exhaust Throttle	P1439
522748	12	EXHAUST THROTTLE	the Exhaust Throttle	P1440
522749	12	EXHAUST THROTTLE	the Exhaust Throttle	P1441
522750	12	EXHAUST THROTTLE	the Exhaust Throttle	P1442
522751	19	EXHAUST THROTTLE	the Exhaust Throttle	P1443
522994	4	ECU INTERNAL ERROR	ECU Internal Error	P1633
523249	5	CRANK/CAM SENSOR	Crankshaft Sensor or the Camshaft sensor	P0008

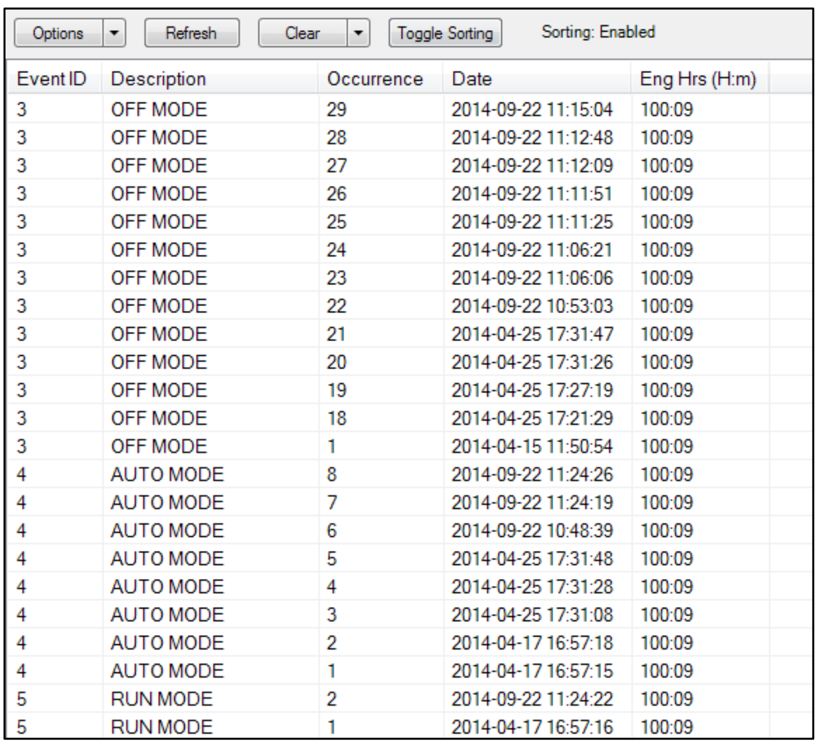
SPN	FMI	Text Displayed	Description	Yanmar Code
523460	7	RAIL PRESSURE SENSOR	the Fuel Rail Pressure Sensor	P1670
523462	13	QR DATA	YANMAR specific fault code	P1648
523463	13	QR DATA	YANMAR specific fault code	P1649
523464	13	QR DATA	YANMAR specific fault code	P1650
523456	13	QR DATA	YANMAR specific fault code	P1651
523468	9	RAIL PRESSURE SENSOR	the Fuel Rail Pressure Sensor	P1665
523469	0	RAIL PRESSURE SENSOR	the Fuel Rail Pressure Sensor	P1666
523470	0	RAIL PRESSURE SENSOR	the Fuel Rail Pressure Sensor	P1667
523471	6	ECU INTERNAL ERROR	ECU Internal Error	P1467
523473	12	ECU INTERNAL ERROR	ECU Internal Error	P1469
523474	12	ECU INTERNAL ERROR	ECU Internal Error	P1470
523475	12	ECU INTERNAL ERROR	ECU Internal Error	P1471
523476	12	ECU INTERNAL ERROR	ECU Internal Error	P1472
523477	12	ECU INTERNAL ERROR	ECU Internal Error	P1473
523478	12	ECU INTERNAL ERROR	ECU Internal Error	P1474
523479	12	ECU INTERNAL ERROR	ECU Internal Error	P1475
523480	12	ECU INTERNAL ERROR	ECU Internal Error	P1476
523481	12	ECU INTERNAL ERROR	ECU Internal Error	P1477
523482	12	ECU INTERNAL ERROR	ECU Internal Error	P1478
523483	12	ECU INTERNAL ERROR	ECU Internal Error	P1479
523484	12	ECU INTERNAL ERROR	ECU Internal Error	P1480
523485	12	ECU INTERNAL ERROR	ECU Internal Error	P1481
523486	12	ECU INTERNAL ERROR	ECU Internal Error	P1482
523487	12	ECU INTERNAL ERROR	ECU Internal Error	P1483
523488	0	ECU INTERNAL ERROR	ECU Internal Error	P1484
523489	0	RAIL PRESSURE SENSOR	Fuel Rail Pressure Sensor	P1668
523491	0	RAIL PRESSURE SENSOR	Fuel Rail Pressure Sensor	P1669

8 • Event Recording

An event log retains history of system events in nonvolatile memory. Fifty event records are retained and each record contains a time stamp of the first and last event occurrence, and the number of occurrences for each event. In addition, each record contains details of the time, date, and engine hours for the most recent 30 occurrences of the event. The number of occurrences stops incrementing at 99. If an event occurs which is of a type that differs from those in the 50 records in memory, the record that has the oldest “last” event occurrence is removed from the log, and the new category takes its place. Since 50 event records with up to 99 occurrences each are retained in memory, a history of nearly 5,000 specific events are retained by the DGC-2020ES. Detailed occurrence information is retained for the most recent 30 occurrences of each event record, and there are 50 event records. Thus the time, date, and engine hours details for up to 1,500 specific event occurrences are retained in the event log.

Event Log

An event log can be downloaded into BESTCOMS*Plus*® for viewing and storage. The *Options* button is used to save the entire event log to a file, or to save the list to the computer clipboard making it available for insertion into other software applications. It is possible to copy a portion of the log to the computer clipboard by selecting the desired portion with the mouse then using the Options->Copy Selection feature. The *Download* button refreshes the event log list by performing a fresh download of the list from the DGC-2020ES. The *Clear* button gives the user the option of clearing selected or all event logs. Refer to Figure 8-1.



Event ID	Description	Occurrence	Date	Eng Hrs (H:m)
3	OFF MODE	29	2014-09-22 11:15:04	100:09
3	OFF MODE	28	2014-09-22 11:12:48	100:09
3	OFF MODE	27	2014-09-22 11:12:09	100:09
3	OFF MODE	26	2014-09-22 11:11:51	100:09
3	OFF MODE	25	2014-09-22 11:11:25	100:09
3	OFF MODE	24	2014-09-22 11:06:21	100:09
3	OFF MODE	23	2014-09-22 11:06:06	100:09
3	OFF MODE	22	2014-09-22 10:53:03	100:09
3	OFF MODE	21	2014-04-25 17:31:47	100:09
3	OFF MODE	20	2014-04-25 17:31:26	100:09
3	OFF MODE	19	2014-04-25 17:27:19	100:09
3	OFF MODE	18	2014-04-25 17:21:29	100:09
3	OFF MODE	1	2014-04-15 11:50:54	100:09
4	AUTO MODE	8	2014-09-22 11:24:26	100:09
4	AUTO MODE	7	2014-09-22 11:24:19	100:09
4	AUTO MODE	6	2014-09-22 10:48:39	100:09
4	AUTO MODE	5	2014-04-25 17:31:48	100:09
4	AUTO MODE	4	2014-04-25 17:31:28	100:09
4	AUTO MODE	3	2014-04-25 17:31:08	100:09
4	AUTO MODE	2	2014-04-17 16:57:18	100:09
4	AUTO MODE	1	2014-04-17 16:57:15	100:09
5	RUN MODE	2	2014-09-22 11:24:22	100:09
5	RUN MODE	1	2014-04-17 16:57:16	100:09

Figure 8-1. Metering Explorer, Event Log Screen (Sorted by Event ID)

The event log may also be viewed on the front panel display by navigating to *Metering, Alarms-Status, Event Log.* Use the Up/Down keys to highlight an event and press the *Right* key to view the summary of that event record. The summary contains the description of the event, date, time, and engine hours of the first occurrence of the event, along with date, time, and engine hours of the most recent occurrence of the event. To view details of specific event occurrences, press the *Down* key until DETAILS is highlighted, and then, press the *Right* key. The occurrence number can be changed by pressing the *Edit* key, *Up/Down* keys to select #, and pressing the *Edit* key again to exit. Table 8-1 lists all possible event strings (as shown in the event log).

Table 8-1. Event List

Event String	Event Description	Event Type
27 UNDVOLT TRP A	27 Undervoltage Trip	Alarm
27 UNDVOLT TRP P	27 Undervoltage Trip	Pre-Alarm
47 PHS IMBAL TRP A	47 Phase Imbalance Trip	Alarm
47 PHS IMBAL TRP P	47 Phase Imbalance Trip	Pre-Alarm
50 OVRCURR TRP A	50 Overcurrent Trip	Alarm
50 OVRCURR TRP P	50 Overcurrent Trip	Pre-Alarm
59 OVRVOLT TRP A	59 Overvoltage Trip	Alarm
59 OVRVOLT TRP P	59 Overvoltage Trip	Pre-Alarm
81O OVRFREQ TRP A	81 Overfrequency Trip	Alarm
81O OVRFREQ TRP P	81 Overfrequency Trip	Pre-Alarm
81U UNDFREQ TRP A	81 Underfrequency Trip	Alarm
81U UNDFREQ TRP P	81 Underfrequency Trip	Pre-Alarm
ATS INPUT CLOSED	ATS Input	Status
AUTO RESTART	Automatic Restart in Progress	Status
AUTO RESTART FAIL A	Automatic Restart Fail	Alarm
BATT CHRG FAIL A	Battery Charger Fail	Alarm
BATT CHRG FAIL P	Battery Charger Fail	Pre-Alarm
BATT OVERVOLT P	Battery Overvoltage	Pre-Alarm
BATTLE OVERRIDE	Battle Override	Status
CAN BUS OFF	CAN Bus entered Bus Off state	Status
CAN ERROR PASSIVE	CAN Bus entered Error Passive state	Status
CEM COMM FAIL P	CEM-2020 Communications Failure	Pre-Alarm
CEM HW MISMATCH P	Connected CEM-2020 is wrong type	Pre-Alarm
CHARGER1 AC OFF P	Battery Charger 1, AC Off	Pre-Alarm
CHARGER1 BATT FAIL P	Battery Charger 1, Battery Failure	Pre-Alarm
CHARGER1 COMMS FAIL P	Battery Charger 1, Communications Failure	Pre-Alarm
CHARGER1 FAILURE P	Battery Charger 1,Charger Failure	Pre-Alarm
CHARGER1 HI DC VOLTS P	Battery Charger 1,High Output Voltage	Pre-Alarm
CHARGER1 INVALID SETTINGS P	Battery Charger 1,Invalid Settings	Pre-Alarm
CHARGER1 LO CRANKING V P	Battery Charger 1,Low Cranking Voltage	Pre-Alarm
CHARGER1 LOW DC VOLTS P	Battery Charger 1, Low Output Voltage	Pre-Alarm
CHARGER1 SINGLE UNIT FAIL P	Battery Charger 1,Single Unit Failure	Pre-Alarm
CHARGER1 THERMAL LIMIT P	Battery Charger 1,Thermal Limit	Pre-Alarm
CHARGER2 AC OFF P	Battery Charger 2, AC Off	Pre-Alarm
CHARGER2 BATT FAIL P	Battery Charger 2, Battery Failure	Pre-Alarm
CHARGER2 COMMS FAIL P	Battery Charger 2, Communications Failure	Pre-Alarm
CHARGER2 FAILURE P	Battery Charger 2,Charger Failure	Pre-Alarm
CHARGER2 HI DC VOLTS P	Battery Charger 2,High Output Voltage	Pre-Alarm
CHARGER2 INVALID SETTINGS P	Battery Charger 2,Invalid Settings	Pre-Alarm
CHARGER2 LO CRANKING V P	Battery Charger 2,Low Cranking Voltage	Pre-Alarm
CHARGER2 LOW DC VOLTS P	Battery Charger 2, Low Output Voltage	Pre-Alarm
CHARGER2 SINGLE UNIT FAIL P	Battery Charger 2,Single Unit Failure	Pre-Alarm

