INSTRUCTION MANUAL

FOR

DGC-2020ES

DIGITAL GENSET CONTROLLER

Accessories

Basler Electric®

Publication: 9469200997
Revision: — Apr-17

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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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.

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.

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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.

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The following statement applies only to the fontconfig library:

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Contents

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, gold contacts
Outputs 17 through 28 ..... 4 Adc at 30 Vdc, Form C

CEM-2020H
Outputs 5 through 16 .....2 Adc at 30 Vdc, Form C, gold contacts
Outputs 17 through 22 .....10 Adc at 30 Vdc, Form C

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.00210

- TP TC 004/2011
- TP TC 020/2011

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 for CEM-2020 overall dimensions. All dimensions are shown in inches with millimeters in brackets.

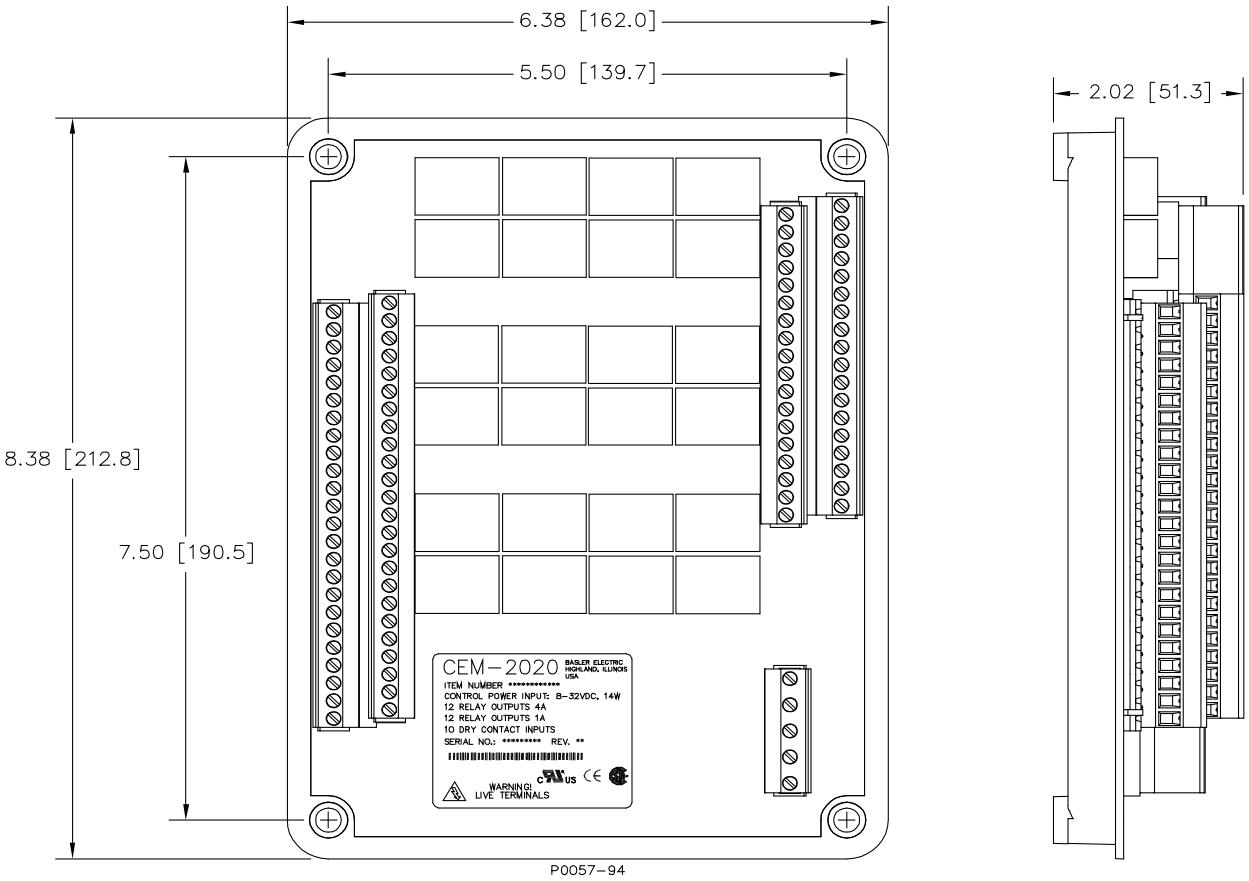

Figure 1. CEM-2020 Overall Dimensions

See Figure 2 for CEM-2020H overall dimensions. All dimensions are shown in inches with millimeters in brackets.

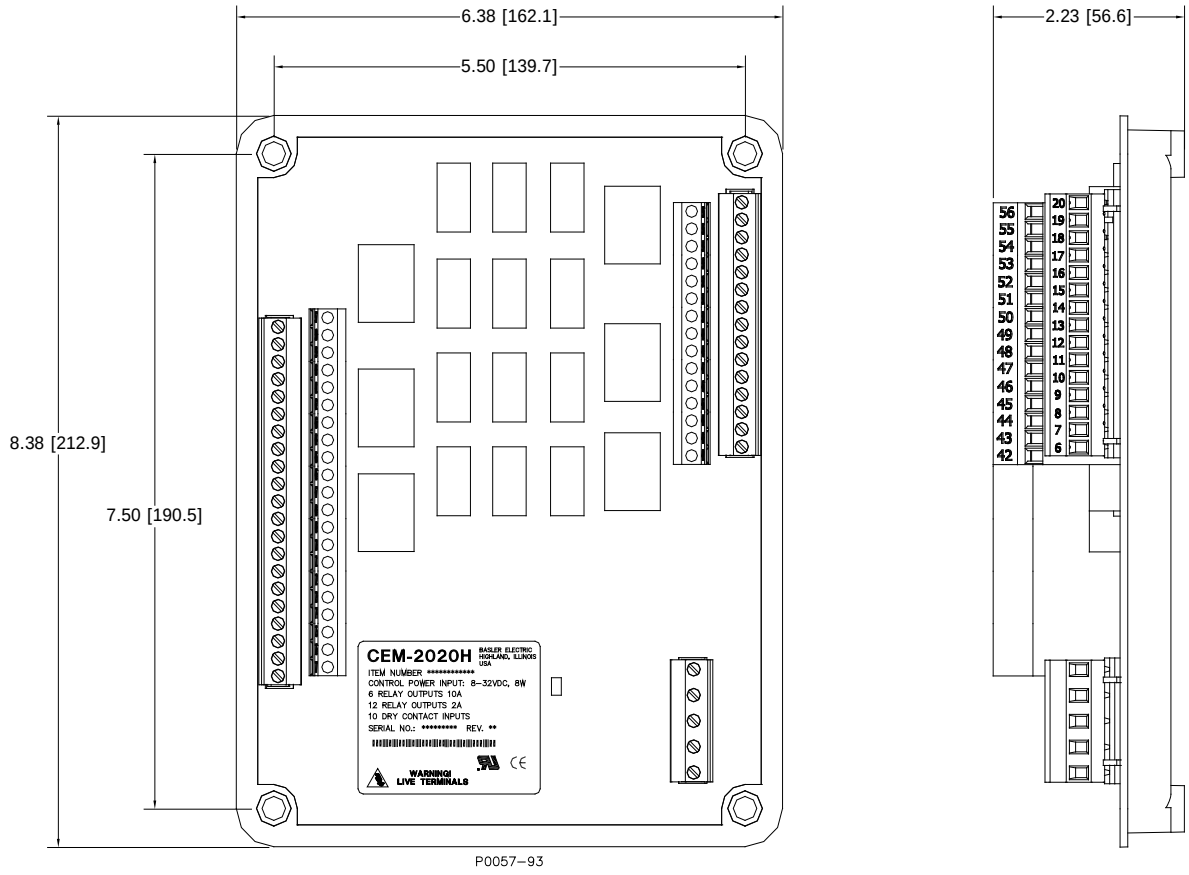

Figure 2. CEM-2020H Overall Dimensions

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.

