



APPLICATION AND INSTALLATION GUIDE

EMCP 3.1, 3.2, 3.3 GENERATOR SET CONTROL

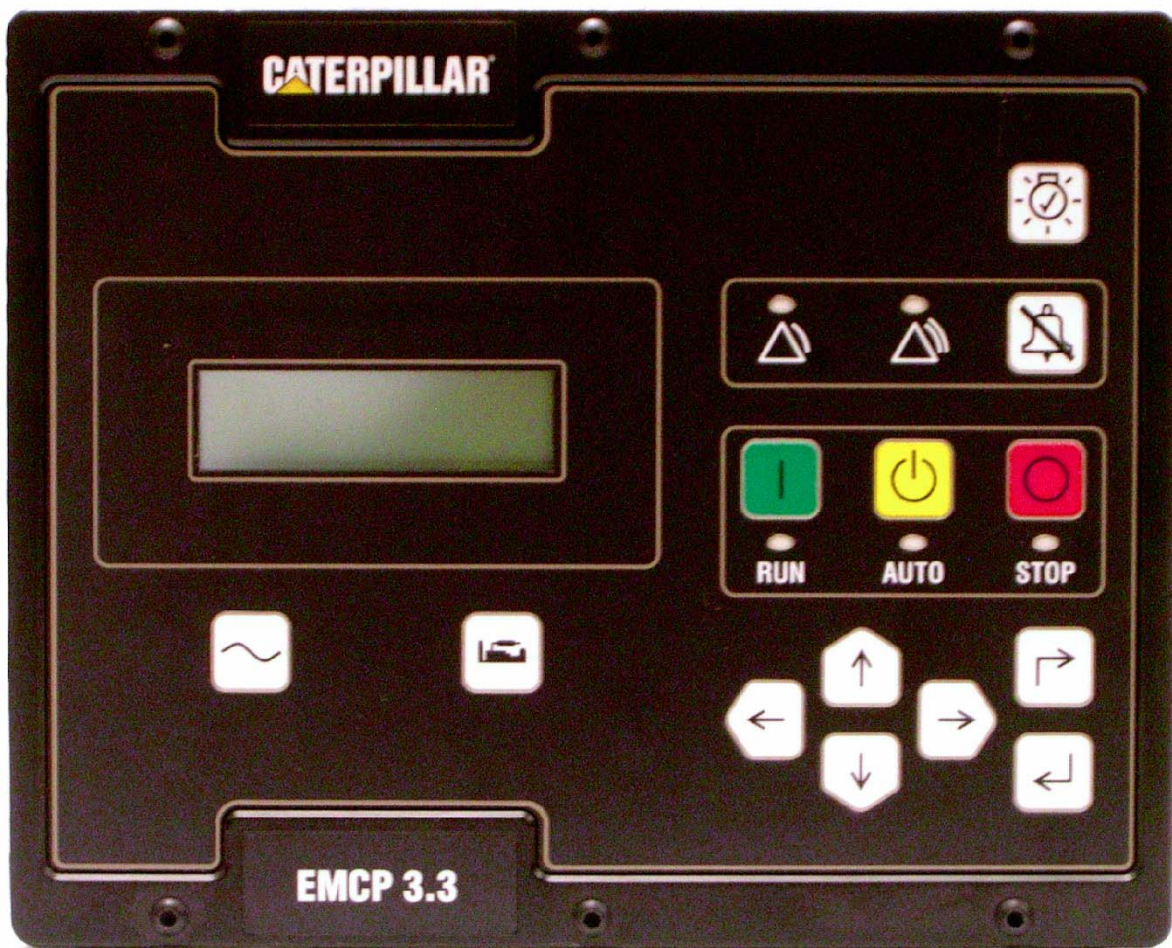


Table of Contents

1	GENERAL INFORMATION.....	7
1.1	COMPANION MEDIA NUMBER	7
1.2	INTRODUCTION	7
1.3	APPLICATIONS.....	7
1.4	REFERENCES	7
2	SAFETY INFORMATION.....	8
2.1	ELECTRICAL SAFETY	8
2.2	ELECTROSTATIC DISCHARGE AWARENESS	8
3	INSTALLATION	9
3.1	MOUNTING LOCATION	9
3.2	OPERATING TEMPERATURE RANGE	9
3.3	POWER REQUIREMENTS.....	9
3.4	BATTERY CHARGER.....	10
3.5	ELECTRICAL CONNECTIONS	10
3.6	EUI ENGINES	11
3.7	EMCP 3.1, 3.2, 3.3 ELECTRICAL DIAGRAMS	12
3.8	WINDING CONNECTIONS	15
3.9	TRANSFORMER CONNECTIONS	16
3.10	WIRING REQUIREMENTS.....	18
3.11	SHIELDED WIRING	19
4	INITIAL OPERATION AND USER ORIENTATION	20
4.1	VIEWING SYSTEM PARAMETERS	20
	SUPPORTED PARAMETERS.....	20
	Engine Parameters	20
	AC Parameters	22
4.2	SETTING USER PREFERENCES	23
	Setting The Preferences Using The EMCP 3 Display	24
	Changing To Technician English	25
	Changing To Primary Language	25
	Setting the Preferences using the Service Tool	25
4.3	CONFIGURING TIME/DATE (EMCP 3.2 AND 3.3).....	26
	Changing Date Format.....	26
	Changing The Time / Date	27
4.4	ADJUSTING GENERATOR SET PARAMETERS	28
	Engine Speed	29
	Generator Output Voltage	29
	Idle/Rated.....	30
4.5	STARTING AND STOPPING THE GENERATOR SET.....	30
	Starting The Engine	30
	Stopping The Engine	31
4.6	ENGINE SETPOINT VERIFICATION.....	32
	Procedure For Overspeed Verification	33
	Procedure For Low Oil Pressure Verification	33
	Procedure For High Coolant Temperature Verification	34
4.7	ENGINE SPEED TIMING CALIBRATION - PREPARATION	34
4.8	ENGINE OPERATING HOURS.....	35

	Updating Engine Operating Hours	35
5	HANDLING EVENTS	37
5.1	CONFIGURING EVENT RESPONSES	38
5.2	CHANGING AN EVENT RESPONSE CONFIGURATION	39
5.3	RESETTING INDIVIDUAL EVENTS FOR THE EMCP 3 GSC	40
5.4	RESETTING ALL EVENTS FOR A SINGLE MODULE	42
5.5	RESETTING ALL EVENTS FOR ALL MODULES	43
5.6	RESETTING EVENTS FOR ENGINE ECMs WITHOUT J1939 SUPPORT	43
5.7	TROUBLESHOOTING RESETTING EVENTS	44
	Not in Auto	44
	Service Maintenance Interval.....	45
6	SECURITY	46
7	SETPOINTS	49
7.1	THREE TYPES OF SETPOINTS	49
7.2	SETPOINT SUB-MENUS.....	51
7.3	SETPOINTS ON THE CATERPILLAR® SERVICE TOOL	51
8	DIGITAL INPUTS.....	55
8.1	PROGRAMMING THE DIGITAL INPUTS	56
9	ANALOG INPUTS.....	60
	Programming Using Display.....	60
	Programming Using Caterpillar® Service Tool	61
9.1	SPARE ANALOG INPUT (EMCP 3.2 & 3.3).....	62
10	OUTPUTS	64
10.1	DIGITAL SELECTOR OPTIONS	68
10.2	PROGRAMMING OUTPUTS USING THE SERVICE TOOL.....	70
10.3	PROGRAMMING OUTPUTS USING THE DISPLAY	76
11	MODIFIABLE TEXT STRINGS	84
11.1	LANGUAGE SUPPORT	85
11.2	MODIFIABLE TEXT STRING CONFIGURATION FILE	85
11.3	PROGRAMMING MODIFIABLE TEXT STRINGS USING CATERPILLAR® SERVICE TOOL.....	87
11.4	TROUBLESHOOTING MODIFIABLE TEXT STRINGS.....	89
12	SAVING AND RESTORING SETPOINTS	92
12.1	SAVING EMCP 3 CONFIGURATION DATA.....	92
	Fleet Configuration Option	92
	ECM Replacement option	93
12.2	LOADING EMCP 3 CONFIGURATION DATA.....	94
13	PROGRAMMABLE CYCLE TIMER (EMCP 3.2 & 3.3)	97
13.1	CONTROLLING THE OUTPUTS.....	97
	Internal Outputs	98
14	REDUCED POWER MODE	100
15	PROGRAMMABLE TRIP POINT FUNCTION	102
16	J1939 DATA LINKS.....	103

16.1	PRIMARY J1939 DATA LINK.....	103
	Primary J1939 Wiring.....	103
	Network Topology	103
16.2	ACCESSORY J1939 DATA LINK (EMCP 3.2 & 3.3).....	106
	Accessory J1939 Wiring	106
	Network Topology	106
17	OPTIONAL MODULES.....	108
	J1939 compliance	109
17.1	ANNUNCIATOR.....	109
	Annunciator Features.....	110
	Annunciator Specifications	110
	Annunciator Wiring.....	111
	LED Colors.....	111
	Annunciator Software Configuration	112
17.2	THERMOCOUPLE MODULE (EMCP 3.3)	116
	Thermocouple Features.....	116
	Thermocouple Specifications	117
	Thermocouple wiring.....	118
	Thermocouple Physical Layout.....	119
	Thermocouple Module – Configuration	119
	Configuring Thermocouple Inputs	120
17.3	RTD MODULE (EMCP 3.3).....	122
	RTD Features	122
	RTD Specifications	122
	RTD Wiring	124
	RTD Module – Configuration.....	125
	Configuring RTD Inputs	125
17.4	DISCRETE I/O MODULE	126
	Discrete I/O Features.....	126
	Discrete I/O Specifications	127
	Discrete I/O Software Configuration.....	129
	Configuring Digital Inputs.....	131
	Configuring Relay Outputs.....	132
18	SCADA (MODBUS) DATA LINK (EMCP 3.2 & 3.3).....	133
	Wiring.....	133
	Line Termination	134
	Software Configuration	135
	Message Data Structure	135
	Communication	136
	Supported Function Codes	136
	Data Link Register Addresses.....	139
	Error Checking	139
	Exception Responses	140
	Fault Identifiers (FID)	141
19	MONITORING SOFTWARE (EMCP 3.2 & 3.3)	142
19.1	SOFTWARE SETUP.....	142
19.2	QUICK START GUIDE	148
19.3	CREATING A CONTROL PANEL VIEW	151
19.4	LOGGING DATA TO A FILE	157
20	INSTALLING & UPGRADING SOFTWARE	159
20.1	UPGRADING SOFTWARE.....	159
20.2	INSTALLING SOFTWARE INTO A BLANK MODULE.....	160
21	SCADA PARAMETER INFORMATION (EMCP 3.2 & 3.3).....	164

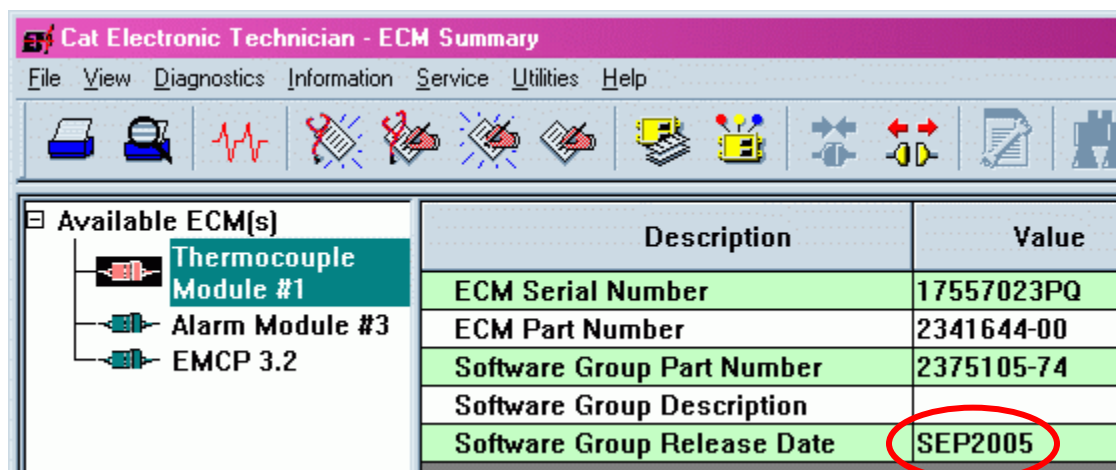
21.1	DATA LINK SECURITY	164
21.2	SPARE ANALOG INPUT	167
21.3	DISCRETE INPUTS AND OUTPUTS.....	172
21.4	GENERATOR AC PARAMETERS	175
21.5	EXTERNAL DEVICE PARAMETERS	183
21.6	GENERATOR SET STATE CONTROL	195
21.7	TIMERS AND COUNTERS.....	197
21.8	EVENT SYSTEM	200
21.9	ENGINE MONITORING	205
21.10	EMCP 3 GSC SETPOINTS	206
21.11	MISCELLANEOUS	209
APPENDIX A SCADA PROGRAMMING EXAMPLES.....		211
	Reading Data Registers	211
	Engine Status.....	212
	SCADA Security Levels	212
	More notes on SCADA passwords.....	214
	Setpoint Interpretation and Calculation	215
	Reading and Writing AVR Registers and Setpoints	215
APPENDIX B ALPHABETIC REFERENCE OF MODBUS REGISTERS.....		219
APPENDIX C BLOCKS FOR SETPOINT CONFIGURATION.....		226
APPENDIX D SETPOINT INFORMATION FOR CONFIGURATION.....		227
APPENDIX E SETPOINT VALUE LISTS		239
APPENDIX F BITMASK VALUE LISTS		246
APPENDIX G MENU STRUCTURES		247
APPENDIX H EMCP 3 GSC WIRING DIAGRAMS.....		250
APPENDIX I EMCP 3 GSC FRONT VIEW & NAVIGATION KEYS.....		253
GLOSSARY OF TERMS		256

Foreword

This Application and Installation Guide describes the EMCP 3.1, 3.2, and 3.3 series electrical power generator set controls.