Event String	Event Description	Event Type
CHARGER2 THERMAL LIMIT P	Battery Charger 2,Thermal Limit	Pre-Alarm
CHECKSUM FAIL P	Corrupt user settings or firmware code	Pre-Alarm
COMBINED RED A	Combined Red	Alarm
COMBINED YELLOW P	Combined Yellow	Pre-Alarm
CONFIG ELEMENT X A (X = 1 to 8)	Configurable Element X (X = 1 to 8)	Alarm
CONFIG ELEMENT X P (X = 1 to 8)	Configurable Element X (X = 1 to 8)	Pre-Alarm
COOL LVL SNDR FL A	Coolant Level Sender Fail	Alarm
COOL SNDR FAIL	Coolant Temperature Sender Fail	Status
COOL SNDR FAIL A	Coolant Temperature Sender Fail	Alarm
COOL SNDR FAIL P	Coolant Temperature Sender Fail	Pre-Alarm
DEFAULTS LOADED	Default settings were uploaded into the DGC,	Status
DEF FLUID EMPTY P	Diesel Exhaust Fluid Empty	Pre-Alarm
DEF FLUID LOW P	Diesel Exhaust Fluid Low	Pre-Alarm
DEF CONSUMPTN ERR P	Diesel Exhaust Fluid Consumption Incorrect	Pre-Alarm
DEF INDUCEMENT P	Diesel Exhaust Fluid Inducement	Pre-Alarm
DEF INDUCMT O-RIDE P	Diesel Exhaust Fluid Inducement Override	Pre-Alarm
DEF LOW SEVERE P	Diesel Exhaust Fluid Low Severe	Pre-Alarm
DEF PRESVR INDUCMT P	Diesel Exhaust Fluid Pre-Severe Inducement	Pre-Alarm
DEF QUALITY POOR P	Diesel Exhaust Fluid Quality Poor	Pre-Alarm
DEF SEVERE INDUCMT P	Diesel Exhaust Fluid Severe inducement	Pre-Alarm
DEF TAMPERING	Diesel Exhaust Fluid Tampering	Pre-Alarm
DEF WARNING	Diesel Exhaust Fluid Pre-Inducement Warning Level 1	Pre-Alarm
DEF WARNING LEVEL 2	Diesel Exhaust Fluid Pre-Inducement Warning Level 2	Pre-Alarm
DGC HEARTBEAT FAIL P	DGC Heartbeat Fail	Pre-Alarm
DIAG TRBL CODE P	Diagnostic Trouble Code	Pre-Alarm
DPF REGNRATE DISABLD P	Diesel Particulate Filter Regeneration Disabled	Pre-Alarm
DPF REGEN REQD P	Diesel Particulate Filter Regeneration Required	Pre-Alarm
DPF SOOT LVL EXT HI P	Diesel Particulate Filter Soot Level Extremely High	Pre-Alarm
DPF SOOT LVL MOD HI P	Diesel Particulate Filter Soot Level Moderately High	Pre-Alarm
ECU SHUTDOWN A	ECU Shutdown	Alarm
EMERGENCY STOP A	Emergency Stop	Alarm
ENGINE RUNNING	Engine Running	Status
EPS SUPPLYING LOAD	Emergency Power System is Supplying Load	Status
FUEL FLT PRS HI P	Fuel Filter Differential Pressure High	Pre-Alarm
FUEL LEAK 1 P	Fuel Filter 1 Leak	Pre-Alarm
FUEL LEAK 2 P	Fuel Filter 2 Leak	Pre-Alarm
FUEL LEAK DETECT A	Fuel Leak Detect	Alarm
FUEL LEAK DETECT P	Fuel Leak Detect	Pre-Alarm
FUEL LEVL SENDR A	Fuel Level Sender Fail	Alarm
FUEL LEVL SENDR FAIL	Fuel Level Sender Fail	Status
FUEL LEVL SENDR P	Fuel Level Sender Fail	Pre-Alarm
GEN TEST LOADED	Generator Exerciser Test with Load	Status
GEN TEST UNLOADED	Generator Exerciser Test without Load	Status

Event String	Event Description	Event Type
GLBL SNDR FAIL A	Global Sender Fail	Alarm
GN BKR CL FL P	Generator Breaker Fail to Close	Pre-Alarm
GN BKR OP FL P	Generator Breaker Fail to Open	Pre-Alarm
GN BKR SYN FL P	Generator Breaker Synchronization Fail	Pre-Alarm
HI COOLANT TMP A	High Coolant Temp	Alarm
HI COOLANT TMP P	High Coolant Temp	Pre-Alarm
HI DAY TANK LEVEL P	High Day Tank Level	Pre-Alarm
HI ECU VOLTS A	High ECU Supply Voltage	Alarm
HI EXHAUSE B T P	High Exhaust Temp B	Pre-Alarm
HI EXHAUST A T P	High Exhaust Temp A	Pre-Alarm
HI PRESSURE IN 1 P	High Pressure Input 1	Pre-Alarm
HI PRESSURE IN 2 P	High Pressure Input 2	Pre-Alarm
HI SUPPLY VOLTS P	High Voltage Supply	Pre-Alarm
HI T FUEL P	High Fuel Temp	Pre-Alarm
HIGH AMB TEMP P	High Ambient Temp	Pre-Alarm
HIGH CHARGE AIR TEMP A	High Charge Air Temp	Alarm
HIGH CHARGE AIR TEMP P	High Charge Air Temp	Pre-Alarm
HIGH COIL TEMP 1 P	High Temp Coil 1	Pre-Alarm
HIGH COIL TEMP 2 P	High Temp Coil 2	Pre-Alarm
HIGH COIL TEMP 3 P	High Temp Coil 3	Pre-Alarm
HIGH COOLANT TEMP A	High Coolant Temp	Alarm
HIGH COOLANT TEMP P	High Coolant Temp	Pre-Alarm
HIGH ECU TEMPERATURE P	High ECU Temp	Pre-Alarm
HIGH EXHAUST TEMP P	High Exhaust Temp	Pre-Alarm
HIGH FUEL LEVEL P	High Fuel Level	Pre-Alarm
HIGH FUEL RAIL PRESS P	High Fuel Rail Pressure	Pre-Alarm
HIGH INTRCOOLER TEMP P	High Intercooler Temp	Pre-Alarm
HIGH OIL TEMPERATURE P	High Oil Temp	Pre-Alarm
HIGH OIL TERMPERATURE A	High Oil Temp	Alarm
HIGH STRG TANK LEVEL P	High Storage Tank Level	Pre-Alarm
IDLE SPD LO P	Idle Speed Low	Pre-Alarm
INPUT X A (X = 1 to 17)	User Configurable Input X (X = 1 to 17)	Alarm
INPUT X P (X = 1 to 17)	User Configurable Input X (X = 1 to 17)	Pre-Alarm
LO AFTERCLR COOL LVL A	Low After Cooler Cool Level	Alarm
LO CHG AIR CLNT LVL P	Low Charge Air Coolant Level	Pre-Alarm
LO DAY TANK LEVEL P	Low Day Tank Level	Pre-Alarm
LO ECU VOLTS P	Low ECU Supply Voltage	Pre-Alarm
LO FUEL DLV PRESSURE A	Low Fuel Delivery Pressure	Alarm
LO SUPPLY VOLTS P	Low Voltage Supply	Pre-Alarm
LOAD TAKEOVER	Load Takeover	Status
LOGIC OUPUT A	Logic Output	Alarm
LOGIC OUPUT P	Logic Output	Pre-Alarm
LOSS OF VOLT	Voltage Sensing Fail	Status