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. 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 3) has 10 contact inputs and 24 contact outputs. The CEM-2020H (Figure 4) has 10 contact inputs and 18 contact outputs.

Note

To follow UL guidelines, a fuse must be implemented in the 2 Adc contact circuits (Outputs 5 through 16) of the CEM-2020H used in hazardous locations. The suggested fuse size in Adc = (100/Contact Voltage) with a maximum fuse size of 5 Adc.

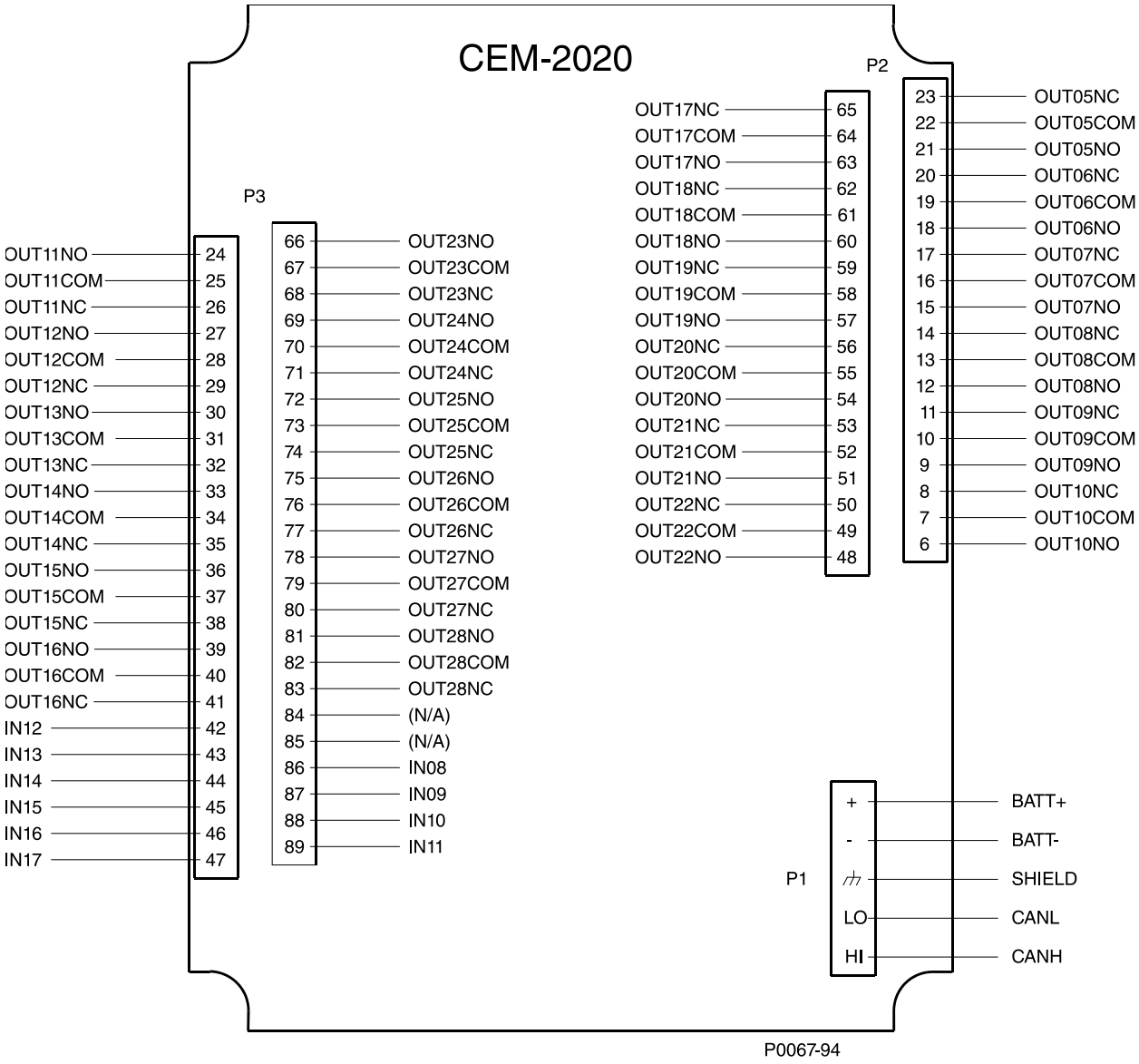

Figure 3. CEM-2020 Contact Input and Contact Output Terminals

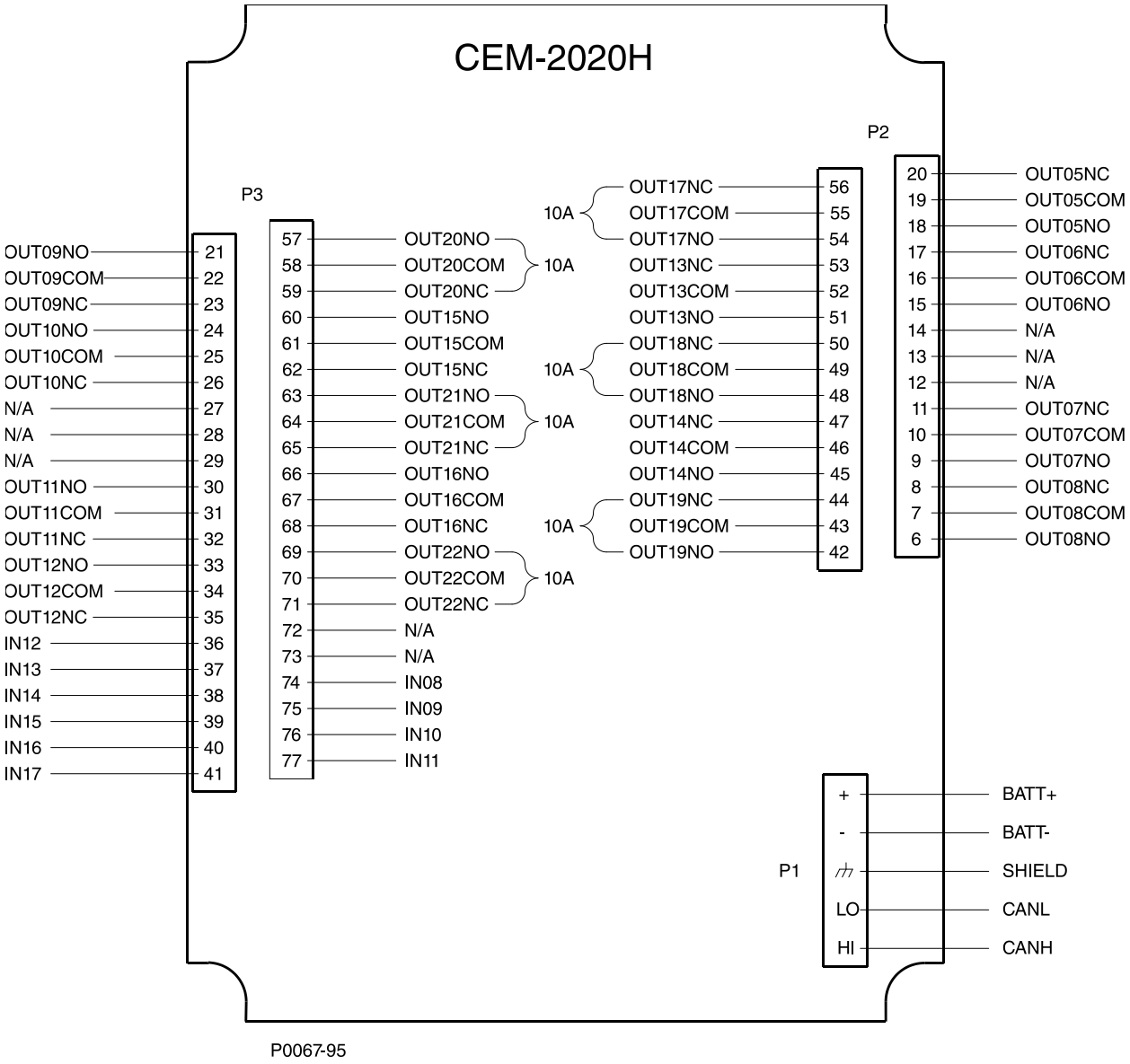

Figure 4. CEM-2020H Contact Input and Contact Output Terminals

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 2. Refer to Figure 5 and Figure 6.

Table 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.