Some data used in this guide is generalized and is provided only for the purpose of comparison or illustration. Also, PC application screenshots and EMCP 3 GSC screen images may be actual screens or simulated and are shown for illustrative purposes only. These images may not be identical to those seen by the user. Screen images of the EMCP 3 GSC may differ from the actual screens depending on flash file language, setpoint configuration, or series of the GSC (3.1 versus 3.2 versus 3.3).

In various places throughout this document, reference is made to the release date of the EMCP 3 software. This information can be found by connecting to the subject module using the Caterpillar® Service Tool, and viewing the ECM Summary (this is the default startup screen). The release date is found in the field entitled Software Group Release Date. See the sample screenshot below, showing the release date for a Thermocouple module.



Other product specific information and data is available from a variety of sources. For more information contact to the Caterpillar dealer or dealer TC nearest you.

To visit the Cat® Electronics website: www.catelectronics.com

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1 GENERAL INFORMATION

1.1 COMPANION MEDIA NUMBER

This document has media number, LEBE5255. It also has a companion media number, LERE5255. If only one of the media numbers is ordered, the other is shipped automatically, but separately. LERE5255 is a mini-CD that contains printable files of schematics found in this document on pages 12,13,14, APPENDIX H (page 250).



1.2 INTRODUCTION

Caterpillar® has developed a product line of Generator Set Controls for use in the Electronic Modular Control Panel 3 (EMCP 3). They are available in three versions based on Generator Set Control feature sets.

The EMCP 3 Generator Set Control, or GSC, is the primary controller within the Generator Set Control system. It contains the primary operator and service interface. The inset photo shows an up-close view of the EMCP 3.3. The EMCP 3 line of Generator Set Controllers includes EMCP 3.1, 3.2, and 3.3. APPENDIX I shows a full view of the EMCP 3.3.

This Application and Installation Guide is intended to cover the EMCP 3 Generator Set Control and its application in generator set systems. The intended audience for this guide includes Caterpillar generator set system designers, Caterpillar service support personnel, Caterpillar Dealers and Service Technicians, contractors, and customers.

1.3 APPLICATIONS

The EMCP 3 GSC product line of generator set controllers is designed for use in a wide range of applications. They can be used on standby and prime power diesel generator sets including Caterpillar®, FG Wilson®, and Olympian® brands. The configurability of the controllers allows them to be used, in some cases, on other applications such as Marine auxiliary generators, switchgear applications, industrial engines and generator sets, and gas generator sets.

Most of the information in this document applies to all applications. However, the document was written with Caterpillar brand diesel generator sets in mind. Please contact your Caterpillar support representative for questions regarding different applications.

1.4 REFERENCES

The following list of literature is available for EMCP 3 Generator Sets.

REN7902	EMCP 3 Systems Operation Troubleshooting Testing and Adjusting
SEBU7898	C18 Generator Set Operation and Maintenance Manual
SEBU7509	3500 Generator Sets Operation and Maintenance Manual
SEBU7508	3500B Generator Sets Operation and Maintenance Manual

2 SAFETY INFORMATION

2.1 ELECTRICAL SAFETY

DO NOT operate or work on a generator set unless you have read and understand the instructions and warnings in the Operation and Maintenance Manual. Failure to follow the instructions or heed the warnings could result in injury or death. Contact any Caterpillar dealer for replacement manuals. Proper care is your responsibility.



2.2 ELECTROSTATIC DISCHARGE AWARENESS

EMCP 3 GSC control contains components that are sensitive to **ELECTROSTATIC DISCHARGE (ESD)**. An electrostatic charge can damage the control resulting in EMCP 3 GSC breakdown or improper operation.



Take the following precautions while installing/removing/handling the control:

- Handle equipment correctly. Use ESD protective packaging and material handling containers that are anti-static and provide discharge protection and electric field suppression.
- Use protective devices: ESD-protective workstations and/or work surfaces (grounding mat, anti-static wrist strap, etc).
- Keep all plastic items away from the devices. Any plastic item is a potential static generator. This includes candy wrappers, foam cups, synthetic carpet, foam cushions, etc.
- The anti-static bag cannot function as a static dissipating mat.
- **DO NOT** use an anti-static bag for any other purpose than to enclose a product.

CAUTION: The 70-pin connector on the back of the control is the most vulnerable area to **ELECTROSTATIC DISCHARGE (ESD)**. While handling the EMCP 3 GSC, extra attention is required to the back of the control. The control may become damaged or inoperable if extra care is not taken.

Consult the Electrostatic Discharge Association for proper procedure during particular situations: <http://www.esda.org>

3 INSTALLATION

3.1 MOUNTING LOCATION

When selecting a mounting location for the EMCP 3 GSC, consider the following:

- Protection from high-voltage and high-current devices.
- Protection from devices which may produce electromagnetic interference.
- Protection from excessive vibration. The controls are designed to withstand normal generator set vibrations. The controls should not be mounted directly to the engine block.
- Protection from direct exposure to water. Once installed, the EMCP 3.1, 3.2, and 3.3 are sealed to a level of IP Level 22 for resistance to moisture.

3.2 OPERATING TEMPERATURE RANGE

EMCP 3 GSC has a continuous operating temperature range of -20°C to $+70^{\circ}\text{C}$ ambient.

3.3 POWER REQUIREMENTS

The EMCP 3 GSC requires a nominal voltage of 12 V DC or 24 V DC. If batteries are used for operating power, a charging source such as an alternator or dual-mode battery charger is necessary to maintain a stable supply voltage. Under steady state operation, the EMCP 3 GSC will draw approximately 0.5 A to 1.5 A current draw (not including any relay loads).

Regional electrical codes must be followed. In the case of standby operation, follow the regional requirements for installing standby power systems. An example of this is the National Fire Protection Association (NFPA) guidelines for emergency power systems.

When connecting the EMCP 3 GSC to the DC power source, make sure that there is only one common connection to the negative potential of the power source. Make extra effort to avoid any ground loops in the DC electrical system. A single point common ground for sensitive electronics is recommended at the negative battery terminal or Power Distribution Box.

Avoid daisy-chaining power supply connections from one device to another. This builds resistance from one (-)Battery point to the next, effectively building a potential difference between two different reference points. Each electronics subsystem and major engine subsystem should have its own DC network so that they do not interfere with each other (see FIGURE 1).

As shown in FIGURE 1, all sensitive electronics are electrically isolated from higher current loads, such as the starter motor. All electronics have a **COMMON POWER BUS** and **SINGLE POINT REFERENCE**. The **CHASSIS GROUND** is a common **POWER AND TRANSIENT GROUND**.

The sensitive electronics, such as sensors and control modules, have isolated power source paths. High current loads such as starters and solenoids can cause interference and possibly damage to low current loads, such as controllers and sensors.

CAUTION: Extra effort must be made to keep the high current and low current loads electrically separated.

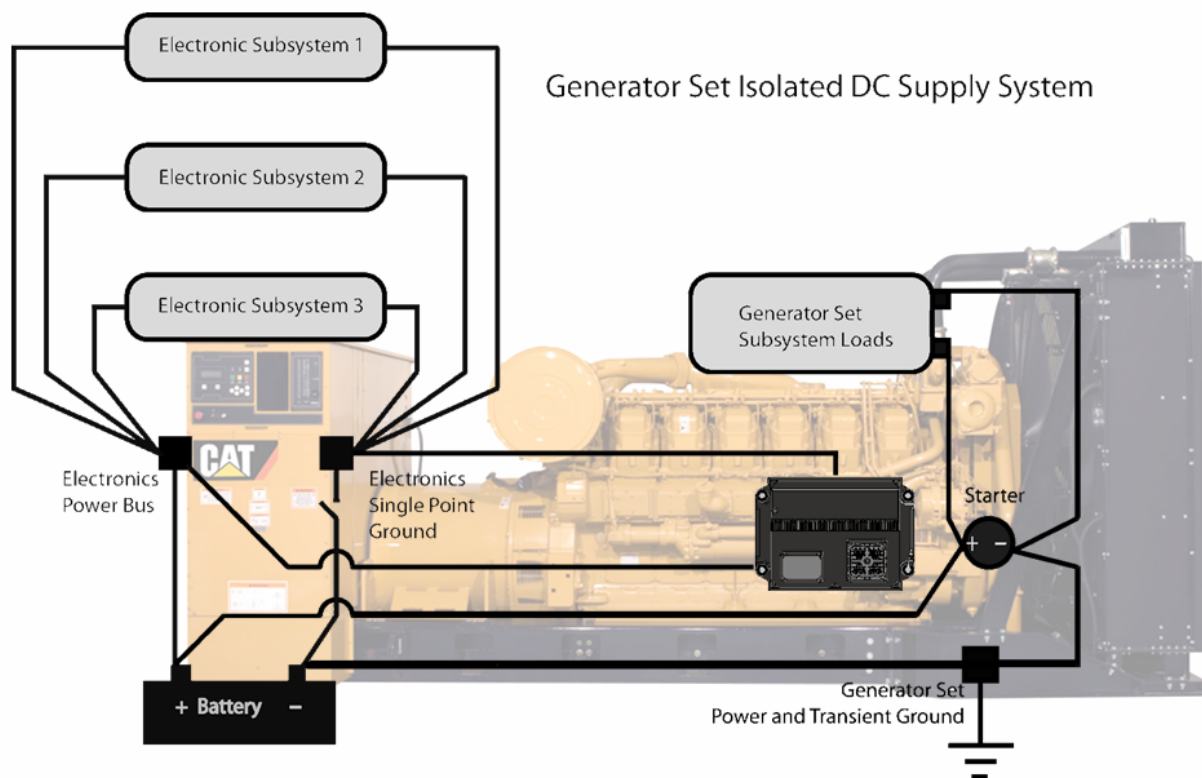


FIGURE 1: GENERATOR SET NETWORK ISOLATION

The two types of loads may share common Battery (+) and Battery (-) connections but, they should not be electrically connected at any other point. This strategy ensures maximum isolation between high current and low current loads.

The battery **DISCONNECT SWITCH** is located on the negative leg of the battery supply.

3.4 BATTERY CHARGER

If a battery charger is to be used, it should be connected on the battery side of the disconnect switch, so as not to power the electronics. Most battery chargers are not to be used as power supplies. Proper battery charger operation requires that the actual battery load is present.

3.5 ELECTRICAL CONNECTIONS

The EMCP 3 GSC has one 70-pin connector on the back of the control and not all of the 70 pins are used.

FIGURE 2, FIGURE 3, and FIGURE 4 show:

- All possible connections
- What pins are used for connections
- How each pin is connected for each control version

3.6 EUI ENGINES

For EUI engines, the **PASSIVE ANALOG INPUTS #1** and **#2** will **NOT** be used. These are for discrete oil pressure and coolant temperature sensors, respectively. These sensors will be wired to the engine ECM and the EMCP 3 GSC will get that information from the engine ECM via the Primary J1939 Data Link.

For more information about the passive inputs, see Chapter 9, ANALOG INPUTS.

ANALOG CONNECTIONS

The 70-pin connector wiring diagrams below, also, show two different ways to connect the analog inputs.

- Connections for 2-wire sensors are shown (including all of the other connections).
- Connections for 1-wire sensors are shown at the bottom right hand side of the figures.

DISCRETE INPUTS

The discrete inputs are shown connected through **NORMALLY OPEN** contacts to battery negative.

These inputs can also be connected through **NORMALLY CLOSED** contacts to battery negative. To do this the **ACTIVE STATE** of the input will need to be set to **ACTIVE HIGH**.

For information on software configuration of the digital inputs see Chapter 8, Digital Inputs.