Event String	Event Description	Event Type
LOSS OF VOLT A	Voltage Sensing Fail	Alarm
LOSS OF VOLT P	Voltage Sensing Fail	Pre-Alarm
LOSS REM COMS P	Loss of Remote Module Communication	Pre-Alarm
LOST ECU COMM A	Loss of ECU Communication	Alarm
LOST ECU COMM P	Loss of ECU Communication	Pre-Alarm
LOW BATT VOLT P	Low Battery Voltage	Pre-Alarm
LOW CHARGE AIR PRESS P	Low Charge Air Pressure	Pre-Alarm
LOW COOL LEVEL A	Low Coolant Level	Alarm
LOW COOL LEVEL P	Low Coolant Level	Pre-Alarm
LOW COOL TMP A	Low Coolant Temperature	Alarm
LOW COOL TMP P	Low Coolant Temperature	Pre-Alarm
LOW COOLANT LEVEL P	Low Coolant Level	Pre-Alarm
LOW FUEL DELIV PRESS P	Low Fuel Delivery Pressure	Pre-Alarm
LOW FUEL LEVEL A	Low Fuel Level	Alarm
LOW FUEL LEVEL P	Low Fuel Level	Pre-Alarm
LOW FUEL RAIL PRESS P	Low Fuel Rail Pressure	Pre-Alarm
LOW OIL PRES A	Low Oil Pressure	Alarm
LOW OIL PRES P	Low Oil Pressure	Pre-Alarm
LOW OIL PRESSURE A	Low Oil Pressure	Alarm
LOW OIL PRESSURE P	Low Oil Pressure	Pre-Alarm
LOW STRG TANK LEVEL P	Low Storage Tank Level	Pre-Alarm
MAINS FAIL TEST	Mains Fail Test	Status
MAINT INTERVAL P	Maintenance Interval	Pre-Alarm
MF TRANSFER	Mains Fail Transfer Complete	Status
MF TRANSFER FAIL	Mains Fail Transfer Fail	Status
MN BKR CL FL P	Mains Breaker Fail to Close	Pre-Alarm
MN BKR OP FL P	Mains Breaker Fail to Open	Pre-Alarm
MPU FAIL P	Magnetic Pickup Fail	Pre-Alarm
MULTIPLE CEM P	Multiple CEM-2020’s	Pre-Alarm
NORM SHUTDOWN	Normal Shutdown	Status
OIL SNDR FAIL	Oil Pressure Sender Fail	Status
OIL SNDR FAIL A	Oil Pressure Sender Fail	Alarm
OIL SNDR FAIL P	Oil Pressure Sender Fail	Pre-Alarm
OVERCRANK A	Overcrank	Alarm
OVERSPD TEST ON P	Overspeed Test On	Pre-Alarm
OVERSPEED A	Overspeed	Alarm
PRIMING FAULT P	Priming Fault	Pre-Alarm
PROT SHUTDOWN	Protective Shutdown	Status
REV BUS ROT P	Reverse Bus Rotation	Pre-Alarm
REV GEN ROT P	Reverse Generator Rotation	Pre-Alarm
RUNUP SPD LO P	Run Up Speed Low	Pre-Alarm
SERFLASH RD FAIL	Serial Flash Read Fail	Pre-Alarm
SPD SNDR FAIL	Speed Sender Fail	Status

Event String	Event Description	Event Type
SPD SNDR FAIL A	Speed Sender Fail	Alarm
SPEED DMD FL P	Speed Demand Fail	Pre-Alarm
SPEED TOO LOW P	Engine Speed Too Low	Pre-Alarm
SS OVERRIDE ON P	Shutdown Override	Pre-Alarm
START SPEED LOW P	Start Speed Low	Pre-Alarm
VOLTAGE SENSE FAIL	Voltage Sensing Fail	Status
VOLTAGE SENSE FAIL A	Voltage Sensing Fail	Alarm
VOLTAGE SENSE FAIL P	Voltage Sensing Fail	Pre-Alarm
UNKNOWN SHUTDOWN A	Unknown Shutdown	Alarm
WEAK BATTERY P	Weak Battery	Pre-Alarm

9 • Troubleshooting

If you do not get the results that you expect from the DGC-2020ES, first check the programmable settings for the appropriate function. Use the following troubleshooting procedures when difficulties are encountered in the operation of your genset control system.

Communications

USB Port Does Not Operate Properly

Step 1. Verify that the proper port of your computer is being used. For more information, refer to the *Communication* chapter in the *Configuration* manual.

CAN Communication Does Not Operate Properly

Step 1: Verify that there is a 120-ohm termination resistor on each end of the bus section of the wiring, and that there are not any termination resistors at any node connections that are on stubs from the main bus.

Step 2: Check all CAN wiring for loose connections and verify that the CAN H and CAN L wires have not gotten switched somewhere on the network.

Step 3: Verify that the cable length of the bus section of the wiring does not exceed 40 meters (131 feet), and verify that any stubs from the main bus do not exceed 3 meters (9.8 feet) in length.

Step 4: If the engine is equipped with a Volvo or MTU ECU, verify that the ECU Configuration setting is set to match the actual ECU configuration.

Inputs and Outputs

Programmable Inputs Do Not Operate as Expected

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Confirm that the inputs are programmed properly.

Step 3. Ensure that the input at the DGC-2020ES is actually connected to the BATT– terminal (17).

Programmable Outputs Do Not Operate as Expected

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Confirm that the outputs are programmed properly.

Metering/Display

Incorrect Display of Battery Voltage, Coolant Temperature, Oil Pressure, or Fuel Level

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Confirm that the SENDER COM terminal (2) is connected to the negative battery terminal and the engine-block side of the senders. Current from other devices sharing this connection can cause erroneous readings.

Step 3. If the displayed battery voltage is incorrect, ensure that the proper voltage is present between the BATT+ terminal (18) and the SENDER COM terminal (2).

Step 4. Verify that the correct senders are being used.

Step 5. Use a voltmeter connected between the BATT– terminal (17) and the SENDER COM terminal (2) on the DGC-2020ES to verify that there is no voltage difference at any time. Any voltage differences may manifest themselves as erratic sender readings. Wiring should be corrected so that no differences exist.

Step 6: Check the sender wiring and isolate sender wiring from any of the ac wiring in the system. The sender wiring should be located away from any power ac wiring from the generator and any ignition wiring. Separate conduits should be used for sender wiring and any ac wiring.

Incorrect Display of Generator Voltage

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Ensure that the proper voltage is present at the DGC-2020ES voltage sensing inputs (40, 41, 43, and 45).

Step 3. Verify that the voltage transformer ratio and sensing configuration is correct.

Step 4. Confirm that the voltage sensing transformers are correct and properly installed.

Incorrect Measurement or Display of Generator Current

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Ensure that the proper current is present at the DGC-2020ES current sensing inputs 33, 34, 35, 36, 37, and 38.

Step 3. Verify that the current sensing transformer ratios are correct.

Step 4. Confirm that the current sensing transformers are correct and properly installed.

Incorrect Display of Engine RPM

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Verify that the flywheel teeth setting is correct.

Step 3. Verify that the prime mover governor is operating properly.

Step 4. Verify that the measured frequency of the voltage at the MPU input (31 and 32) is correct.

Step 5. If the MPU is shared with the governor, verify that the polarity of the MPU input to the governor matches the polarity of the MPU input to the DGC-2020ES.

DGC-2020ES Indicates Incorrect Power Factor

Check the rotation of the machine and the labeling of the A-B-C terminals. The machine must be rotating in the same phase sequence as dictated by the generator phase rotation setting for correct power factor metering. A power factor indication of 0.5 with resistive load present is a symptom of incorrect phase rotation.

LCD is Blank and all LEDs are Flashing at Approximately Two-Second Intervals

This indicates that the DGC-2020ES does not detect that valid application firmware is installed. The unit is running its boot loader program, waiting to accept a firmware upload.

Step 1. Start BESTCOMS*Plus*®. Use the top pull-down menu and select FILE > NEW > DGC-2020ES.

Step 2. Select COMMUNICATIONS > UPLOAD DEVICE FILES and select the device package file that contains the firmware and language you want to upload.

Step 3. Check the boxes for DGC-2020ES Firmware and DGC-2020ES Language Module. Click the UPLOAD button to start the upload process.

Ground Faults Detected in Ungrounded System Applications

Step 1: Verify that there is no connection from the neutral connection of the generator to the system ground.

Step 2: Perform insulation resistance tests on the system wiring to check for insulation integrity in the overall system.

Step 3: If ground faults are detected on a DGC-2020ES in an ungrounded system application, it is recommended that potential transformers be employed on the voltage sensing inputs to provide full isolation between the DGC-2020ES and monitored voltage phases.

Step 4: If potential transformers are in place, remove the connectors from the DGC-2020ES one at a time. If removal of a connector removes the ground fault, check the system wiring to that connector and out into the system to verify that connections are secure and all wiring insulation is in good condition.

Generator Breaker and Mains Breaker

Generator Breaker Will Not Close to a Dead Bus

Step 1: Review the description of how the generator breaker logic element functions contained in the GENBRK logic element description in the BESTlogic™*Plus* chapter in the *Configuration* manual.

Step 2: Review the section on breaker close requests in the *Breaker Management* chapter in the *Configuration* manual.

Step 3: Navigate to the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE > GEN BREAKER screen and set DEAD BUS CL ENBL to ENABLE.

Step 4: Verify that the Generator status is stable. The breaker will not close if the generator status is not stable. Check status by using the Metering Explorer in BESTCOMS*Plus* and verify that when the generator is running, the GEN STABLE status LED is lit. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen.

Step 5: Verify the bus status is DEAD. Check status by using the Metering Explorer in BESTCOMS*Plus* and verify that when the generator is running, the BUS DEAD status LED is lit. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen.

Step 6: Verify the connections in BESTlogic*Plus* Programmable Logic to the generator breaker logic element. The *Status* input must be driven by an "A" or normally open contact from the generator breaker. The OPEN and CLOSE command inputs on the left side of the logic block are inputs for open and close commands. These can be wired to physical inputs if it is desired to have open and close command switches. If they are wired, they must either be pulsed inputs, or some logic must be employed so that the open and close command inputs are never driven at the same time. If these are both driven at the same time, the breaker is receiving open and close commands simultaneously. The breaker will not change state if it is being commanded to open and close at the same time.

Step 7: Verify the breaker is receiving a close command. Breaker close command sources are:

- The DGC-2020ES itself when the automatic mains fail transfer (ATS) feature is enabled.
- The DGC-2020ES itself when the RUN WITH LOAD logic element receives a *Start* pulse in the programmable logic.
- The DGC-2020ES itself when started from the Exercise Timer and the Run with Load box is checked in the Generator Exerciser settings.
- Manual Breaker Close Input Contacts applied to the Open and Close inputs on the left side of the Generator Breaker logic element in the programmable logic.

Step 8: Verify the wiring to the breaker from the DGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker open output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

Generator Breaker Does Not Open When It Should

Step 1: Review the description of how the generator breaker logic element functions contained in the GENBRK logic element description in the *BESTlogicPlus* chapter in the *Configuration* manual.

Step 2: Review the section on breaker operation requests in the *Breaker Management* chapter in the *Configuration* manual.

Step 3: Verify the connections in BESTlogic*Plus* Programmable Logic to the generator breaker logic element. The *Status* input must be driven by an “A” or normally open contact from the generator breaker. The OPEN and CLOSE command inputs on the left side of the logic block are inputs for open and close commands. These can be wired to physical inputs if it is desired to have open and close command switches. If they are wired, they must either be pulsed inputs, or some logic must be employed so that the open and close command inputs are never driven at the same time. If these are both driven at the same time, the breaker is receiving open and close commands simultaneously. The breaker will not change state if it is being commanded to open and close at the same time.