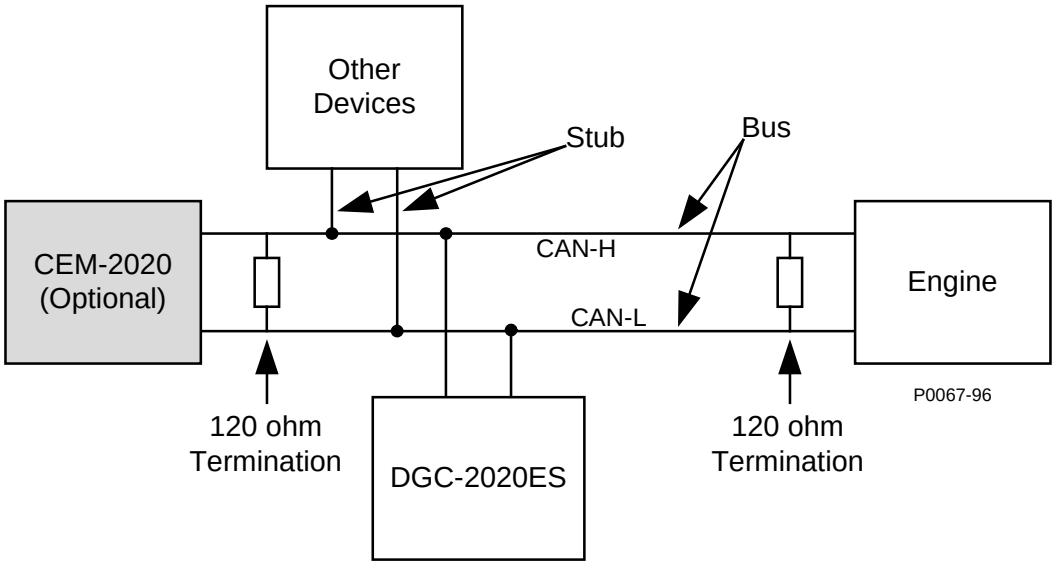

Figure 5. CAN Interface with CEM-2020 providing One End of the Bus

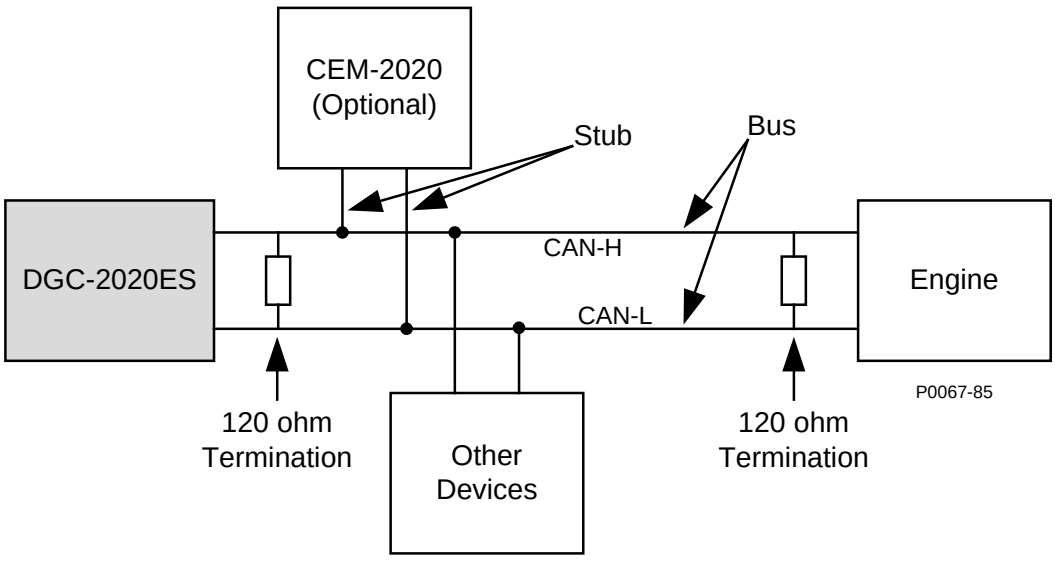

Figure 6. CAN Interface with DGC-2020ES providing One End of the Bus