3.7 EMCP 3.1, 3.2, 3.3 ELECTRICAL DIAGRAMS

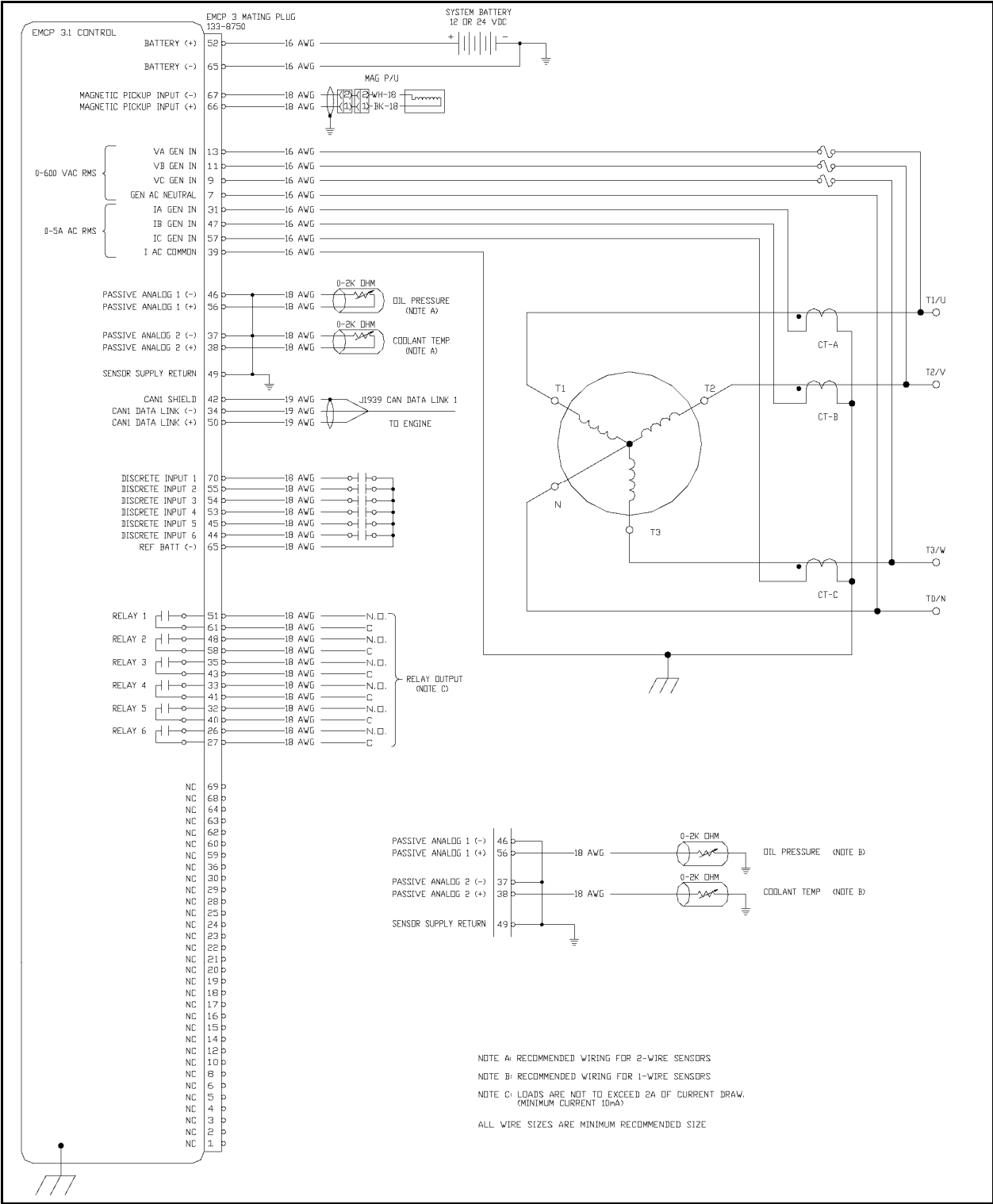


FIGURE 2: EMCP 3.1 ELECTRICAL DIAGRAM

(Refer to APPENDIX H EMCP 3 GSC for printable image)

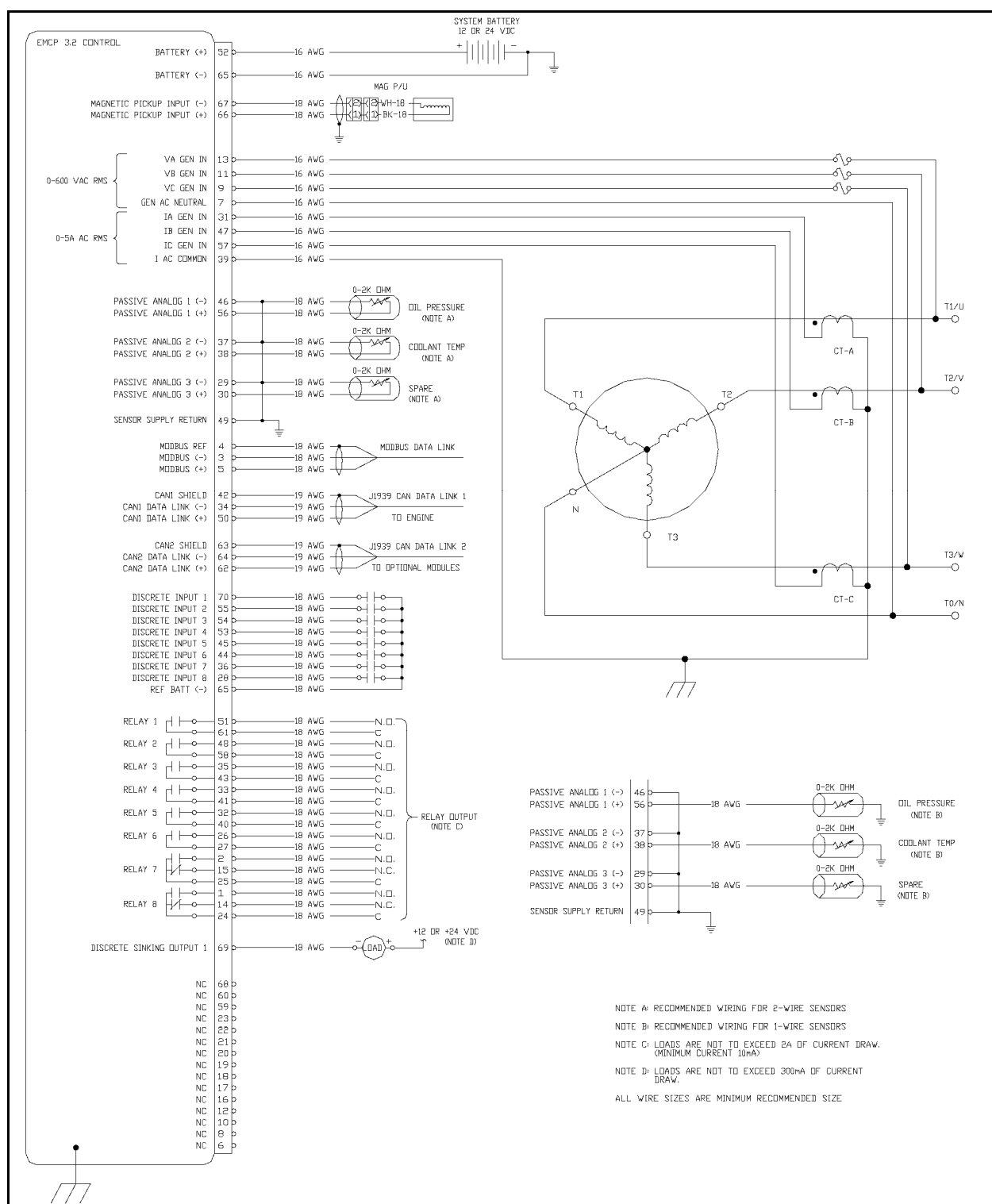


FIGURE 3: EMCP 3.2 ELECTRICAL DIAGRAM

(Refer to APPENDIX H EMCP 3 GSC for printable image)

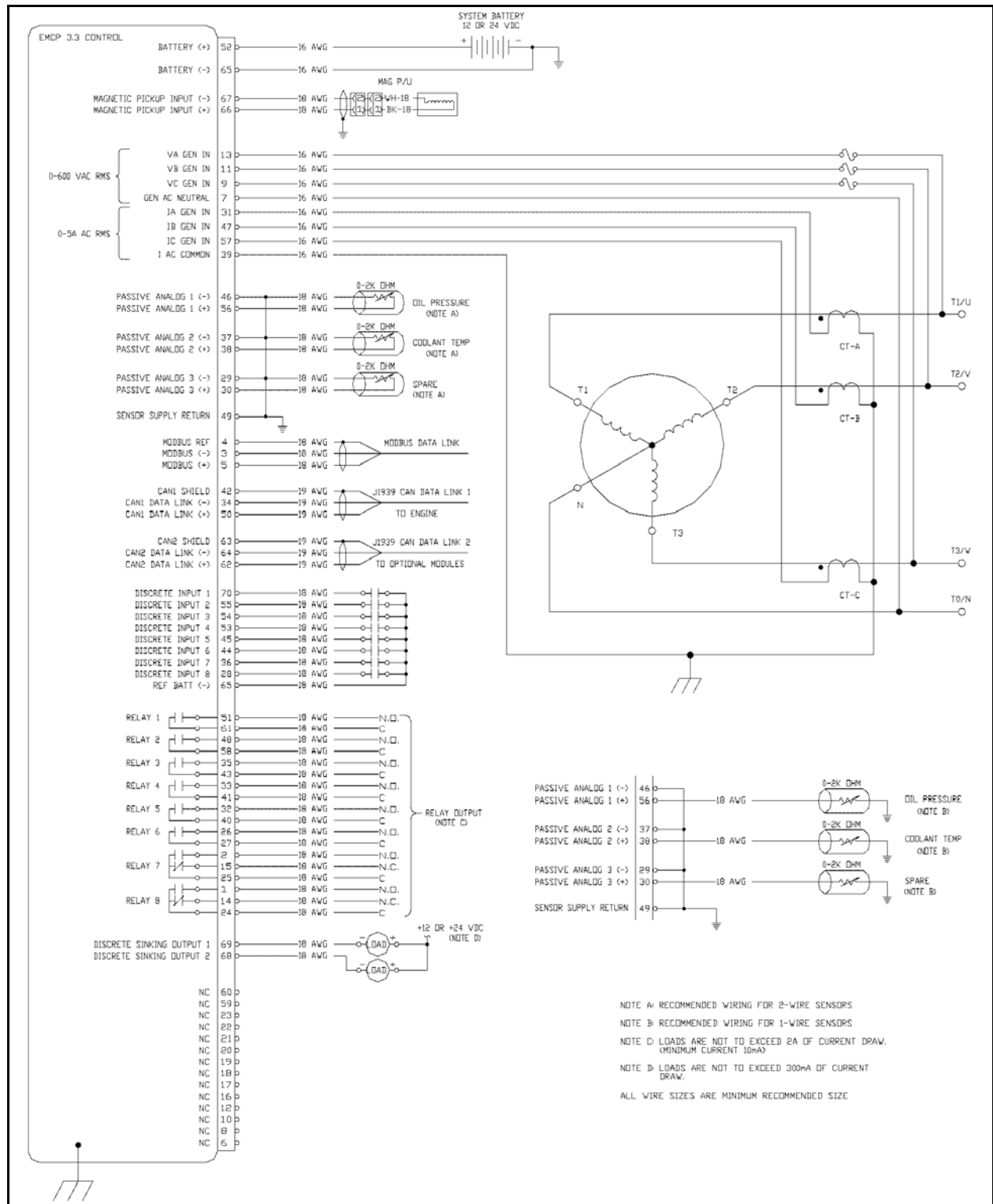


FIGURE 4: EMCP 3.3 ELECTRICAL DIAGRAM

(Refer to APPENDIX H EMCP 3 GSC for printable image)

3.8 WINDING CONNECTIONS

The connections between the generator and the EMCP 3 GSC depend on the winding configuration as shown in the connection diagrams below.