Step 4: Verify the breaker is receiving an open command. Breaker open command sources are:

- The DGC-2020ES itself when the automatic transfer (ATS) feature is enabled.
- The DGC-2020ES itself when the RUN WITH LOAD logic element receives a *Stop* pulse in the programmable logic.
- The DGC-2020ES itself when shutting down the engine due to an active alarm.
- The DGC-2020ES itself when ending a run session from the Exercise Timer and the *Run with Load* box is checked in the Generator Exerciser settings.
- Manual Breaker Open Input Contacts applied to the Open and Close inputs on the left side of the Generator Breaker logic element in the programmable logic.

Step 5: Verify the wiring to the breaker from the DGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker open output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

Mains Breaker Does Not Open When Mains Fails

Step 1: Verify that a Mains Breaker has been configured by examining the settings on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 2: Verify the mains breaker has been correctly included in the programmable logic.

Step 3: Verify that the MAINS FAIL TRANSFER parameter is set to ENABLE on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 4: Verify that a failure of the mains is detected by the DGC-2020ES. Check status using the Metering Explorer in BESTCOMS*Plus* and verify that the MAINS FAIL status LED is lit when

the power on the DGC-2020ES bus voltage input is either out of voltage or frequency range. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen to achieve correct detection.

Step 5: Verify the wiring to the breaker from the DGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker close output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

Mains Breaker Does Not Close After Mains Returns

Step 1: Verify that a Mains Breaker has been configured by examining the settings on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 2: Verify the mains breaker has been correctly included in the programmable logic.

Step 3: Verify that the MAINS FAIL TRANSFER parameter is set to ENABLE on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 4: Verify that stable mains power is detected by the DGC-2020ES. Check status using the Metering Explorer in BESTCOMS*Plus* and verify that the MAINS STABLE status LED is lit when the power on the DGC-2020ES bus voltage input is good. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen to achieve correct detection.

Step 5: Verify the wiring to the breaker from the DGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker open output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

DGC-2020ES Front Panel Debug Screen

There is one debug screen in the DGC-2020ES that can be useful for debugging I/O module related issues. The following debug screen is available: CEM DEBUG

CEM DEBUG

This screen shows the binary data that is being sent between the CEM-2020 (Contact Expansion Module) and the DGC-2020ES.

The CEM DEBUG screen is located on the front panel at SETTINGS > SYSTEM PARAMS > REMOTE MODULE SETUP > CEM SETUP > CEM DEBUG MENU.

The following parameters are visible on the CEM DEBUG screen:

- DGC TO CEM BP: DGC-2020ES to CEM-2020 Binary Points. This is the status of the CEM-2020 output relays being transmitted from the DGC-2020ES to the CEM-2020. This is a 32-bit, bit packed number representing the desired states of the CEM-2020 outputs. The left most bit is the first output, etc.
- CEM TO DGC BP: CEM-2020 to DGC-2020ES Binary Points. This is the status of the CEM-2020 inputs being transmitted from the CEM-2020 to the DGC-2020ES. This is a 32-bit, bit packed number representing the metered states of the CEM-2020 inputs. The left most bit is the first input, etc.

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DGC-2020ES

Digital Genset Controller

Accessories Instruction Manual

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Preface

This instruction manual provides information about the accessories for the DGC-2020ES Digital Genset Controller. To accomplish this, the following information is provided:

- CEM-2020 (Contact Expansion Module)

Conventions Used in this Manual

Important safety and procedural information is emphasized and presented in this manual through Warning, Caution, and Note boxes. Each type is illustrated and defined as follows.

Warning!
Warning boxes call attention to conditions or actions that may cause personal injury or death.

Caution
Caution boxes call attention to operating conditions that may lead to equipment or property damage.

Note
Note boxes emphasize important information pertaining to Digital Genset Controller installation or operation.

DGC-2020ES Instruction Manual Catalog

Available instruction manuals for the DGC-2020ES are listed in Table 1.

Table 1. Instruction Manuals

Part Number	Description
9469200993	Quick Start
9469200994	Installation
9469200995	Configuration
9469200996	Operation
9469200997	Accessories (this manual)

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Warning!

READ THIS MANUAL. Read this manual before installing, operating, or maintaining the DGC-2020ES. Note all warnings, cautions, and notes in this manual as well as on the product. Keep this manual with the product for reference. Only qualified personnel should install, operate, or service this system. Failure to follow warning and cautionary labels may result in personal injury or property damage. Exercise caution at all times.

Caution

Installing previous versions of firmware may result in compatibility issues causing the inability to operate properly and may not have the enhancements and resolutions to issues that more recent versions provide. Basler Electric highly recommends using the latest version of firmware at all times. Using previous versions of firmware is at the user's risk and may void the warranty of the unit.

It is not the intention of this manual to cover all details and variations in equipment, nor does this manual provide data for every possible contingency regarding installation or operation. The availability and design of all features and options are subject to modification without notice. Over time, improvements and revisions may be made to this publication. Before performing any of the following procedures, contact Basler Electric for the latest revision of this manual.

The English-language version of this manual serves as the only approved manual version.

Revision History

A historical summary of the changes made to this instruction manual is provided below. Revisions are listed in reverse chronological order.

Visit www.basler.com to download the latest hardware, firmware, and BESTCOMS*Plus*® revision histories.

Instruction Manual Revision History

Manual Revision and Date	Change
C, Jul-21	• Removed CEM-2020 UL Recognition for use in Hazardous Locations • Minor text edits
B, Nov-19	• Removed Rev Letter from all pages. • Changed sequential numbering to sectional numbering. • Moved Instruction Manual Revision History into *Preface*. • Removed standalone Revision History chapter.
A1, Apr-19	• Updated Proposition 65 statement
A, Sep-18	• Updated output contacts ratings and added hazardous location specs in the *CEM-2020* chapter • Updated *Revision History* chapter
—, Apr-17	• Initial release

Contents

1 • CEM-2020

General Information

The optional CEM-2020 is a remote auxiliary device that provides additional DGC-2020ES contact inputs and outputs. Two types of modules are available. A low current module (CEM-2020) provides 24 contact outputs and high current module (CEM-2020H) provides 18 contact outputs.

Features

CEM-2020s have the following features:

- 10 Contact Inputs
- 18 Contact Outputs (CEM-2020H) or 24 Contact Outputs (CEM-2020)
- Functionality of Inputs and Outputs assigned by BESTlogic™*Plus* Programmable Logic
- Communications via CAN

Specifications

Operating Power

Nominal .... 12 or 24 Vdc
Range .... 8 to 32 Vdc (Withstands cranking ride-through down to 6 Vdc for 500 ms)

Maximum Power Dissipation

CEM-2020 .... 14 W
CEM-2020H .... 8 W

Contact Inputs

The CEM-2020 contains 10 programmable inputs that accept dry contacts.

Time from a CEM-2020 input application to:

- Shut down the generator via an alarm = 700 ms max
- Close a relay on board the DGC-2020ES = 300 ms max
- Close a relay on board the CEM-2020 = 550 ms max

Notes

A CEM-2020 contact input is true (on) if the input is connected to battery ground with a resistance of less than 200 ohms.

The maximum length of wire that can be accommodated depends on the resistance of the wire, and the resistance of the contacts of the device driving the input at the far end of the wire.

The maximum wire length can be calculated as follows:

$L_{max} = (200 - R_{device})/(\text{Resistance per Foot of Desired Wire})$

Contact Outputs

Ratings

CEM-2020

Outputs 5 through 16 .... 1 Adc at 30 Vdc, Form C *
Outputs 17 through 28 .... 4 Adc at 30 Vdc, Form C – 1.2 A Pilot Duty †

CEM-2020H
Outputs 5 through 16 ....2 Adc at 30 Vdc, Form C *
Outputs 17 through 22 ....10 Adc at 30 Vdc, Form C – 1.2 A Pilot Duty †

* Gold contacts intended for low voltage signaling to dry circuits. Not rated for inductive loads or pilot duty.

† For pilot duty, the load must be in parallel with a diode rated at least 3 x the coil current and 3 x the coil voltage.

Communications Interface

CAN
Differential Bus Voltage...........................1.5 to 3 Vdc
Maximum Voltage ....–32 to +32 Vdc with respect to negative battery terminal
Communication Rate...............................250 kb/s

Type Tests

Shock

Withstands 15 G in three perpendicular planes.

Vibration

Swept over the following ranges for12 sweeps in each of three mutually perpendicular planes with each 15-minute sweep consisting of the following:
5 to 29 to 5 Hz...1.5 G peak for 5 min.
29 to 52 to 29 Hz....................................0.036 in (0.914 mm) Double Amplitude for 2.5 min.
52 to 500 to 52 Hz..................................5 G peak for 7.5 min.

Ignition System

Tested in close proximity to an unshielded, unsuppressed Altronic DISN 800 ignition system.

HALT (Highly Accelerated Lift Testing)

HALT is used by Basler Electric to prove that our products will provide the user with many years of reliable service. HALT subjects the device to extremes in temperature, shock, and vibration to simulate years of operation, but in a much shorter period span. HALT allows Basler Electric to evaluate all possible design elements that will add to the life of this device. As an example of some of the extreme testing conditions, the CEM-2020 was subjected to temperature tests (tested over a temperature range of –80°C to +130°C), vibration tests (of 5 to 50 G at +25°C), and temperature/vibration tests (tested at 10 to 20 G over a temperature range of –60°C to +100°C). Combined temperature and vibration testing at these extremes proves that the CEM-2020 is expected to provide long-term operation in a rugged environment. Note that the vibration and temperature extremes listed in this paragraph are specific to HALT and do not reflect recommended operation levels. These operational ratings are included in this section.

Environment

Humidity ....Complies with IEC 68-2-38

Temperature
Operating...–40 to +158°F (–40 to +70°C)
Storage ....–40 to +185°F (–40 to +85°C)

UL Approval (CEM-2020 Only)

The CEM-2020 and CEM-2020H are Recognized Components applicable to the Canadian and US safety standards and requirements by UL. The product is covered under UL File (E97035 FTPM2/FTPM8) and evaluated to the following standards through UL:

- UL6200
- CSA C22.2 No. 14

CSA Certification

The CEM-2020 and CEM-2020H are Certificated under CSA report 1042505 (LR23131-138S) and evaluated to the following standards through CSA:

- CSA C22.2 No. 0
- CSA C22.2 No. 14

CE Compliance

This product has been evaluated and complies with the relevant essential requirements set forth in the following EC Directives and by the EU legislation:

- Low Voltage Devices (LVD) - 2014/35/EU
- Electromagnetic Compatibility (EMC) - 2014/30/EU
- Hazardous Substances (ROHS2) -2011/65/EU

Harmonized Standards used for evaluation:

- EN 50178 - *Electronic Equipment for use in Power Installations*
- EN 61000-6-4 - *Electromagnetic Compatibility (EMC), Generic Standards, Emission Standard for Industrial Environments*
- EN 61000-6-2 - *Electromagnetic Compatibility (EMC), Generic Standards, Immunity for Industrial Environments*
- EN 50581 – *Technical Documentation for the Assessment of Electrical and Electric Products with Respect to the Restriction of Hazardous Substances (ROHS2)*

NFPA Compliance

Designed to comply with NFPA Standard 110, *Standard for Emergency and Standby Power*.