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 7.

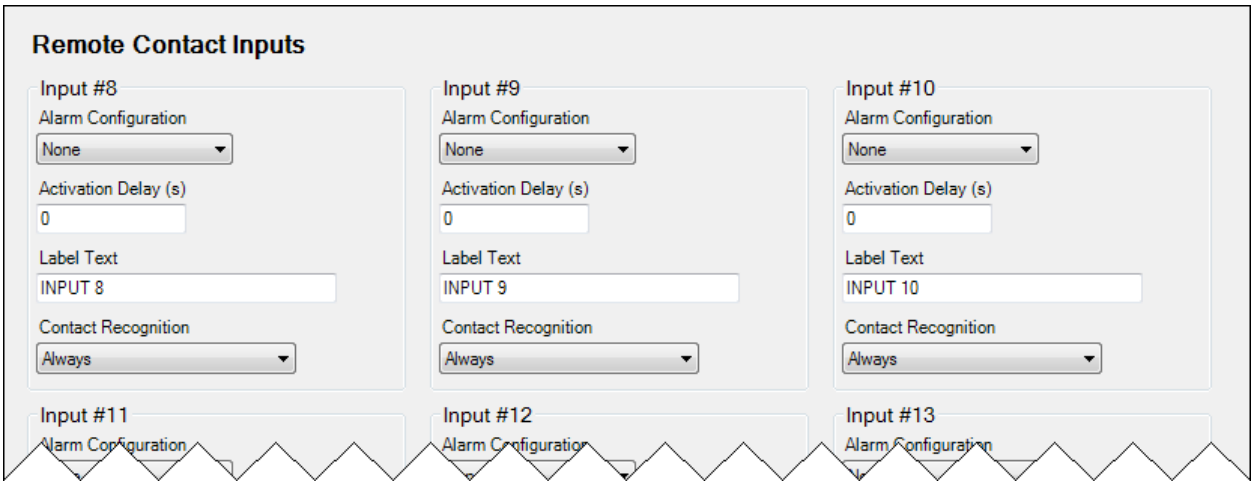

Figure 7. Settings Explorer, Programmable Inputs, Remote Contact Inputs Screen

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 8.