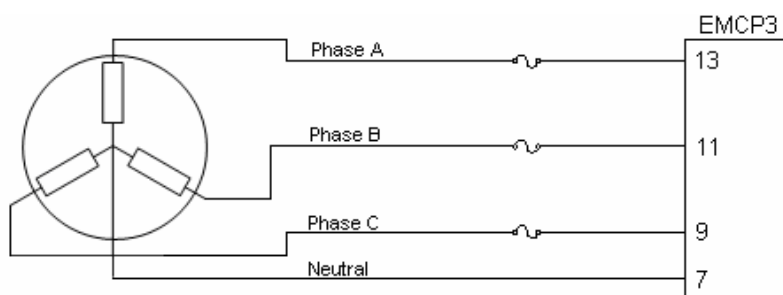


FIGURE 5: THREE PHASE FOUR WIRE (SERIES OR PARALLEL) WYE (STAR)

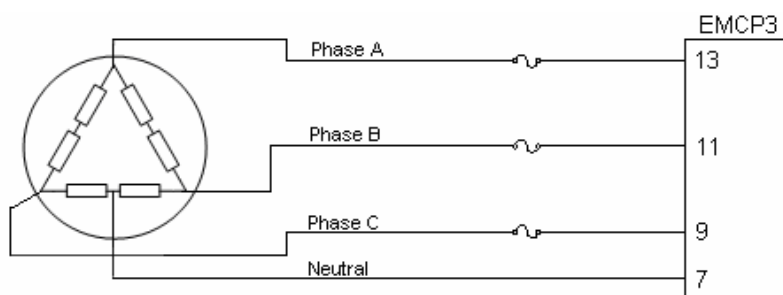


FIGURE 6: THREE PHASE FOUR WIRE DELTA

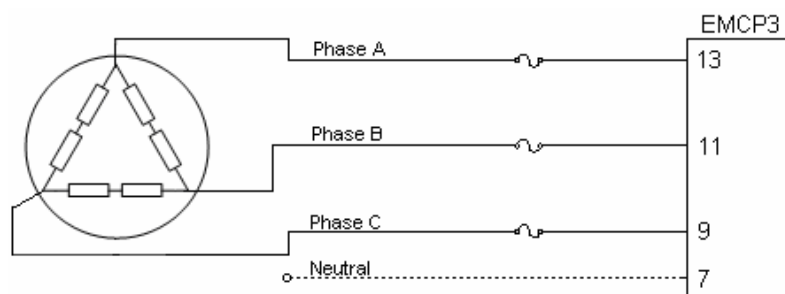


FIGURE 7: THREE PHASE THREE WIRE DELTA

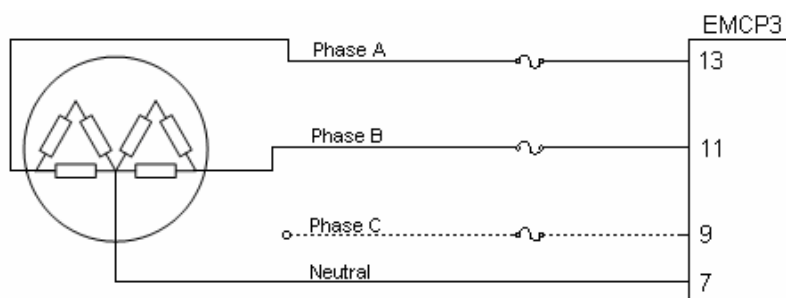


FIGURE 8: SINGLE PHASE THREE WIRE (DOUBLE DELTA)

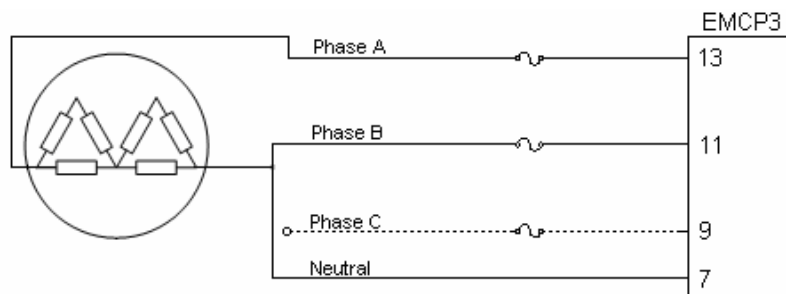


FIGURE 9: SINGLE PHASE TWO WIRE (DOUBLE DELTA)

3.9 TRANSFORMER CONNECTIONS

In order to monitor generator output voltages greater than 600 Volts, external potential transformers must be used.

NOTE: The EMCP 3 GSC must be programmed for the correct winding ratios when connecting external potential transformers. See Chapter 7, Setpoints for more information on how to program the winding ratios.

CAUTION: The **WYE** configuration of external potential transformers is preferred for 4-wire wye generators because of the greater accuracy when loads are unbalanced. With the open delta configuration, some power parameters can not be determined. These parameters are real power phase A, B, C and power factor phase A, B, C. For maximum accuracy, the open delta configuration of external potential transformers should be used only for 3-wire delta generators. Refer to Table 1: Power Values Valid by Generator Configuration, page 17.

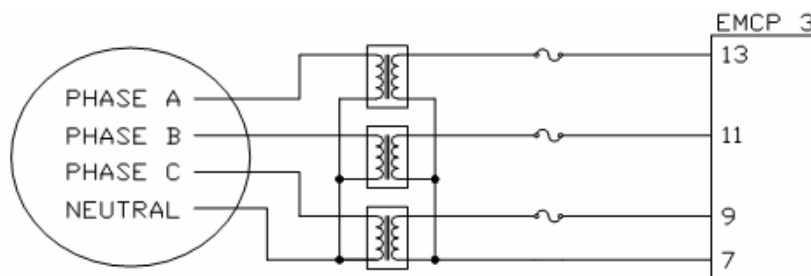


FIGURE 10: WYE CONFIGURATION OF EXTERNAL POTENTIAL TRANSFORMERS

(PT) on the 4-Wire Wye Connected Generator

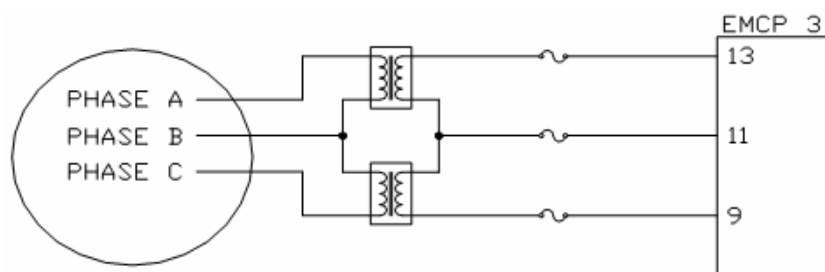


FIGURE 11: OPEN DELTA CONFIGURATION OF EXTERNAL POTENTIAL TRANSFORMERS

(PT) on the 3-Wire Delta Connected Generator

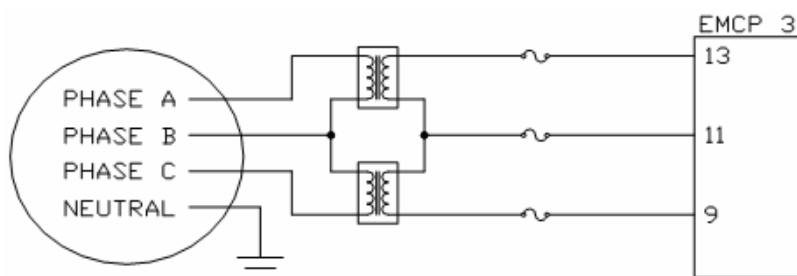


FIGURE 12: OPEN DELTA CONFIGURATION OF EXTERNAL POTENTIAL TRANSFORMERS

(PT) on the 4-Wire Wye Connected Generator

TABLE 1: POWER VALUES VALID BY GENERATOR CONFIGURATION

TRANSFORMER CONNECTIONS						
Parameter	Modbus Register	STAR	3-WIRE DELTA	4-WIRE DELTA	2-WIRE 1-PHASE	3-WIRE 1-PHASE
Gen Freq	102	OK	OK	OK	OK	OK
$V_{L-L \text{ AVG}}$	100	OK	OK	OK	OK	OK
V_{A-B}	108	OK	OK	OK	OK	OK
V_{B-C}	109	OK	OK	OK	Invalid	Invalid
V_{C-A}	110	OK	OK	OK	Invalid	Invalid
$V_{L-N \text{ AVG}}$	148	OK	Invalid	OK	Invalid	OK
V_A	114	OK	Invalid	OK	Invalid	OK
V_B	115	OK	Invalid	OK	Invalid	OK
V_C	116	OK	Invalid	OK	Invalid	Invalid
I_{AVG}	101	OK	OK	OK	OK	OK
I_A	111	OK	OK	OK	OK	OK
I_B	112	OK	OK	OK	OK	OK
I_C	113	OK	OK	OK	Invalid	Invalid

3.10 WIRING REQUIREMENTS

Use the tables below for wiring requirements at 50 and 300 foot lengths.

TABLE 2: 50 FOOT REQUIREMENTS

50 FOOT REQUIREMENTS			
Component	Wire Size (AWG)	Type of Wire	Connections ⁽¹⁾
Three-Wire Sensors (when applicable. Not used on all systems)	16	Shielded twisted triad cable is recommended. For conduits inside facilities, use Belden 8618. For the engine harness, use the 4G-2556 Shielded Cable. The cable must be resistant to fuel and oil. The cable must have a temperature range from -40°C (-40°F) to plus 125°C (257°F).	Deutsch DT type of connectors are recommended. If Spring Spade or Ring Terminals are used, the connection between the terminals and the wire should be crimped and soldered.
Two-Wire Components (Magnetic Speed Sensors)	16 or 18	Shielded twisted pair cable is recommended. For conduits inside facilities, use the 123-2376 Electrical Cable or the 3E-4594 Electrical Cable. For the engine harness, use the 6V-2744 Wire. The cable must be resistant to fuel and oil. The cable must have a temperature range of -40°C (-40°F) to plus 125°C (257°F).	
Engine Solenoids (Air Shutoff)	10	Stranded wire normally used on engine harnesses. The cable must be resistant to fuel and oil. The cable must have a temperature range of -40°C (-40°F) to plus 125°C (257°F).	The leads of the cable should have Spring Spade Terminals or Ring Terminals. The Connection between the wire and the terminal should be crimped and soldered.
Power			

⁽¹⁾ The number of connections must be kept to a minimum.

TABLE 3: 300 FOOT REQUIREMENTS

300 FOOT REQUIREMENTS			
Component	Wire Size (AWG)	Type of Wire	Connections ⁽¹⁾
Three-Wire Sensors (when applicable. Not used on all systems)	16	Shielded twisted triad cable is recommended. For conduits inside facilities, use Belden 8618. For the engine harness, use the 4G-2556 Shielded Cable. The cable must be resistant to fuel and oil. The cable must have a temperature range from -40°C (-40°F) to plus 125°C (257°F).	Deutsch DT type of connectors are recommended. If Spring Spade or Ring Terminals are used, the connection between the terminals

300 FOOT REQUIREMENTS			
Component	Wire Size (AWG)	Type of Wire	Connections ⁽¹⁾
Two-Wire Components (Magnetic Speed Sensors)	16 or 18	Shielded twisted pair cable is recommended. For conduits inside facilities, use the 123-2376 Electrical Cable or the 3E-4594 Electrical Cable. For the engine harness, use the 6V-2744 Wire. The cable must be resistant to fuel and oil. The cable must have a temperature range of -40°C (-40°F) to plus 125°C (257°F).	and the wire should be crimped and soldered.
J1939 Data Link cable	16 or 18	Part number 153-2707 is available for lengths of up to 200ft. The cable has a temperature range of -40°C (-40°F) to plus 125°C (257°F). For longer runs, select a cable that meets SAE J1939-11 requirements.	Deutsch DT type of connectors are recommended. If Spring Spade or Ring Terminals are used, the connection between the terminals and the wire should be crimped and soldered.
Engine Solenoids (Air Shutoff)	8	Stranded wire normally used on engine harnesses. The cable must be resistant to fuel and oil. The cable must have a temperature range of -40°C (-40°F) to plus 125°C (257°F).	The leads of the cable should have Spring Spade Terminals or Ring Terminals. The Connection between the wire and the terminal should be crimped and soldered.
Power			

⁽¹⁾ The number of connections must be kept to a minimum.

3.11 SHIELDED WIRING

Shielded twisted pair cable is required for the J1939 datalink and the magnetic speed sensor. This cable is used for maximum protection against inductive noise, electromagnetic interference, and radio frequency interference. The shield greatly reduces the amplitude of any unwanted voltages on the signal wire. If the shields are connected to sheet metal, the connections are susceptible to loose bolts, corrosion, etc. The faulty connections increase the resistance of the shield. Faulty connections also reduce the effectiveness of the shield.

All the shields of the shielded cable must be connected to the common battery negative terminal of the generator set only. The shields should not be connected to the sheet metal. Sheet Metal connections corrode over time, increasing the resistance on the shield. When the cable terminates at junction boxes, the shields must be connected to each other in order to maintain a continuous path. Wire exposed beyond the shield should be as short as possible and **not** exceeding two inches. To avoid ground loops, shields should be grounded at one point only.

To avoid electromagnetic interference, do not run shielded signal wires near other wires carrying large currents. In installations with unavoidable risk of electromagnetic interference (EMI), shielded wire run in conduit, extra shielding, or other precautions may be necessary.

4 INITIAL OPERATION AND USER ORIENTATION

4.1 VIEWING SYSTEM PARAMETERS

Many generator and engine parameters are accessible from both from the Caterpillar® Service Tool, and the EMCP 3 display.

FROM THE CATERPILLAR® SERVICE TOOL

Parameters are accessed by selecting Information > Status from the menu, or by clicking on the **STATUS TOOL**  icon in the toolbar. Refer to the Caterpillar® Service Tool help from the Help > Contents menu for more information on the Status Tool.

FROM THE EMCP 3 DISPLAY

Parameters are accessed (irrespective of the current screen position) by pressing the **AC OVERVIEW**  or **ENGINE OVERVIEW**  buttons located below the screen. Detail screens provide even more information by pressing the **SCROLL DOWN**  button from each of the overview screens.

SUPPORTED PARAMETERS

Different revisions of the EMCP 3 support different numbers of parameters. EMCP 3.3 supports several parameters not supported on the EMCP 3.2, which supports several parameters not supported on the EMCP 3.1. Some parameters are only available in certain configurations, for example, electronic engine ECMs provide more engine data than what is available from mechanical engines. The sections below list all of the parameters available, and on which level of EMCP 3 they may be available.