EAC Mark (Eurasian Conformity)

- TC RUUS.HO03.B.00742

Physical

Dimensions..See *Installation* later in this chapter.

Weight

CEM-2020 ....2.25 lb (1.02 kg)
CEM-2020H ....1.90 lb (0.86 kg)

Functional Description

Contact Inputs

The CEM-2020 provides 10 programmable contact inputs with the same functionality as the contact inputs on the DGC-2020ES. The label text of each contact input is customizable.

Contact Outputs

CEM-2020

The CEM-2020 provides 24 programmable contact outputs with the same functionality as the contact outputs on the DGC-2020ES. Outputs 5 through 16 can carry 1 A. Outputs 17 through 28 can carry 4 A. The label text of each contact output is customizable.

CEM-2020H

The CEM-2020H provides 18 programmable contact outputs with the same functionality as the contact outputs on the DGC-2020ES. Outputs 5 through 16 can carry 2 A. Outputs 17 through 22 can carry 10 A. The label text of each contact output is customizable.

Communications

CAN

A Control Area Network (CAN) is a standard interface that enables communication between the CEM-2020 and the DGC-2020ES.

BESTCOMSPlus® Software

BESTCOMS*Plus* provides the user with a point-and-click means to set and monitor the Contact Expansion Module. Installation and operation of BESTCOMS*Plus* is described in the BESTCOMS*Plus* chapter.

Installation

Contact Expansion Modules are delivered in sturdy cartons to prevent shipping damage. Upon receipt of a module, check the part number against the requisition and packing list for agreement. Inspect for damage, and if there is evidence of such, immediately file a claim with the carrier and notify the Basler Electric regional sales office or your sales representative.

If the device is not installed immediately, store it in the original shipping package in a moisture- and dust-free environment.

Mounting

Contact Expansion Modules are contained in a potted plastic case and may be mounted in any convenient position. The construction of a Contact Expansion Module is durable enough to mount directly on a genset using ¼-inch hardware. Hardware selection should be based on any expected shipping/transportation and operating conditions. The torque applied to the mounting hardware should not exceed 65 in-lb (7.34 N•m).

See Figure 1-1 for CEM-2020 overall dimensions. All dimensions are shown in inches with millimeters in brackets.

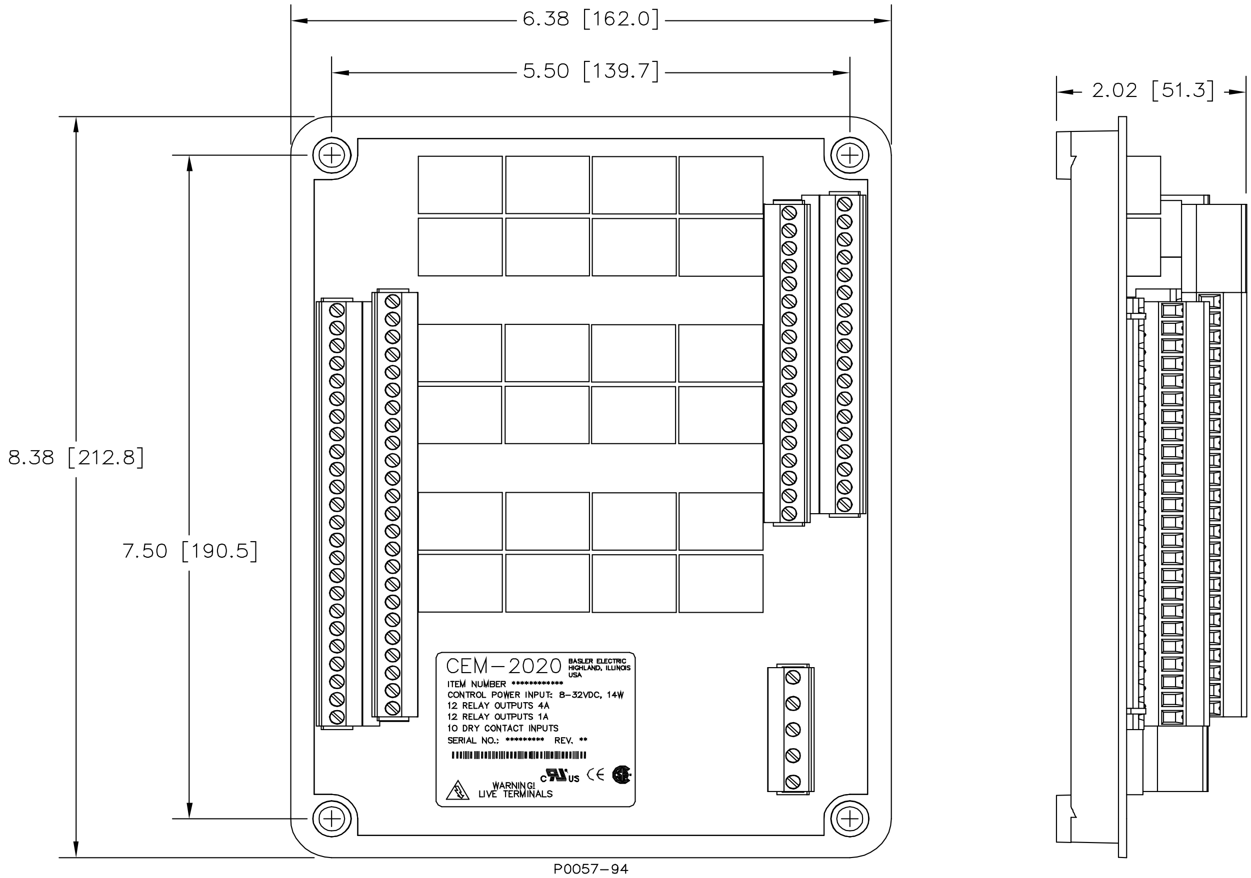

Figure 1-1. CEM-2020 Overall Dimensions

See Figure 1-2 for CEM-2020H overall dimensions. All dimensions are shown in inches with millimeters in brackets.

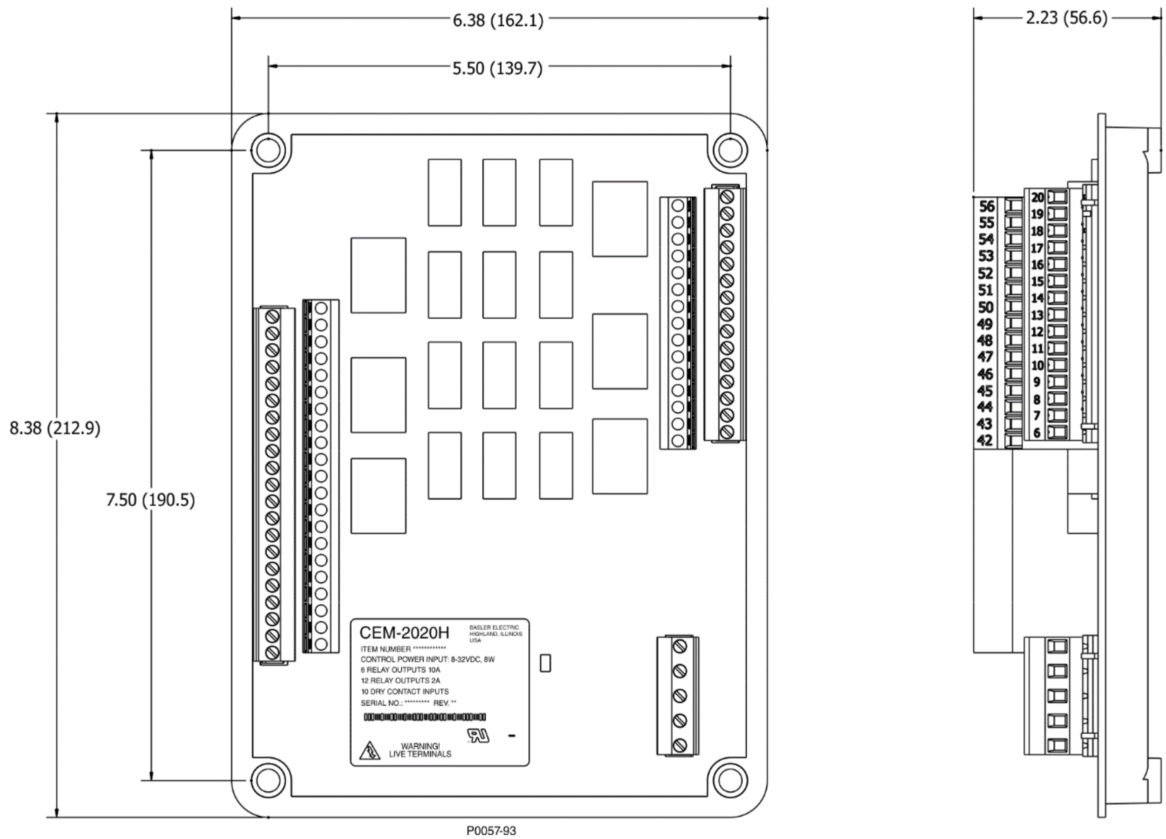

Figure 1-2. CEM-2020H Overall Dimensions

Connections

Contact Expansion Module connections are dependent on the application. Incorrect wiring may result in damage to the module.

Note
Operating power from the battery must be of the correct polarity. Although reverse polarity will not cause damage, the CEM-2020 will not operate. Be sure that the CEM-2020 is hard-wired to earth ground with no smaller than 12 AWG copper wire attached to the chassis ground terminal on the module.

Terminations

The terminal interface consists of plug-in connectors with screw-down compression terminals.

CEM-2020 connections are made with one 5-position connector, two 18-position connectors, and two 24-position connectors with screw-down compression terminals. These connectors plug into headers on the CEM-2020. The connectors and headers have dovetailed edges that ensure proper connector orientation. The connectors and headers are uniquely keyed to ensure that the connectors mate only with the correct headers. Connector screw terminals accept a maximum wire size of 12 AWG (3.31 mm^2). Maximum screw torque is 5 inch-pounds (0.56 N•m).