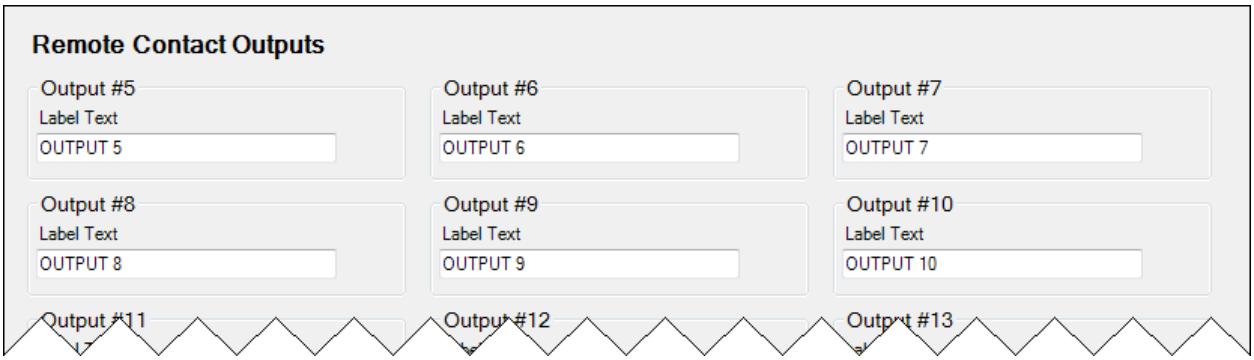

Figure 8. Settings Explorer, Programmable Outputs, Remote Contact Outputs Screen

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.

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.

Revision History

Table 3 provides a historical summary of the changes made to the DGC-2020ES hardware. Firmware changes are listed in Table 4 and software changes are listed in Table 5. The corresponding revisions made to this instruction manual are summarized in Table 6. Revisions are listed in chronological order.

Table 3. Hardware Revision History

Hardware Version and Date	Change
A, Mar-13	• Initial release
B, Jun-13	• Maintenance release
C, Apr-14	• Released firmware version 1.01.00
D, May-14	• Released firmware version 1.01.01
E, Nov-14	• Released firmware version 1.02.00 and BESTCOMSPlus 3.07.00
F, Jul-15	• Released firmware version 1.03.00 and BESTCOMSPlus 3.14.00
G, Aug-16	• Front panel upgraded with a membrane switch overlay

Table 4. Firmware Revision History

Firmware Version and Date	Change
1.00.00, Mar-13	• Initial release
1.01.00, Jan-14	• Changed to make horn always sound for pre-alarm after alarm silence button is pressed • Extended minimum range of Low Coolant Temp Pre-alarm down to 0 degrees F • Changed to prevent default run statistics after firmware upload • Modified Diesel Particulate Filter Soot Level and Regeneration Required Status Information to use the Diesel Particulate Filter Status parameter (SPN 3701) • Added a one-line diagram to the Front-Panel Overview screen • Improved the Event Log • Increased number of events to 50 • Added Scania Engine ECU support • Added Diesel Exhaust Fluid Level on Overview screen on systems which have Selective Catalytic Reduction with Diesel Exhaust Fluid implemented • Added Diesel Exhaust Fluid Tank Level and Percent kW Load to Configurable Metering • Modified Cummins Proprietary J1939 communications to support Cummins QSX-15 model and run at RPM selected under Speed Setup • Modified Volvo Proprietary J1939 communications to support RPM selection • Added ATS Programmable Function Setting to HMI • Removed Contact Input Recognition Parameter as a setting for the ATS Programmable Function • Removed Contact Input Recognition Parameter as a setting for the Low Coolant Level, Batt Charger Fail, and Fuel Leak Detect Programmable Functions • Removed Contact Input Recognition Parameter as a setting for the Low Fuel Level Programmable Function • Added logic point for DPF Lamp Status from Diesel Particulate Filter Control 1 PGN