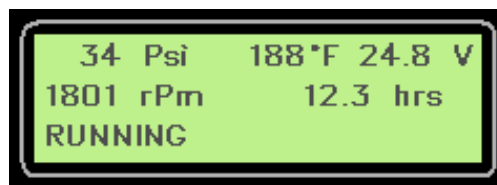
Parameters are displayed with units, some of which are configurable. For changing units or setting other user preferences see Chapter 4.2, Setting User Preferences.

Parameters that are not available to the EMCP 3 are shown as ******** (four asterisks). This may indicate an incorrect software configuration, a wiring problem, or a problem with the sensor.

ENGINE PARAMETERS

ENGINE OVERVIEW SCREEN

- Engine Oil Pressure
- Engine Coolant Temperature
- Battery Voltage, as measured at the 70-pin connector entering the EMCP 3 GSC
- Engine Speed
- Engine Operating Hours
- Engine Operating State (Initialization, Pre-Crank, Starting, Running, Pre-Cooldown, Cooldown, Stopping, Stopped, Idling; many states are transient and only briefly active, and some states may not occur in some configurations)



ENGINE SCREEN 1

- Engine Oil Pressure (same as in Engine Overview Screen)

- Engine Coolant Temperature (same as in Engine Overview Screen)
- Engine Speed (same as in Engine Overview Screen)

ENGINE SCREEN 2

- Battery Voltage (same as in Engine Overview Screen)
- Engine Operating Hours (same as in Engine Overview Screen)
- Spare Analog Input parameter (configurable using the Spare Analog Input Suspect Parameter Number; for configuration, see Chapter 9.1, Spare Analog Input)

ENGINE SCREEN 3

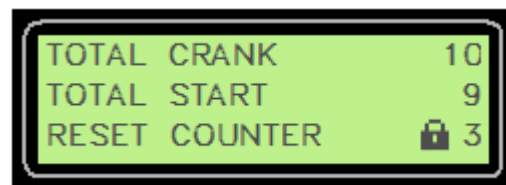
- Engine Hours remaining until Service Maintenance Interval expires
- Calendar Days remaining until Service Maintenance Interval expires



(option to reset the Service Maintenance Interval countdown timer)

ENGINE SCREEN 4

- Total engine Cranks since last reset (a crank is defined as the number of times the starter motor switches on)
 - Total engine Starts since last reset (a start is defined as the number of times the engine transitions from below the Crank Terminate speed setpoint to above it)
- (option to reset the crank and start counters)

**ENGINE SCREEN 5[†]**

- Cylinder #1 Temperature
UP TO
- Cylinder #20 Temperature

ENGINE SCREEN 6[†]

- Left Exhaust Manifold Temperature
- Right Exhaust Manifold Temperature
- Intake Manifold Temperature
- Exhaust Temperature
- Turbocharger #1 Compressor Inlet Temperature
UP TO
- Turbocharger #4 Compressor Inlet Temperature
- Turbocharger #1 Turbine Inlet Temperature
UP TO
- Turbocharger #4 Turbine Inlet Temperature
- Turbocharger #1 Turbine Outlet Temperature
UP TO
- Turbocharger #4 Turbine Outlet Temperature

ENGINE SCREEN 7[†]

[†] Only shown if these parameters are supported by the engine ECM, and if the EMCP 3 setpoint Engine J1939 Support is set to Enhanced J1939.

- Engine Oil Temperature
- Engine Fuel Temperature

ENGINE SCREEN 8[†]

- Fuel Pressure
- Crankcase Pressure
- Boost Pressure

ENGINE SCREEN 9[†]

- Oil Filter Differential Pressure
- Fuel Filter Differential Pressure

ENGINE SCREEN 10[†]

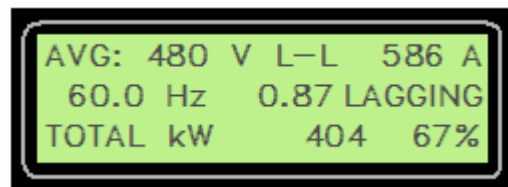
- Air Filter Differential Pressure

ENGINE SCREEN 11[†]

- Total Fuel Consumption
- Instantaneous Fuel Consumption

AC PARAMETERS**AC OVERVIEW SCREEN**

- Average Line-Line AC Voltage
- Average Current
- AC Frequency
- Power Factor (EMCP 3.2-3.3 only)



- Power Factor Lead/Lag status (EMCP 3.2-3.3 only)
- Total Generator Real Power – kW – (EMCP 3.2-3.3 only)
- Percent Real Power – as a percent of Generator Rated Power setpoint – (EMCP 3.2-3.3 only)

AC SCREEN 1

- Line-Line Voltages: A-B, B-C, C-A
- Phase Currents: A, B, C
- AC Frequency

AC SCREEN 2

- Line-Neutral Voltages: A-N, B-N, C-N
- Phase Currents: A, B, C (same as AC Screen 1)
- AC Frequency (same as AC Screen 1)

AC SCREEN 3 (EMCP 3.2-3.3 ONLY)

- Per Phase Generator Real Power: A, B, C
- Per Phase Generator Apparent Power: A, B, C
- Per Phase Generator Reactive Power: A, B, C

AC SCREEN 4 (EMCP 3.2-3.3 ONLY)

- Per Phase Generator Real Power: A, B, C (same as AC Screen 3)
- Per Phase Generator Apparent Power: A, B, C (same as AC Screen 3)

[†] Only shown if these parameters are supported by the engine ECM, and if the EMCP 3 setpoint Engine J1939 Support is set to Enhanced J1939.

- Per Phase Power Factor: A, B, C

AC SCREEN 5 (EMCP 3.2-3.3 ONLY)

- Total Generator Real Power (same as AC Overview Screen)
- Percent Real Power (as a percent of Generator Rated Power setpoint)
- Total Generator Apparent Power
- Percent Apparent Power (as a percent of Generator Rated Apparent Power setpoint)
- Total Generator Reactive Power
- Percent Reactive Power (as a percent of the rated reactive power, as calculated by using the other two rated power setpoints and the power triangle:

$$kVar = \sqrt{(kVA)^2 - (kW)^2}$$

TOTAL kW	404	0%
TOTAL kVA	426	0%
TOTAL kVar	134	0%

AC SCREEN 6 (EMCP 3.2-3.3 ONLY)

- Generator Real Energy produced since last meter reset
- Generator Reactive Energy produced since last meter reset
- (option to reset energy meters)

kWh	4211
kVarh	1548
RESET ENGY MTRS	3

AC SCREEN 7

- Average Line-Line AC Voltage (same as AC Overview Screen)
- Average Line-Neutral AC Voltage
- Power Factor (EMCP 3.2-3.3 only) (same as AC Overview Screen)
- Power Factor Lead/Lag status (EMCP 3.2-3.3 only) (same as AC Overview Screen)

AVERAGE L-L	480 V
AVERAGE L-N	277 V
P.f.	0.87 LAGGING

AC SCREEN 8 (EMCP 3.3 ONLY) [‡]

- Generator Front Bearing Temperature
- Generator Rear Bearing Temperature

AC SCREEN 9 (EMCP 3.3 ONLY) [‡]

- Generator Phase A Winding Temperature
- Generator Phase B Winding Temperature
- Generator Phase C Winding Temperature

AC SCREEN 10 (EMCP 3.3 ONLY) [‡]

- Generator Excitation Field Voltage
- Generator Excitation Field Current

4.2 SETTING USER PREFERENCES

The EMCP 3 GSC display can be used for monitoring the generator status, viewing and resetting events, and configuring setpoints. There are several preferences to alter how you view the data on the display. These include: display contrast, units used to display pressure, units used to display temperature, units used to display volume (EMCP 3.3 only), and display

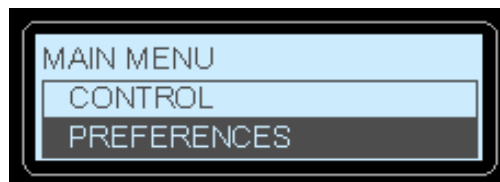
[‡] Only shown on the EMCP 3.3, and only if an optional Thermocouple or RTD module is connected and configured for one of these parameters.

language (to select between the customer language and Technician English).

NOTE: These preferences do not affect operation of the EMCP 3 or the data as viewed in the Caterpillar® Service Tool. They only affect how the text and data is converted and displayed on the EMCP 3 GSC display.

SETTING THE PREFERENCES USING THE EMCP 3 DISPLAY

On the EMCP 3 display, the Preferences menu is located at the bottom of the Main Menu.



The preferences are listed, with the current settings shown to the right (except language, whose current setting is usually obvious).



For any preference, press **ENTER KEY**  to accept the change (or **ESCAPE KEY**  to reject the change) and return to the Preferences menu.

PREFERENCES

- | | |
|----------------------------------|--|
| CONTRAST | This determines the darkness of the pixels on the display. A contrast setting of zero (reached by pressing and holding the down or left arrow) effectively blanks the screen, and a contrast setting of 100 (reached by pressing and holding the up or right arrow) effectively darkens the entire screen. |
| PRESSURE | This allows pressure parameters (such as Engine Oil Pressure) and setpoints (such as Low Engine Oil Pressure Event Threshold) to be shown in either kPa, psi, or bar. Select the desired unit with the left or right arrows. |
| TEMPERATURE | This allows temperature parameters (such as Engine Coolant Temperature) and setpoints (such as High Engine Coolant Temperature Event Threshold) to be shown in either Celsius (Centigrade) or degrees Fahrenheit. |
| VOLUME
(EMCP 3.3 only) | This allows volume parameters (such as Fuel Volume) to be shown in either Liters, Imperial Gallons, or US Gallons. |
| LANGUAGE | This allows the display to be switched between Technician English (always listed first) and the customer language (always listed second, and written in the font of the customer language). The below example shows the language selection in the German language flash file. |

The **LANGUAGE** setting has been conveniently located at the bottom of the Preferences menu, which is at the bottom of the Main Menu.



If an EMCP 3 which is set to display an unknown language, the following steps will change the language to Technician English, regardless of the current screen, and without needing to read the text.

CHANGING TO TECHNICIAN ENGLISH

Press the **ENGINE OVERVIEW**  key

Press the **ESCAPE KEY**  (this will take you to the top of the Main Menu)

SCROLL DOWN  until the scrolling stops

Press the **ENTER KEY**  (this will take you into the Preferences Menu)

SCROLL DOWN  until the scrolling stops

Press the **ENTER KEY**  (this will take you into the language selection)

Press the **ENTER KEY**  to select **TECHNICIAN ENGLISH** (shows as TECH ENGLISH on the EMCP 3.1 or 3.2)

The EMCP 3 language setting is changed back to **TECHNICIAN ENGLISH**.

Similar steps can be followed by a customer who is unfamiliar with English, to change the language setting back to their primary language:

CHANGING TO PRIMARY LANGUAGE

Press the **ENGINE OVERVIEW**  key

Press the **ESCAPE KEY**  (this will take you to the top of the Main Menu)

SCROLL DOWN  until the scrolling stops

Press the **ENTER KEY**  (this will take you into the Preferences Menu)

SCROLL DOWN  until the scrolling stops

Press the **ENTER KEY**  (this will take you into the language selection)

Press the **SCROLL DOWN**  arrow to select the customer language

Press **ENTER KEY**  to change to the customer language

The EMCP 3 language setting is changed back to the customer language.

SETTING THE PREFERENCES USING THE SERVICE TOOL

Only the preferences for units configuration can be configured using the Caterpillar® Service Tool. They are located in the Configuration Tool. Select Display Preferences from the left pane.

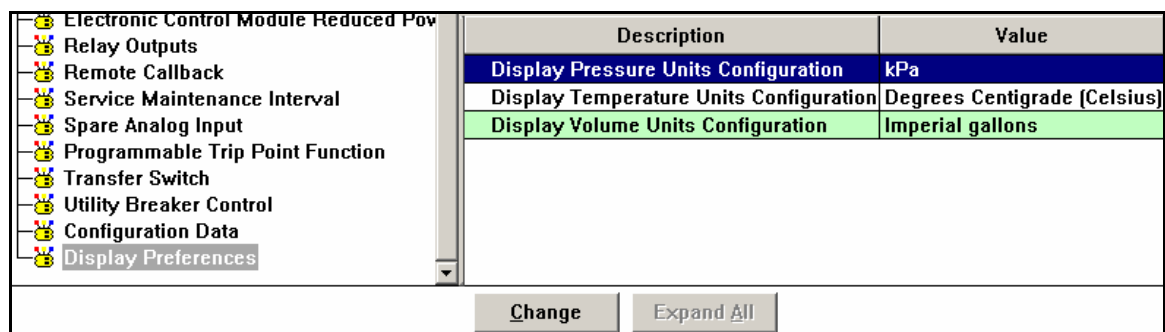


FIGURE 13: DISPLAY PREFERENCES

The display units can be changed the same way other setpoints are changed with the Service Tool.

- PRESSURE** This allows pressure parameters (such as Engine Oil Pressure) and setpoints (such as Low Engine Oil Pressure Event Threshold) to be shown in either kPa, psi, or bar. Select the desired unit with the left or right arrows.
- TEMPERATURE** This allows temperature parameters (such as Engine Coolant Temperature) and setpoints (such as High Engine Coolant Temperature Event Threshold) to be shown in either Celsius (Centigrade) or degrees Fahrenheit.
- VOLUME** This allows volume parameters (such as Fuel Volume) to be shown in either Liters, Imperial Gallons, or US Gallons.