Operating Power

The Contact Expansion Module operating power input accepts either 12 Vdc or 24 Vdc and tolerates voltage over the range of 6 to 32 Vdc. Operating power must be of the correct polarity. Although reverse polarity will not cause damage, the CEM-2020 will not operate. Operating power terminals are listed in Table 1-1.

It is recommended that a fuse be added for additional protection for the wiring to the battery input of the Contact Expansion Module. A Bussmann ABC-7 fuse or equivalent is recommended.

Table 1-1. Operating Power Terminals

Terminal	Description
P1- ⏚ (SHIELD)	Chassis ground connection
P1- – (BATT–)	Negative side of operating power input
P1 + (BATT+)	Positive side of operating power input

Contact Inputs and Contact Outputs

The CEM-2020 (Figure 1-3) has 10 contact inputs and 24 contact outputs. The CEM-2020H (Figure 1-4) has 10 contact inputs and 18 contact outputs.

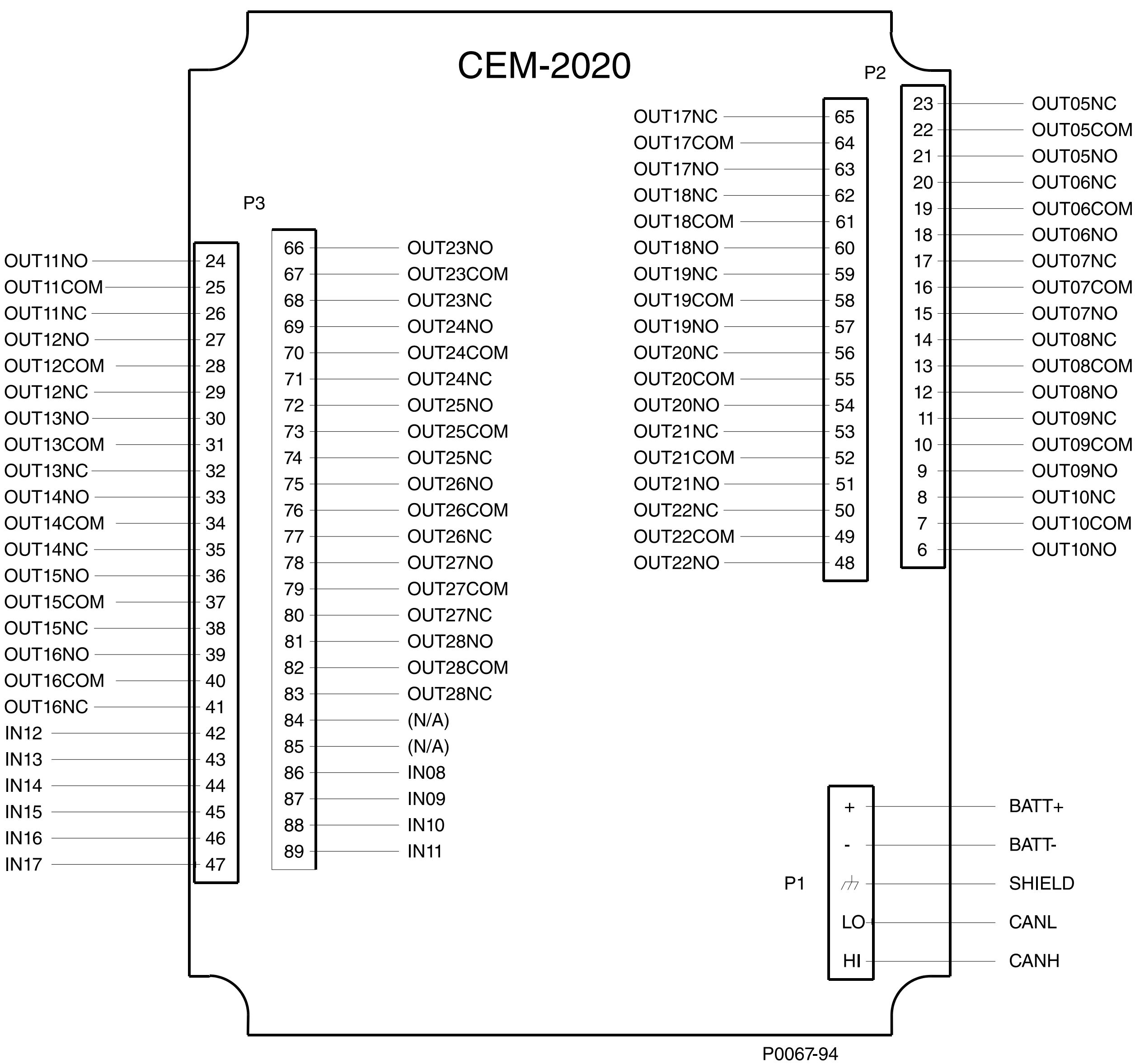

Figure 1-3. CEM-2020 Contact Input and Contact Output Terminals

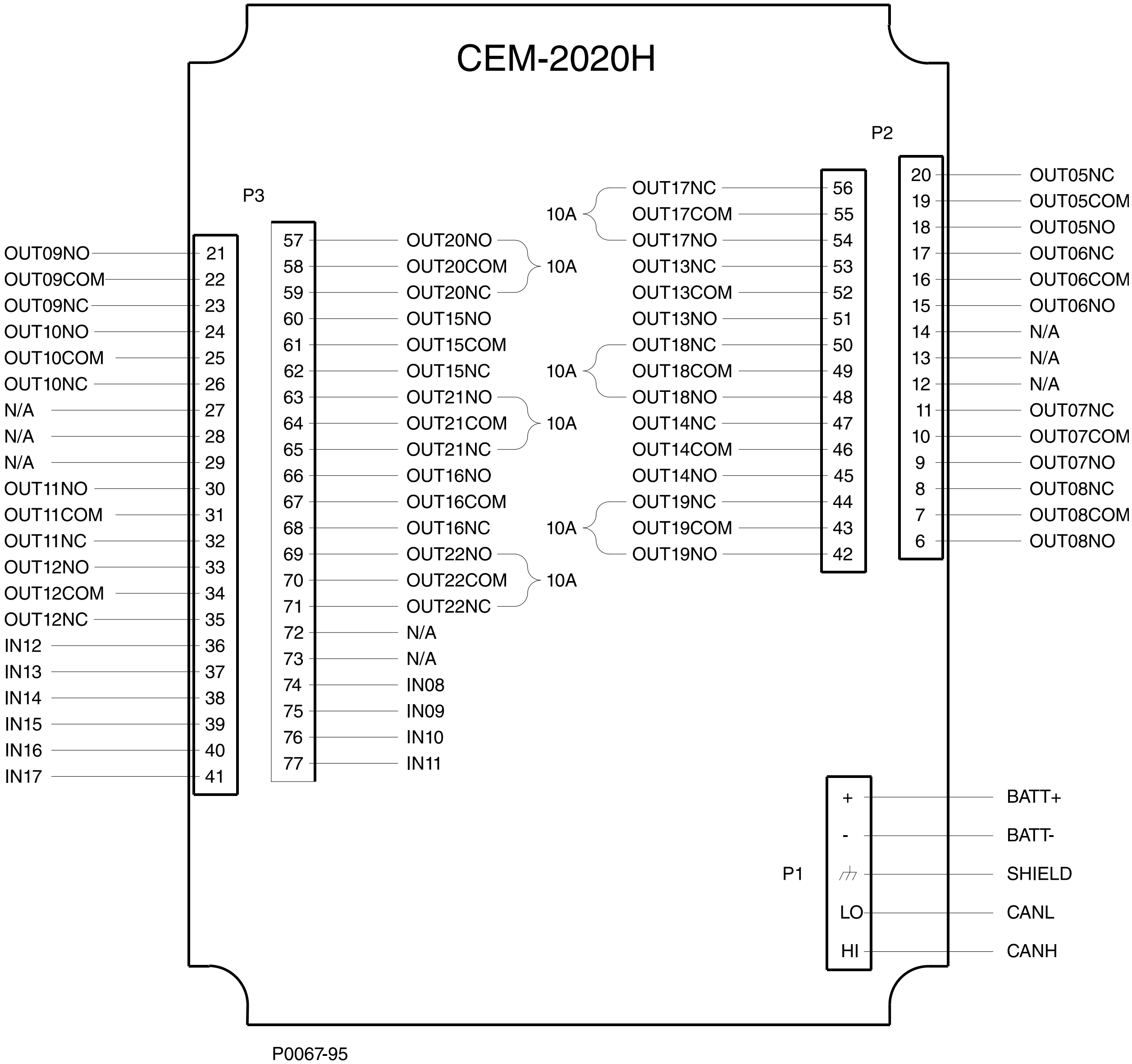

Figure 1-4. CEM-2020H Contact Input and Contact Output Terminals

CAN Interface

These terminals provide communication using the SAE J1939 protocol and provide high-speed communication between the Contact Expansion Module and the DGC-2020ES. Connections between the CEM-2020 and DGC-2020ES should be made with twisted-pair, shielded cable. CAN interface terminals are listed in Table 1-2. Refer to Figure 1-5 and Figure 1-6.

Table 1-2. CAN Interface Terminals

Terminal	Description
P1- HI (CAN H)	CAN high connection (yellow wire)
P1- LO (CAN L)	CAN low connection (green wire)
P1- ⏚ (SHIELD)	CAN drain connection

Notes

1. If the CEM-2020 is providing one end of the J1939 bus, a 120 ohm, ½ watt terminating resistor should be installed across terminals P1- LO (CANL) and P1- HI (CANH).
2. If the CEM-2020 is not part of the J1939 bus, the stub connecting the CEM-2020 to the bus should not exceed 914 mm (3 ft) in length.
3. The maximum bus length, not including stubs, is 40 m (131 ft).
4. The J1939 drain (shield) should be grounded at one point only. If grounded elsewhere, do not connect the drain to the CEM-2020.