Firmware Version and Date	Change
	• Changed to prevent Oil Pressure Crank Disconnect from operating if there is a valid RPM Source • Removed the letter "DPF" from DPF Regenerate Required and DPF Regeneration Inhibited Strings • Added Selective Catalytic Reduction Parameters to the list of strings displayed for SPN's in Diagnostic Trouble Codes • Modified front panel so that if MTU Fault Codes are in effect while an alarm or pre-alarm is in effect, the DGC-2020ES will alternate between the Alarm or Pre-alarm display and the MTU Fault Code display • Added a Mains Fail Transfer Status screen on the front panel • Changed to prevent unit from starting the machine when Battle Override is engaged after an alarm occurs, but the OFF button has never been pressed to clear the alarm, if the DGC pulses while in the alarm state, at the end of the pulse cycle • Generator Status string now displays Alarm if Battle Override is applied after an alarm shutdown
1.01.01, Apr-14	• Made the J1939 data menu available through the HMI when the unit is configured for Scania ECU type
1.02.00, Oct-14	• Added MTU Speed Demand Switch setting from logic capability • Added a rest timer for cyclic cranking • Added Mains Fail Return Fail pre-alarm and Mains Fail Max Return Time setting • Added John Deere to list of ECU configurations • Changed DEF EMPTY pre-alarm to DEF LOW SEVERE • Changed DEF ENGINE DERATE pre-alarm to DEF INDUCEMENT • Added descriptive text for Diagnostic Trouble Codes (DTC's) broadcast by Mercedes, PSI, and MTU-ECU9 engine ECU's • Added ECU9 Fault Code list for MTU
1.03.00, May-16	• Added Cylinder Cutout Enable Override logic element • Added a setting for Expected Engine ECU Address • Added a setting for CAN Bus Low Coolant Level Alarm Enable • Changed to set Expected Engine ECU Address to 0 when ECU CONFIG is GM/DOOSAN. • Added Chinese language support • Modified checksum handling to prevent a false Checksum Fail pre-alarm • Changed alarm annunciation so alarms are not suppressed if the OFF mode logic element is held true and prevents unit start attempt if the OFF mode logic element is held true and an alarm is active • Improved J1939 transmit buffer handling • Changed how the DGC-2020ES sends an Acknowledgement PGN indicating No Acknowledgement (NACK) when a request PGN is received that had the Global Address as the Destination Address • Improved ac line-to-line voltage calculation to allow for hardware gain differences between voltage channel inputs

Table 5. Software Revision History

Software Version and Date	Change
3.03.00, Mar-13	• Initial Release
3.03.03, Jun-13	• Maintenance release (BE1-11 changes)
3.04.00, Aug-13	• Maintenance release (BE1-11 changes)

Software Version and Date	Change
3.05.02, Jan-14	• Maintenance release (BE1-11 changes)
3.05.03, Mar-14	• Maintenance release (DGC-2020HD changes)
3.06.00, Apr-14	• Maintenance release (BE1-11 changes)
3.07.00, Oct-14	• Updated to support firmware version 1.02.00 (see firmware revision history) • Removed duplicate results in the device discovery list • Improvements to device directory on Connection screen • Changed to allow a comma in the Device ID • Changed to annunciate a connection failure message when a device is not present on a selected port • Improved prompts to save settings when choosing to close all open views • Changed to allow the middle mouse button to close the security view • Improved display of raw analog input currents • Changed to make BESTlogicPlus status LEDs report all logic errors
3.07.03, Jan-15	• Maintenance release (DECS-250 changes)
3.08.00, Feb-15	• Added a setting to download settings after initial connect • Added file save error message when trying to save an event log with an invalid filename
3.08.02, Mar-15	• Minor regional settings improvement
3.09.00, Jun-15	• Maintenance release (DGC-2020HD changes)
3.10.00, Jul-15	• Maintenance release (DECS-150 launch)
3.11.00, Dec-15	• Maintenance release (DECS-150, DGC-2020HD, BE1-11 changes)
3.12.00, Apr-16	• Added Windows 10 compatibility • Changed to prevent Offline Simulator button from disabling after sending settings to the device
3.14.00, Jun-16	• Updated to support firmware version 1.03.00 (see firmware revision history) • Added several pre-alarm status inputs to logic • Added MTU Combined Red Alarm status to logic • Added Chinese language support
3.15.00, Aug-16	• Maintenance release (DGC-2020HD changes)

Table 6. Instruction Manual Revision History

Manual Revision and Date	Change
—, Apr-17	• Initial release