4.3 CONFIGURING TIME/DATE (EMCP 3.2 AND 3.3)

The EMCP 3.2 and 3.3 have an internal clock that is used for time-stamping events. The timestamps for the first date and time an event has occurred and the last date and time the event has occurred are viewed by selecting an Event and pressing Enter, then scrolling down. See FIGURE 14 below.

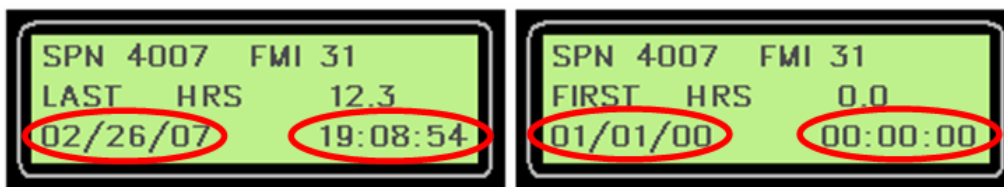


FIGURE 14: EVENT DETAILS SCREENS – LAST OCCURRENCE (LEFT) AND FIRST OCCURRENCE (RIGHT)

CHANGING DATE FORMAT

The data format can be set to either display in the form Month/Day/Year or the form Day/Month/Year. This procedure must be performed on the EMCP 3 GSC display; it cannot be done using the Caterpillar® Service Tool.

NOTE: This preference does not affect operation of the EMCP 3 or the data as viewed in the Caterpillar® Service Tool. It only affects how the date is displayed on the EMCP 3 GSC display.

To change the date format, do the following:

At MAIN MENU

ENTER KEY 

SCROLL DOWN 

to CONFIGURE

ENTER KEY 

SCROLL DOWN 

to TIME/DATE

ENTER KEY 

Highlight FORMAT MM/DD/YY

ENTER KEY 

Select the format using the

LEFT ARROW  or RIGHT

ARROW 

ENTER KEY 



(or FORMAT DD/MM/YY, depending on the current setting)

CHANGING THE TIME / DATE

The EMCP 3 clock allows the time/date to be modified. Changing the time/date will change the timestamp on all future events, but not for existing events. (For example, an event that has occurred previously will still show the same FIRST time/date, but if it occurs again after the time/date has been adjusted, the LAST time/date will reflect the change.)

This procedure must be performed on the EMCP 3 GSC display; it cannot be done using the Caterpillar® Service Tool. In order to update time/date, **LEVEL 1 ACCESS** is required. Refer to Chapter 6, Security for information on obtaining **LEVEL 1 ACCESS**.

To change the time/date, do the following:

To CHANGE THE TIME

At MAIN MENU

ENTER KEY 

SCROLL DOWN 

to CONFIGURE

ENTER KEY 

SCROLL DOWN 

to TIME/DATE

ENTER KEY 

With the box around the time, press

ENTER KEY 

To begin editing the time press

ENTER KEY 

Select a digit using the

LEFT ARROW  or RIGHT ARROW 

To change the selected digit use the

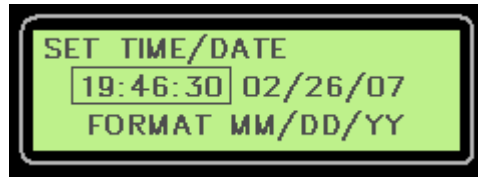
UP ARROW  or DOWN ARROW 

To accept change:

Press ENTER KEY 

To reject, change:

ESCAPE KEY 



(if the time cannot be selected, and a padlock is shown on the screen, then Level 1 access has not been obtained)



TO CHANGE THE DATE

Press ESCAPE KEY  again to return to the SET TIME/DATE screen.

Press the RIGHT ARROW  key to put the box around the date ENTER KEY .

Press ENTER KEY  again to begin editing the date.

Use the LEFT ARROW  or RIGHT ARROW  keys to select a digit and the UP ARROW  or DOWN ARROW  keys to change it.

Press ENTER KEY  to accept, or ESCAPE KEY  to reject, your change.

Press ESCAPE KEY  again to return to the SET TIME/DATE screen.

4.4 ADJUSTING GENERATOR SET PARAMETERS

On some gensets, the engine speed, generator output voltage, and idle/rated status can be adjusted from the display of the EMCP 3 GSC.

ENGINE SPEED

To program the Engine Speed of a genset it must have an electronic engine controlled by an ADEM III or newer ECM. The Primary Desired Speed Input Configuration Setpoint in the ADEM is programmed to **CAN INPUT**, then the engine speed can be adjusted from the display of the EMCP 3 GSC. The Engine Type Configuration setpoint must be programmed to **ELECTRONIC**.

PROGRAMMING THE ENGINE SPEED

From the **MAIN MENU**
select **CONTROL**

Once in that screen the first option will be highlighted and it will display one of the following: **SPEED**, **VOLTAGE**, or **SPEED & VOLTAGE**. The engine speed can only be controlled if **SPEED** or **SPEED & VOLTAGE** is displayed. If the EMCP 3 GSC is not programmed for an electronic engine, speed will not show up as an option.

Press the **ENTER KEY** 

The speed and voltage adjust screen will be displayed. To adjust the engine speed from this screen

Adjust Engine Speed:

Press **RIGHT ARROW KEY** 

To **INCREASE** the engine speed

Press **LEFT ARROW KEY** 

To **DECREASE** the engine speed

The EMCP 3 GSC will broadcast an engine speed bias based on the adjustment that is made. If the engine speed is adjusted, that value will remain until either it is adjusted again or until the control is power-cycled.

GENERATOR OUTPUT VOLTAGE

If the genset is equipped with a Caterpillar Digital Voltage Regulator (CDVR), then the generator output voltage can be adjusted from the display of the EMCP 3 GSC.

PROGRAMMING THE GENERATOR OUTPUT VOLTAGE

From the **MAIN MENU**
select **CONTROL**

Once in that screen the first option will be highlighted and it will display one of the following: **SPEED**, **VOLTAGE**, or **SPEED & VOLTAGE**. The generator output voltage can only be controlled if **VOLTAGE** or **SPEED & VOLTAGE** is displayed.

Press the **ENTER KEY** 

The speed and voltage adjust screen will be displayed. To adjust the generator output voltage from this screen

Adjust Output Voltage:

Press **UP ARROW KEY** 

To **INCREASE** the generator output voltage.

Press **DOWN ARROW KEY** 

To **DECREASE** the generator output voltage.

NOTE: In order for the **VOLTAGE ADJUST** to work, the **AVR VOLTAGE CONTROL DESIRED INPUT CONFIGURATION** setpoint in the CDVR must be programmed for **CAN INPUT**. If that setpoint is set to **SWITCH**, the **VOLTAGE CONTROL** from the EMCP 3 GSC will **NOT WORK**.

IDLE/RATED

The engine speed can be toggled between **LOW IDLE** and **RATED SPEED** from the display of the control.

From the **MAIN MENU**
select **CONTROL**

Press **DOWN ARROW** 

Press **ENTER KEY** 

To change the state,

Press **UP ARROW**  or **DOWN ARROW** 

Press **ENTER KEY** 

Highlight **IDLE/RATED**.

The **IDLE/RATED** screen will be displayed and the current state will be shown.

Then select the value.

4.5 STARTING AND STOPPING THE GENERATOR SET

STARTING THE ENGINE

Once the control is configured correctly, the control panel is powered up, and the generator set is ready to be operated, the generator set can be started. Refer to FIGURE 15, Stopping The Engine. There are several ways the generator set can be started from the control panel.

To **START** the engine in **MANUAL OPERATION**:

1. Press the **RUN KEY** 
 - or
2. Place the control in **AUTO** mode
 - then
3. The engine can be started **THREE DIFFERENT WAYS**.
 - a: Activate **DIGITAL INPUT #2**, which is the **REMOTE INITIATE INPUT**.
 - b: Activate a **REMOTE INITIATE** over the MODBUS data link.
 - c: Configure a **PROGRAMMABLE CYCLE TIMER**.

When the control panel initiates a start command on a diesel engine, the control checks to make sure there are no **SHUTDOWN EVENTS** present (labeled **PRESENT**) or that there are no latched **SHUTDOWN EVENTS** (labeled **ACTIVE**).

If there are no shutdown events that are active or present, and after any pre-crank or start-aid activities have completed, the starter motor and fuel control will be activated. The EMCP 3 GSC will activate Relay Output #1 to activate the starter motor magnetic switch, and Relay Output #2 to activate the fuel enable circuit.

On electronic engines with ADEM™ A3 or newer engine ECM, the start command and fuel enable signals will be sent from the EMCP 3 GSC to the engine ECM via the J1939 data link. After receiving the signals, the engine ECM will operate the fuel control relay and starter motor magnetic switch. Relay outputs #1 and #2 will not be used on those engines.

Relay Output #1 will remain active until the programmed **ENGINE CRANK TIME** has been reached, or until the engine speed has reached the programmed **CRANK TERMINATE SPEED** setpoint value.

NOTE: the EMCP 3 GSC Crank setpoints: number of cranks, crank duration, and crank terminate speed are not used on engines using the ADEM™ A4 with the Common Engine Interface option or newer engine ECM. These values must be adjusted in the engine ECM.

CAUTION: To determine the exact starting sequence for your engine, consult your engine's Operation and Maintenance Manual.

STOPPING THE ENGINE

Once the engine is started, the engine can be stopped by pressing the **STOP KEY**  on the control panel. If the control is in **AUTO**, the engine can also be stopped by **DEACTIVATING** all of the remote initiate commands. There are three possible sources for this command:

1. The remote initiate input (digital input #2)
2. The remote initial command over the Modbus datalink (register number 1055)
3. The Programmable Cycle Timer

Once the **STOP** command is issued, the control will go into **COOLDOWN MODE**. Cooldown mode will run for the duration of time that it is programmed in the **COOLDOWN DURATION** setpoint. If the cooldown time is set for zero minutes, the engine will stop immediately.

On engines with ADEM™ A4 or newer engine ECM, the cooldown timer in the EMCP 3 GSC should be set to 0 (Zero) minutes because the cooldown time is controlled from the engine ECM (if this is not done, both cooldown timers will run in sequence). Also, the **ENGINE OPERATING STATE INPUT CONFIGURATION** parameter must be set to **CAN INPUT**.

The cooldown timer can be overridden by pressing and holding the **STOP KEY**  for 5 seconds. The display will show a splash screen that will ask if you want to **BYPASS COOLDOWN?** or continue with the cooldown cycle.

If the **ENTER KEY**  is pressed from the splash screen, the cooldown timer will be bypassed.

If the **ESCAPE KEY**  is pressed from the splash screen, the cooldown cycle will continue until the programmed cooldown time has elapsed.

When the cooldown timer has elapsed or has been bypassed, Relay Output #2 will open. The **STOP** command will also be sent over the J1939 data link for those engines that require it. At that point, the fuel injection will be **DISABLED** and the engine will stop.

Any time, while the engine is **RUNNING**:

The EMCP 3 GSC detects a condition where an engine or generator parameter is **ABOVE** or **BELOW** programmed thresholds for a programmed amount of time or another **SHUTDOWN EVENT** occurs, then the EMCP 3 GSC will attempt to shut the engine down

Depending on how a specific **EVENT RESPONSE** configuration is programmed, the EMCP 3 GSC will either put the engine in **COOLDOWN**, followed by a soft shutdown or shut the engine down immediately (a **HARD SHUTDOWN**).