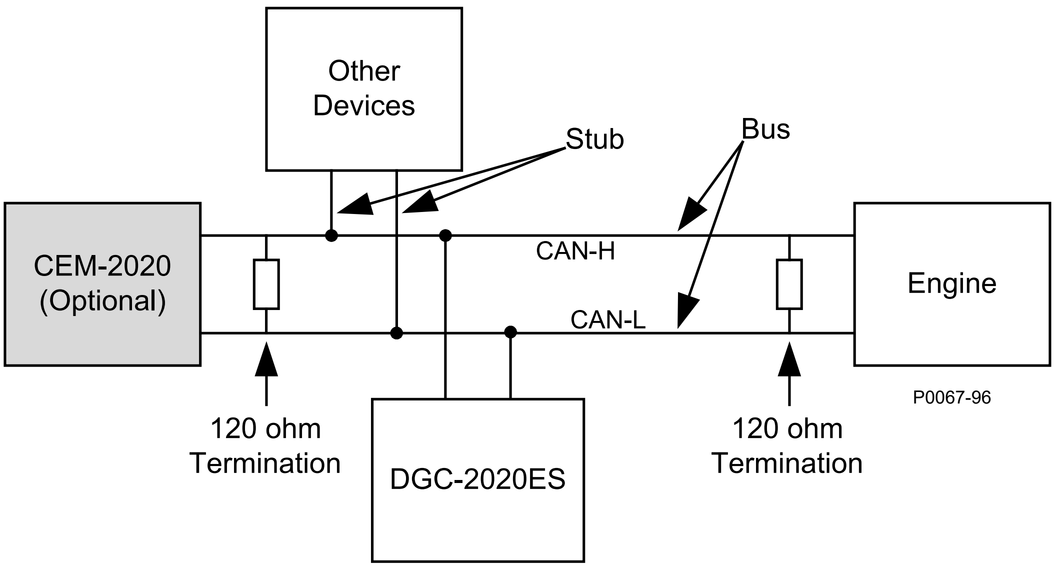

Figure 1-5. CAN Interface with CEM-2020 providing One End of the Bus

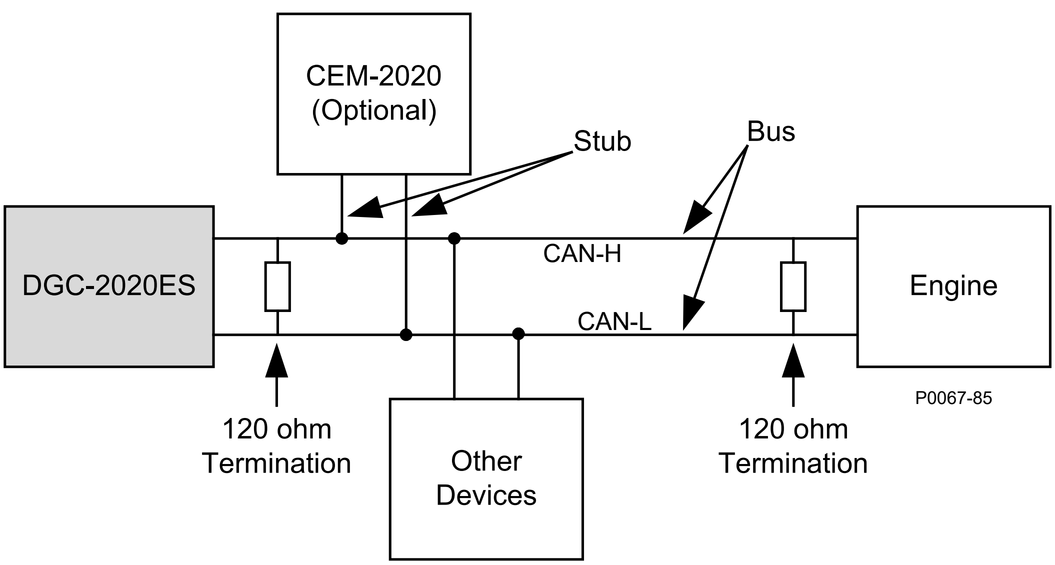

Figure 1-6. CAN Interface with DGC-2020ES providing One End of the Bus

Remote Contact Input Configuration

The CEM-2020 provides 10 contact inputs. Each of the 10 contact inputs can be independently configured to annunciate an alarm or pre-alarm when the input senses a contact closure. A user-adjustable time delay can be set to delay recognition of a contact input. By default, all inputs are configured so that they do not trigger an alarm or pre-alarm.

To make identifying the contact inputs easier, a user-assigned name can be given to each input.

Contacts can be recognized always or only while the engine is running.

The remote contact inputs are incorporated into a BESTlogic*Plus* programmable logic scheme by selecting them from the *I/O* group in BESTlogic*Plus*. For more details, refer to the BESTlogic*Plus* chapter in the *Configuration* manual.

Remote contact input status is available in BESTlogic*Plus* Programmable Logic when “None” is selected for Alarm Configuration.

The *Remote Contact Input*s screen is found in the BESTCOMS*Plus Settings Explorer* under the *Programmable Inputs* category. If using the front panel, navigate to Settings > Programmable Inputs > Configurable Inputs. The BESTCOMS*Plus* Remote Contact Inputs screen is illustrated in Figure 1-7.

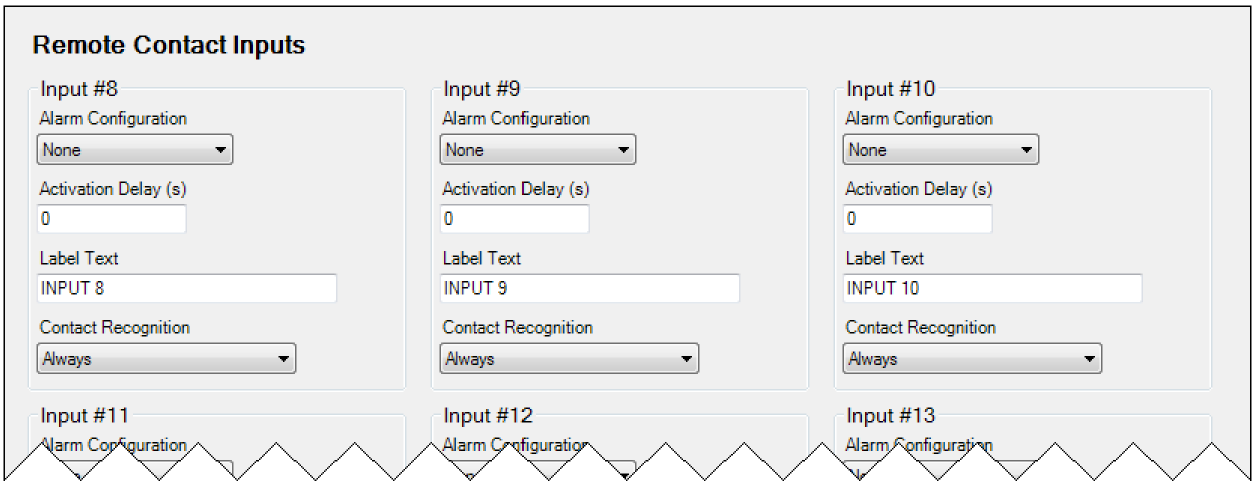

Figure 1-7. Settings Explorer, Programmable Inputs, Remote Contact Inputs Screen

Remote Contact Output Configuration

To make identifying the contact outputs easier, each of the contact outputs can be given a user-assigned name.

The contact outputs are incorporated into a BESTlogic*Plus* programmable logic scheme by selecting them from the *I/O* group in BESTlogic*Plus*. For more details, refer to the BESTlogic*Plus* chapter in the *Configuration* manual.

The *Remote Contact Output*s screen is found in the BESTCOMS*Plus Settings Explorer* under the *Programmable Inputs* category. If using the front panel, navigate to Settings > Programmable Outputs > Configurable Outputs. The BESTCOMS*Plus* Contact Outputs screen is illustrated in Figure 1-8.

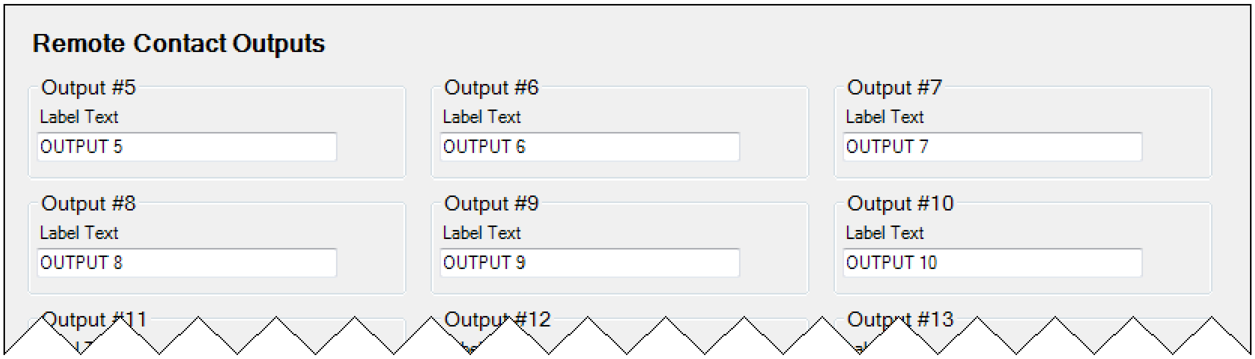

Figure 1-8. Settings Explorer, Programmable Outputs, Remote Contact Outputs Screen

Firmware Updates

Refer to the *Device Information* chapter in the *Configuration* manual for information on upgrading firmware in the CEM-2020.

Repair

Contact Expansion Modules are manufactured using state-of-the-art surface-mount technology. As such, Basler Electric recommends that no repair procedures be attempted by anyone other than Basler Electric personnel.

Before returning the CEM-2020 for repair, contact Basler Electric Technical Services Department at 618-654-2341 for a return authorization number.

Maintenance

Preventive maintenance consists of periodically checking that the connections between the CEM-2020 and the system are clean and tight.

Storage

This device contains long-life aluminum electrolytic capacitors. For devices that are not in service (spares in storage), the life of these capacitors can be maximized by energizing the device for 30 minutes once per year.

2 • Troubleshooting

If you do not get the results that you expect from the DGC-2020ES, first check the programmable settings for the appropriate function. Use the following troubleshooting procedures when difficulties are encountered in the operation of your genset control system.

Communications

USB Port Does Not Operate Properly

Step 1. Verify that the proper port of your computer is being used. For more information, refer to the *Communication* chapter in the *Configuration* manual.

CAN Communication Does Not Operate Properly

Step 1: Verify that there is a 120-ohm termination resistor on each end of the bus section of the wiring, and that there are not any termination resistors at any node connections that are on stubs from the main bus.

Step 2: Check all CAN wiring for loose connections and verify that the CAN H and CAN L wires have not gotten switched somewhere on the network.

Step 3: Verify that the cable length of the bus section of the wiring does not exceed 40 meters (131 feet), and verify that any stubs from the main bus do not exceed 3 meters (9.8 feet) in length.

Step 4: If the engine is equipped with a Volvo or mtu ECU, verify that the ECU Configuration setting is set to match the actual ECU configuration.

Inputs and Outputs

Programmable Inputs Do Not Operate as Expected

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Confirm that the inputs are programmed properly.