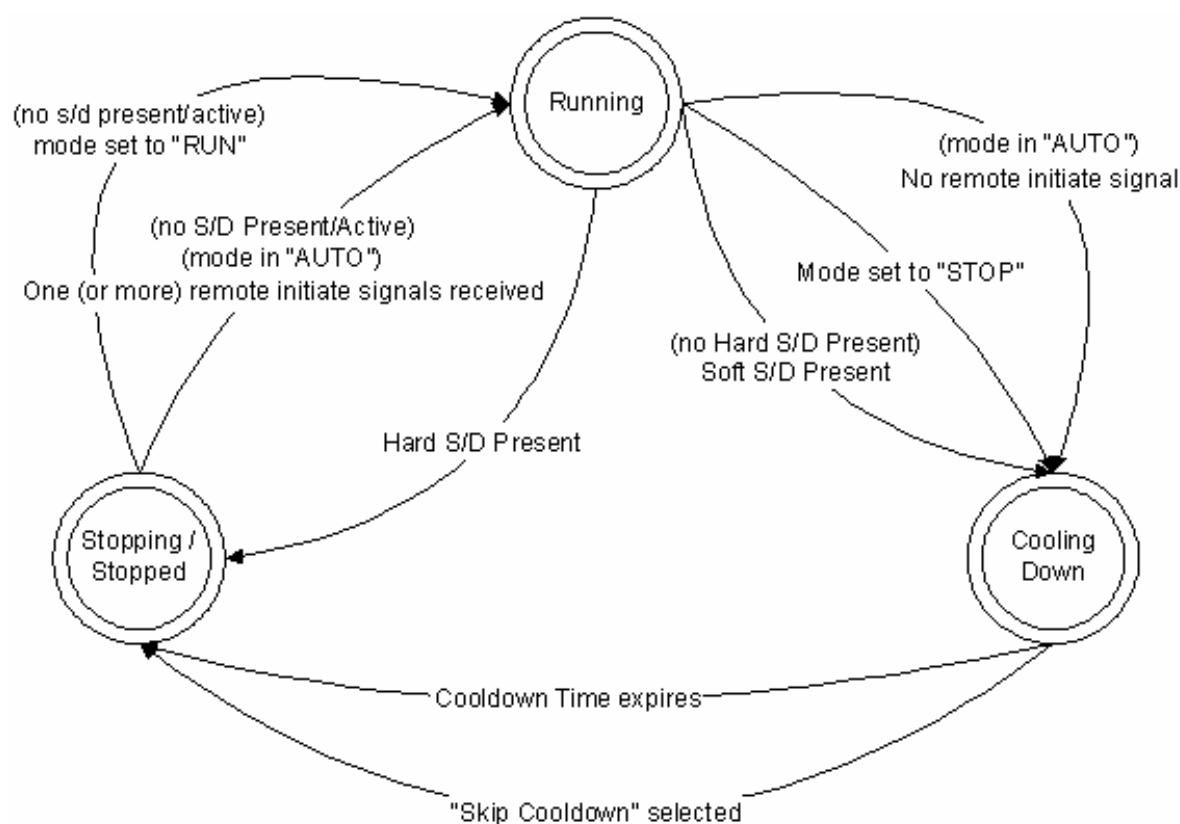


FIGURE 15: STOPPING THE ENGINE

4.6 ENGINE SETPOINT VERIFICATION

The engine setpoint verification procedure verifies that the EMCP 3 GSC operates correctly when **OIL PRESSURE**, **HIGH COOLANT TEMPERATURE**, **LOW OR ENGINE OVERSPEED** events occur.

On an **ENGINE OVERSPEED EVENT**, the EMCP 3 GSC will shut the engine down.

LOW OIL PRESSURE and **HIGH COOLANT TEMPERATURE** each have two events, **WARNING** and **SHUTDOWN**. The EMCP 3 GSC will issue a **WARNING** whenever the warning threshold is reached and a **SHUTDOWN** whenever the shutdown threshold is reached. The configuration setpoints used in normal operation will be modified.

During this procedure

- ☒ Each configuration setpoint should be recorded prior to adjustment.
- ☒ Returned back to the original setting after the setpoint has been verified.

The following conditions are required before the **ENGINE SETPOINTS** are verified:

REQUIRED CONDITIONS

- ☒ The setpoints must be correct for the engine application.
- ☒ No shutdown events should be present. If necessary, troubleshoot, correct, and reset any and all shutdown events.

PROCEDURE FOR OVERSPEED VERIFICATION

NOTE: Adjustment of **ENGINE OVER SPEED SHUTDOWN THRESHOLD** setpoint requires a level 3 password. For details on changing security levels refer to Chapter 6, Security.

The Security Level only affects changing parameters from the EMCP 3 GSC. Changing parameters with the Caterpillar[®] Service Tool does not require passwords.

1. Start the engine and run the engine at rated speed.
2. Adjust the setpoint value for Engine Over Speed Shutdown Threshold to a value that is below the speed that the engine is running at. An Engine Overspeed Shutdown event will occur immediately after the setpoint is changed, and the engine will shut down.
3. View the event by going to the Genset Control event log. Reset the event. For more information about how to view and reset the event, refer to Chapter 5, Handling Events.
4. Return setpoint value for Engine Over Speed Shutdown Threshold to the original value.

PROCEDURE FOR LOW OIL PRESSURE VERIFICATION

NOTE: Low oil pressure shutdown is disabled during start-up and while the engine is not running by the Fault Protection Timer (FPT). The fault protection timer starts timing when the crank terminate RPM is reached during the starting sequence. The fault protection timer will then run for a programmed time which is determined by the Engine Start Fault Protection Activation Delay Time setpoint. Make sure the fault protection timer has elapsed before starting the Low Oil Pressure Verification.

1. Start the engine and run the engine at rated speed.
2. Adjust the setpoint value for Low Engine Oil Pressure Shutdown Event Threshold to a value that is above the oil pressure that the engine is operating at. The shutdown event will occur after the programmable time delay (the Low Engine Oil Pressure Shutdown Delay Time setpoint).
3. View the event by going to the Genset Control event log. Reset the event. For more information about how to view and reset the event, refer to Chapter 5, Handling Events.
4. Return setpoint value for Low Engine Oil Pressure Shutdown Event Threshold to the original value.

PROCEDURE FOR HIGH COOLANT TEMPERATURE VERIFICATION

NOTE: High Coolant Temperature shutdown is disabled during start-up and while the engine is not running by the Fault Protection Timer (FPT). The fault protection timer starts timing when the crank terminate RPM is reached during the starting sequence. The fault protection timer will then run for a programmed time (the Engine Start Fault Protection Activation Delay Time setpoint). Make sure the fault protection timer has elapsed before starting the High Coolant Temperature Verification.

- 1: Start the engine and run the engine at rated speed.
- 2: Adjust setpoint value for High Engine Coolant Temperature Shutdown Event Threshold to a value that is below the engine coolant temperature that the engine is operating at. The minimum value for this setpoint is 49°C (120°F), so you may have to run the engine for a few minutes to get the temperature above the minimum value. The shutdown event will occur after the programmable time delay (the High Engine Coolant Temperature Shutdown Event Notification Delay Time setpoint).
- 3: View the event by going to the Genset Control event log.
- 4: Reset the event. Refer to Handling Events for more information about how to view and reset the event.
- 5: Return setpoint value for High Engine Coolant Temperature Shutdown Event Threshold to the original value.

4.7 ENGINE SPEED TIMING CALIBRATION - PREPARATION

The following procedure describes the required steps before an **ENGINE SPEED TIMING CALIBRATION** procedure is performed. After this procedure has been completed, the engine can be started and the engine can be run at rated speed.

NOTE: This procedure does **NOT** include the instructions for performing the actual calibration. For instructions on performing the calibration procedure, refer to the Testing and Adjusting Manual for your engine.

NOTE: Before changing any value per this procedure, **RECORD THE ORIGINAL VALUE!**

- 1: Stop the engine.
- 2: In the main menu scroll down until **CONTROL** is highlighted. Press the **ENTER KEY** . Scroll through the options in the control menu. If there is an option called **IDLE/RATED**, go to Step 3. If not go to Step 5.
- 3: Make sure the **IDLE/RATED** option is highlighted and press **ENTER KEY** . If the display shows **RUN AT IDLE** in the **IDLE/RATED** screen, go to Step 10. If the display shows **RUN AT RATED** in the **IDLE/RATED** screen, go to Step 4.
- 4: Press the **ENTER KEY**  and then use the **UP ARROW**  and **DOWN ARROW**  keys in order to select **RUN AT IDLE**. Press **ENTER KEY**  to accept the new value. Go to step 10.

- 5: Set the **ENGINE START FAULT PROTECTION ACTIVATION DELAY TIME** setpoint (under Control > Auto Start/Stop) in the EMCP 3 GSC to 300 seconds.
- 6: If a device such as a load share module is supplying a PWM signal in order to bias the engine speed, then disconnect the PWM signal wires from the device. Go to Step 7. If there is not a device supplying a PWM signal and the engine speed bias is controlled from the EMCP 3 GSC, go to Step 9.
- 7: Set the **PRIMARY DESIRED SPEED** setpoint in the Engine ECM to **PWM**.
- 8: Set the **SECONDARY DESIRED SPEED** setpoint in the Engine ECM to **DISABLED**.
- 9: Start the engine and run the engine at idle speed.
- 10: Perform the Engine Speed Timing Calibration. See the Systems Operation, Testing and Adjusting manual for your engine for more information on how to perform the calibration procedure.
- 11: Stop the engine.
- 12: Return any modified setpoints to the original values.
- 13: Reconnect any wires that were disconnected in Step 6.
- 14: If steps 3 and 4 were performed, set the idle/rated status back to **RUN AT RATED**.

4.8 ENGINE OPERATING HOURS

One of the features of the EMCP 3 is the ability to maintain the **ENGINE OPERATING HOURS**, which is the cumulative amount of time that the engine has run above the Crank Terminate speed. This time is displayed on the Engine Overview screen, just below Battery Voltages shown in FIGURE 16.

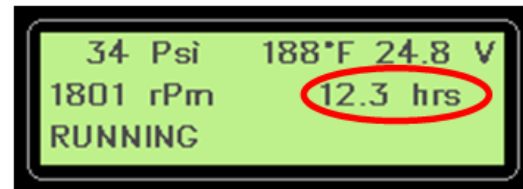


FIGURE 16: ENGINE OVERVIEW SCREEN

UPDATING ENGINE OPERATING HOURS

For applications where a new EMCP 3 GSC is fitted to a generator set that was previously in operation, the EMCP 3 allows the user to increment the engine hours to match the engine.

NOTE: Engine Hours can only be increased. They cannot be decreased.

This procedure must be performed on the EMCP 3 GSC display; it cannot be done using the Caterpillar® Service Tool. In order to update engine hours, **LEVEL 3 ACCESS** is required. Refer to Chapter 6, Security for information on obtaining **LEVEL 3 ACCESS**.

UPDATING ENGINE HOURS

At MAIN MENU

SCROLL DOWN  to:

ENG OPERATE HRS

ENTER KEY 

To edit the **ENGINE HOURS**:

Select a digit using the

LEFT ARROW  or

RIGHT ARROW 

To change the selected digit
use the

UP ARROW  or

DOWN ARROW 

To accept change:

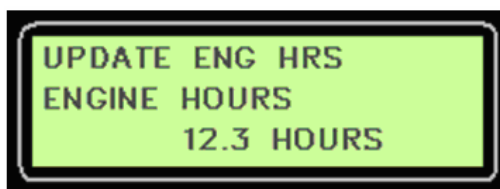
Press ENTER KEY 

To reject, change:

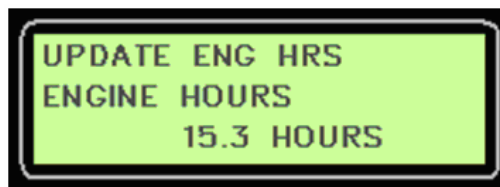
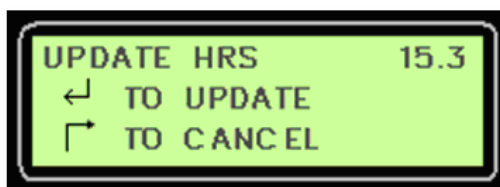
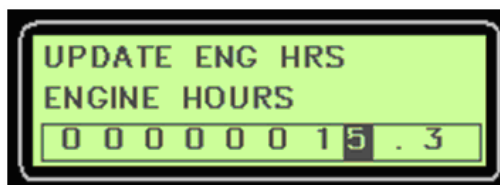
Press ESCAPE KEY 

Again, press ENTER KEY  to confirm, or

ESCAPE KEY  to reject the change.



(if pressing Enter on this menu item has no effect, then Level 3 access has not been obtained)



5 HANDLING EVENTS

The EMCP 3 shows previous and current events. These events are organized into logs for each physical EMCP 3 module.

The logs include:

EMCP 3.1, 3.2, AND 3.3

GENSET CONTROL	Events for the EMCP 3 GSC
ENGINE CONTROL	Events for a J1939-compatible engine ECM
DIGITAL AVR	Events for the Caterpillar Digital Voltage Regulator (CDVR)

EMCP 3.2 AND 3.3 ONLY

EXTERNAL I/O	Events for an Auxiliary Input/Output module (DIO)
--------------	---

EMCP 3.3 ONLY

THERMOCOUPLE	Events for the thermocouple module
RTD MODULE	Events for the Resistive Temperature Device (RTD) module

Each log is visible only if the module is connected to the appropriate EMCP 3 J1939 data link, and is communicating with the EMCP 3 GSC.

The EMCP 3 supports more than one instance of some of the above modules. (See Chapter 17, Optional Modules, for the number of modules supported by each of the EMCP 3.1, 3.2, or 3.3 systems). Those modules are uniquely identified with a number at the end of the log name, such as EXTERNAL I/O #2.

The number is software-configured, and is called the module's **ECU INSTANCE NUMBER**. The ECU Instance Number can be viewed and modified by the Caterpillar® Service Tool. See the appropriate sub section of Chapter 17, Optional Modules, for the expansion module in question, to see how to program the Instance Number.

Events for the EMCP 3 GSC can be in three states; **PRESENT**, **ACTIVE**, or **INACTIVE**.

PRESENT	The condition that caused the event is still present. The condition needs to be addressed before the event can be reset.
ACTIVE	The condition that caused the event is no longer present, but the event must be manually reset in order to return to normal operation. (See Chapter 5.3, 5.4, and 5.5 on how to Reset Events).
INACTIVE	The event has happened at some time in the past but is no longer affecting the system. Inactive events are stored for historical purposes only.