Step 3. Ensure that the input at the DGC-2020ES is actually connected to the BATT– terminal (17).

Programmable Outputs Do Not Operate as Expected

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Confirm that the outputs are programmed properly.

Metering/Display

Incorrect Display of Battery Voltage, Coolant Temperature, Oil Pressure, or Fuel Level

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Confirm that the SENDER COM terminal (2) is connected to the negative battery terminal and the engine-block side of the senders. Current from other devices sharing this connection can cause erroneous readings.

Step 3. If the displayed battery voltage is incorrect, ensure that the proper voltage is present between the BATT+ terminal (18) and the SENDER COM terminal (2).

Step 4. Verify that the correct senders are being used.

Step 5. Use a voltmeter connected between the BATT– terminal (17) and the SENDER COM terminal (2) on the DGC-2020ES to verify that there is no voltage difference at any time. Any voltage differences may manifest themselves as erratic sender readings. Wiring should be corrected so that no differences exist.

Step 6: Check the sender wiring and isolate sender wiring from any of the ac wiring in the system. The sender wiring should be located away from any power ac wiring from the generator and any ignition wiring. Separate conduits should be used for sender wiring and any ac wiring.

Incorrect Display of Generator Voltage

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Ensure that the proper voltage is present at the DGC-2020ES voltage sensing inputs (40, 41, 43, and 45).

Step 3. Verify that the voltage transformer ratio and sensing configuration is correct.

Step 4. Confirm that the voltage sensing transformers are correct and properly installed.

Incorrect Measurement or Display of Generator Current

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Ensure that the proper current is present at the DGC-2020ES current sensing inputs 33, 34, 35, 36, 37, and 38.

Step 3. Verify that the current sensing transformer ratios are correct.

Step 4. Confirm that the current sensing transformers are correct and properly installed.

Incorrect Display of Engine RPM

Step 1. Verify that all wiring is properly connected. Refer to the *Typical Connections* chapter in the *Installation* manual.

Step 2. Verify that the flywheel teeth setting is correct.

Step 3. Verify that the prime mover governor is operating properly.

Step 4. Verify that the measured frequency of the voltage at the MPU input (31 and 32) is correct.

Step 5. If the MPU is shared with the governor, verify that the polarity of the MPU input to the governor matches the polarity of the MPU input to the DGC-2020ES.

DGC-2020ES Indicates Incorrect Power Factor

Check the rotation of the machine and the labeling of the A-B-C terminals. The machine must be rotating in the same phase sequence as dictated by the generator phase rotation setting for correct power factor metering. A power factor indication of 0.5 with resistive load present is a symptom of incorrect phase rotation.

LCD is Blank and all LEDs are Flashing at Approximately Two-Second Intervals

This indicates that the DGC-2020ES does not detect that valid application firmware is installed. The unit is running its boot loader program, waiting to accept a firmware upload.

Step 1. Start BESTCOMS*Plus*®. Use the top pull-down menu and select FILE > NEW > DGC-2020ES.

Step 2. Select COMMUNICATIONS > UPLOAD DEVICE FILES and select the device package file that contains the firmware and language you want to upload.

Step 3. Check the boxes for DGC-2020ES Firmware and DGC-2020ES Language Module. Click the UPLOAD button to start the upload process.

Ground Faults Detected in Ungrounded System Applications

Step 1: Verify that there is no connection from the neutral connection of the generator to the system ground.

Step 2: Perform insulation resistance tests on the system wiring to check for insulation integrity in the overall system.

Step 3: If ground faults are detected on a DGC-2020ES in an ungrounded system application, it is recommended that potential transformers be employed on the voltage sensing inputs to provide full isolation between the DGC-2020ES and monitored voltage phases.

Step 4: If potential transformers are in place, remove the connectors from the DGC-2020ES one at a time. If removal of a connector removes the ground fault, check the system wiring to that connector and out into the system to verify that connections are secure and all wiring insulation is in good condition.

Generator Breaker and Mains Breaker

Generator Breaker Will Not Close to a Dead Bus

Step 1: Review the description of how the generator breaker logic element functions contained in the GENBRK logic element description in the BESTlogic™*Plus* chapter in the *Configuration* manual.

Step 2: Review the section on breaker close requests in the *Breaker Management* chapter in the *Configuration* manual.

Step 3: Navigate to the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE > GEN BREAKER screen and set DEAD BUS CL ENBL to ENABLE.

Step 4: Verify that the Generator status is stable. The breaker will not close if the generator status is not stable. Check status by using the Metering Explorer in BESTCOMS*Plus* and verify that when the generator is running, the GEN STABLE status LED is lit. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen.

Step 5: Verify the bus status is DEAD. Check status by using the Metering Explorer in BESTCOMS*Plus* and verify that when the generator is running, the BUS DEAD status LED is lit. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen.

Step 6: Verify the connections in BESTlogic*Plus* Programmable Logic to the generator breaker logic element. The *Status* input must be driven by an “A” or normally open contact from the generator breaker. The OPEN and CLOSE command inputs on the left side of the logic block are inputs for open and close commands. These can be wired to physical inputs if it is desired to have open and close command switches. If they are wired, they must either be pulsed inputs, or some logic must be employed so that the open and close command inputs are never driven at the same time. If these are both driven at the same time, the breaker is receiving open and close commands simultaneously. The breaker will not change state if it is being commanded to open and close at the same time.

Step 7: Verify the breaker is receiving a close command. Breaker close command sources are:

- The DGC-2020ES itself when the automatic mains fail transfer (ATS) feature is enabled.
- The DGC-2020ES itself when the RUN WITH LOAD logic element receives a *Start* pulse in the programmable logic.
- The DGC-2020ES itself when started from the Exercise Timer and the Run with Load box is checked in the Generator Exerciser settings.
- Manual Breaker Close Input Contacts applied to the Open and Close inputs on the left side of the Generator Breaker logic element in the programmable logic.

Step 8: Verify the wiring to the breaker from the DGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker open output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

Generator Breaker Does Not Open When It Should

Step 1: Review the description of how the generator breaker logic element functions contained in the GENBRK logic element description in the *BESTlogicPlus* chapter in the *Configuration* manual.

Step 2: Review the section on breaker operation requests in the *Breaker Management* chapter in the *Configuration* manual.

Step 3: Verify the connections in BESTlogic*Plus* Programmable Logic to the generator breaker logic element. The *Status* input must be driven by an "A" or normally open contact from the generator breaker. The OPEN and CLOSE command inputs on the left side of the logic block are inputs for open and close commands. These can be wired to physical inputs if it is desired to have open and close command switches. If they are wired, they must either be pulsed inputs, or some logic must be employed so that the open and close command inputs are never driven at the same time. If these are both driven at the same time, the breaker is receiving open and close commands simultaneously. The breaker will not change state if it is being commanded to open and close at the same time.

Step 4: Verify the breaker is receiving an open command. Breaker open command sources are:

- The DGC-2020ES itself when the automatic transfer (ATS) feature is enabled.
- The DGC-2020ES itself when the RUN WITH LOAD logic element receives a *Stop* pulse in the programmable logic.
- The DGC-2020ES itself when shutting down the engine due to an active alarm.
- The DGC-2020ES itself when ending a run session from the Exercise Timer and the *Run with Load* box is checked in the Generator Exerciser settings.
- Manual Breaker Open Input Contacts applied to the Open and Close inputs on the left side of the Generator Breaker logic element in the programmable logic.

Step 5: Verify the wiring to the breaker from the DGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker open output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

Mains Breaker Does Not Open When Mains Fails

Step 1: Verify that a Mains Breaker has been configured by examining the settings on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 2: Verify the mains breaker has been correctly included in the programmable logic.

Step 3: Verify that the MAINS FAIL TRANSFER parameter is set to ENABLE on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 4: Verify that a failure of the mains is detected by the DGC-2020ES. Check status using the Metering Explorer in BESTCOMS*Plus* and verify that the MAINS FAIL status LED is lit when

the power on the DGC-2020ES bus voltage input is either out of voltage or frequency range. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen to achieve correct detection.

Step 5: Verify the wiring to the breaker from the DGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker close output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

Mains Breaker Does Not Close After Mains Returns

Step 1: Verify that a Mains Breaker has been configured by examining the settings on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 2: Verify the mains breaker has been correctly included in the programmable logic.

Step 3: Verify that the MAINS FAIL TRANSFER parameter is set to ENABLE on the SETTINGS > BREAKER MANAGEMENT > BREAKER HARDWARE screen.

Step 4: Verify that stable mains power is detected by the DGC-2020ES. Check status using the Metering Explorer in BESTCOMS*Plus* and verify that the MAINS STABLE status LED is lit when the power on the DGC-2020ES bus voltage input is good. If necessary, modify the settings on the SETTINGS > BREAKER MANAGEMENT > BUS CONDITION DETECTION screen to achieve correct detection.

Step 5: Verify the wiring to the breaker from the DGC-2020ES. If it seems OK, you can do a manual close and open by modifying the programmable logic. Map some unused outputs to the OPEN and CLOSE outputs from the Gen Breaker Block in the programmable logic. Map a virtual switch to the logic output that would normally be the breaker open output. Map another virtual switch to the logic output that would normally be the breaker close output. Connect with BESTCOMS*Plus*, and exercise the virtual switches using the Control panel located in the Metering Explorer. Never turn open and close on at the same time. This could damage the breaker and/or motor operator. If everything is working as expected, restore the logic to its original diagram.

DGC-2020ES Front Panel Debug Screen

There is one debug screen in the DGC-2020ES that can be useful for debugging I/O module related issues. The following debug screen is available: CEM DEBUG

CEM DEBUG

This screen shows the binary data that is being sent between the CEM-2020 (Contact Expansion Module) and the DGC-2020ES.

The CEM DEBUG screen is located on the front panel at SETTINGS > SYSTEM PARAMS > REMOTE MODULE SETUP > CEM SETUP > CEM DEBUG MENU.

The following parameters are visible on the CEM DEBUG screen:

- DGC TO CEM BP: DGC-2020ES to CEM-2020 Binary Points. This is the status of the CEM-2020 output relays being transmitted from the DGC-2020ES to the CEM-2020. This is a 32-bit, bit packed number representing the desired states of the CEM-2020 outputs. The left most bit is the first output, etc.
- CEM TO DGC BP: CEM-2020 to DGC-2020ES Binary Points. This is the status of the CEM-2020 inputs being transmitted from the CEM-2020 to the DGC-2020ES. This is a 32-bit, bit packed number representing the metered states of the CEM-2020 inputs. The left most bit is the first input, etc.

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