Events for the other modules are only shown as **ACTIVE** or **INACTIVE**, in other words, there is no indication on whether the condition that caused the event is still present.

There are three categories of events that can occur; **ACTIVE ONLY** events, **WARNINGS**, and **SHUTDOWNS**.

ACTIVE ONLY	Active Only events merely show up in the event log for information purposes, and are not logged after the condition goes away.
WARNING	If a Warning occurs, the amber LED on the control will flash and the warning will appear in the event log. The engine will not shut down. In most cases, a Warning will reset itself as soon as the condition that caused it goes away.

However, if the setpoint Event Warning Condition Response Auto Reset Enable Status is set to False, then all Warnings will remain in the Active state, with the amber LED on, until they are manually reset.

SHUTDOWN If a shutdown event occurs, the engine will shutdown, and the red LED will flash on the control. A shutdown event is a latched event and will not reset itself. The condition that caused the shutdown must first be fixed, only then can the event be reset.

NOTE: Information on how to reset events is given further on in this Chapter.

5.1 CONFIGURING EVENT RESPONSES

The category of event, as well as other behavior when an event occurs, can be configured via a group of EMCP 3 GSC setpoints called EVENT RESPONSE CONFIGURATION. An example of an event response configuration is **ENGINE LOW OIL PRESSURE WARNING EVENT RESPONSE CONFIGURATION**. This setpoint configures the system response to a low engine oil pressure warning event.

The following is a list of all the possible options for an event response configuration:

WARNING	Creates a Warning event in the event log and lights the amber LED.
AUDIBLE ALERT	Activates any relays that are programmed for horn control. Without programming a relay, no action will be taken. Audible Alert can only be programmed if: either Warning or Shutdown is also programmed.
SOFT SHUTDOWN	Creates a Shutdown event in the event log, lights the red LED, and shuts the engine down after the cooldown period (Note: the control must be configured to have control of the generator breaker in order to be able to cool down the set offload).
HARD SHUTDOWN	Creates a Shutdown event in the event log, shuts the engine down immediately and lights the red LED.
UTILITY FAILURE	Indicates a Utility Failure, which can be used by internal logic or to trigger outputs.
BREAKER #1 TRIP	Activates a Breaker #1 Trip, which can be used by internal logic or to trigger outputs.
BREAKER #2 TRIP	Activates a Breaker #2 Trip, which can be used by internal logic or to trigger outputs.
FAULT PROTECTION TIMER ENABLED	Suppresses the event until the engine is running and the Fault Protection Timer has expired (this prevents nuisance events during startup). The fault protection timer starts when the engine speed goes above crank terminate speed.
ACTIVE ONLY	Creates an Active Only event in the event log.

NOTE: Not all options are available for all setpoints. For example, the Engine Low Oil Pressure Warning event cannot be configured as a shutdown, because there is a separate event (Engine Low Oil Pressure Shutdown) dedicated for that purpose.

5.2 CHANGING AN EVENT RESPONSE CONFIGURATION

To change an event response configuration, the control must be in **STOP** mode.

Here are the steps to access event response configurations on the EMCP 3 GSC display.

START AT:

MAIN MENU

scroll down  to:

CONFIGURE

ENTER KEY 

scroll down  to:

SETPOINTS

ENTER KEY 

scroll down  to:

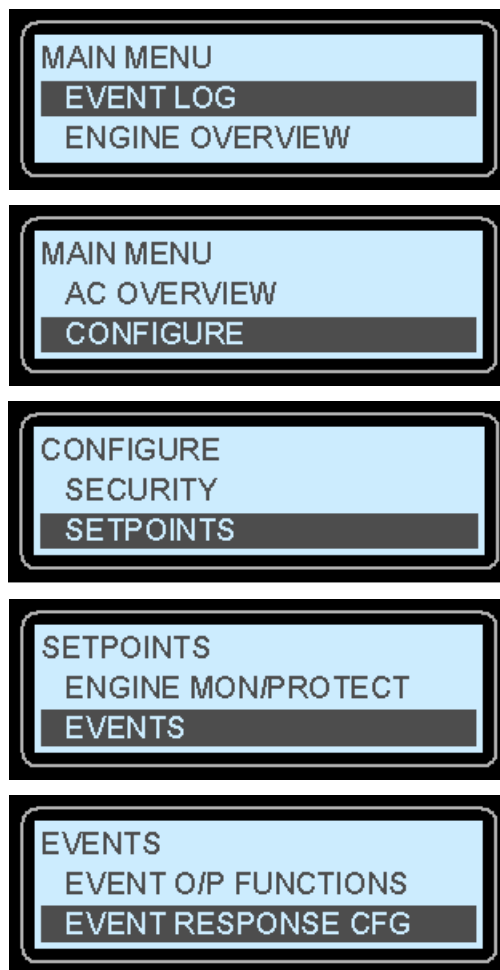
EVENTS

ENTER KEY 

scroll down  to:

EVENT RESPONSE CFG

ENTER KEY 



Now, choose the group for the event to configure.

The group name should help find the setpoint. However, a list of setpoints in each group (also called a Block) is given in APPENDIX D. Block numbers are given in APPENDIX C.

FOR EXAMPLE:

To see the list of all event response configurations that are part of **DIAGNOSTIC CONFIGURATION**, notice in APPENDIX C that it is Block 17. Then in APPENDIX D, find the list of setpoints in Block 17. Notice that there are 31 setpoints in that particular Block.

EXAMPLE:

Select

DIAGNOSTICS CFGENTER KEY 

In this group of event response configurations, there are four types of events, grouped by the type of data: Pressures, Temperatures, Levels, and Others (such as status).

EXAMPLE:

Select

PRESSURESPress ENTER KEY 

To edit a setpoint,

Press RIGHT ARROW key to highlight **EDIT**.

This brings up a list of event response configuration setpoints.

NOTE: This will only work if the control is in **STOP** mode. Some setpoints cannot be configured, or require a minimum security level. Those setpoints will display a lock icon to the right of the **EDIT** text.

Then,

Press ENTER KEY 

to edit the setpoint.

Use the LEFT ARROW  andRIGHT ARROW  to toggle between checked and unchecked, and use the UPARROW  and DOWN ARROW to move between the responses.

Here you can edit individual responses, as described above.



Some responses are fixed and cannot be disabled. For those responses, a lock will be displayed instead of a checkbox.

5.3 **RESETTING INDIVIDUAL EVENTS FOR THE EMCP 3 GSC**

There are three ways to reset events. One way, described in this Chapter, which applies to the EMCP 3 GSC only, is to reset individual events by navigating to the desired event in the event log.

The second way, which applies to all modules other than the EMCP 3 GSC, is to reset all events in that modules event log by navigating to one of the active events in the event log.

The third way is a shortcut to reset all events for all modules. With any method, you must be in **STOP** mode.

To reset individual events on the EMCP 3 GSC, start by navigating to the event log:

From the top of the Main Menu, enter Event Logs by pressing the Enter key.

FROM:

MAIN MENU

Select

EVENT LOGS

by pressing the

ENTER KEY 

Scroll up  or down  to
select the desired log and

Press ENTER KEY 

Scroll up  or down 
through the list of events and
find the **ACTIVE** event that
requires resetting.

Press ENTER KEY 
to view the event details.

Pressing the

ENTER KEY 
will RESET the event.



Next, select the log that contains the event that needs to be RESET.



In this example image, there are only two **PRESENT** or **ACTIVE** events, and they are both in the **GENSET CONTROL** log.



Events are ordered by the status of the event; **PRESENT** events are listed first, followed by **ACTIVE** events, and finally the **INACTIVE** events.



If the control is in **STOP** mode, **RESET** will be shown and highlighted.

NOTE: If the event status is present, the **RESET** text will **not** be visible and the event cannot be reset until the condition that caused the event has been addressed.

5.4 RESETTING ALL EVENTS FOR A SINGLE MODULE

The second way to reset events, described in this Chapter, which applies to all modules other than the EMCP 3 GSC, is to reset all of the module's events by navigating to one of the active events in the event log.

With any method, you must be in **STOP** mode. A key difference between the EMCP 3 GSC and all other modules is that the other modules don't display a **PRESENT** status for events.

Events are shown as **ACTIVE** if they are currently affecting the system, or as **INACTIVE** if they are not.

To reset all of a modules events on any individual module except the EMCP 3 GSC (listed as **GENSET CONTROL** in the event log), start by navigating to the event log.

FROM:

MAIN MENU

Select

EVENT LOGS

by pressing the

ENTER KEY 

Scroll up  or down  to
select the desired log and

Press ENTER KEY 

Press ENTER KEY 

to view the event details.

Pressing the

ENTER KEY 

will RESET all events.



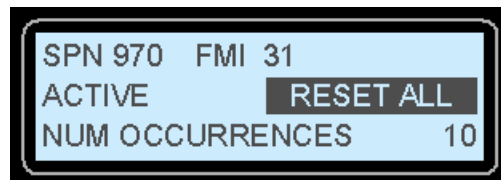
Next, select the log which contains the event that needs to be reset. In this example image, there is only one ACTIVE event, and it is in the ENGINE CONTROL log.



Events are ordered by the status of the event; **ACTIVE** events are listed first, followed by the **INACTIVE** events. Scroll up or down through the list of events and find the **ACTIVE** event that requires resetting.



If the control is in STOP mode, and engine speed is zero, **RESET ALL** will be shown and highlighted.



Pressing the enter key will reset all of the **ACTIVE** events in that module's event log that can be reset.

NOTE: Modules other than the EMCP 3 GSC cannot display events as **PRESENT**.

So if pressing **ENTER KEY**  at **RESET ALL** doesn't reset all of the events, the condition causing the event being viewed may still be present. For example, if the engine shut down on high coolant temperature, then the events will not reset until the coolant temperature drops below the shutdown threshold.

5.5 RESETTING ALL EVENTS FOR ALL MODULES

The third way to reset events, described in this Chapter, is a shortcut to reset all events for all modules. With any method, you must be in **STOP** mode.

Once all of the events have been viewed and the condition(s) that are causing the events have been corrected, all active events (those for which the condition is not present) on all modules can be reset using the **RESET ALL EVENTS** feature.

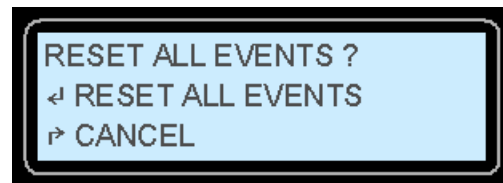
In order to do this, the control must be in **STOP** mode and engine speed should be zero.

FROM ANY SCREEN:

Press the and hold the

ACKNOWLEDGE 

for approximately **5** seconds.



A confirmation prompt will appear.

Pressing the

ENTER KEY 

will continue and **RESET** all events on all modules.

Pressing the

ESCAPE KEY 

will **CANCEL** the reset operation.

NOTE: Reset All Events will not reset Present events! For example, if the E-Stop switch is pressed and an **EMERGENCY STOP SWITCH ACTIVATED SHUTDOWN** is present, it cannot be reset until the E-Stop is pulled out and the event status changes from **PRESENT** to **ACTIVE**.

5.6 RESETTING EVENTS FOR ENGINE ECMS WITHOUT J1939 SUPPORT

The EMCP 3 GSC support for engine events depends on the type of engine ECM. This is configured with the setpoints **ENGINE TYPE CONFIGURATION** and **ENGINE CONTROL J1939 DATA LINK SUPPORT CONFIGURATION**.

The functionality available for the different types of engine ECM is shown in Table 4: ECM Functionality.

TABLE 4: ECM FUNCTIONALITY

ECM FUNCTIONALITY

Engine Type Configuration	Engine Control J1939 Data Link Support Configuration	Engine Events Functionality
Mechanical		None
Electronic	No J1939 Support	Can reset all events only
Electronic	Basic J1939 Support	Can view and reset all events
Electronic	Enhanced J1939 Support	Can view and reset all and view additional event info

The EMCP 3 GSC has the ability to reset all events for electronic engines with no J1939 support by means of a relay output. A number of conditions must be satisfied in order for this to work.

FIRST: One of the Digital Selectors must be configured for **ECU FAULT RESET**. Refer to Digital Selector Options, in Chapter 10.1 for a list of options for Digital Selectors.

SECOND: The corresponding relay output must be wired to a corresponding Fault Reset I/O pin on the engine ECM or it must be setup to power cycle the ECM.

THIRD: The EMCP 3 GSC setpoints given in the table above must be set properly. Engine Type Configuration must be set to **ELECTRONIC** and Engine Control J1939 Data Link Support must be set to **No J1939 SUPPORT**.

In that case, the Engine Control will not be listed in the EMCP 3 GSC display event log. However, there will be an option to **RESET ALL ENGINE EVENTS**.

Pressing the **ENTER KEY**  with this option selected will activate the **ECU FAULT RESET**, which will activate the corresponding relay output and trigger the engine ECU to reset its faults or will power cycle the ECU.

5.7 TROUBLESHOOTING RESETTNG EVENTS

There are common reasons for the EMCP 3 GSC not allowing events to be reset. First of all, in order to reset any event, the EMCP 3 GSC must be in STOP mode. In order to reset engine ECM events, the engine speed must also be zero.

One common confusion about events is the **SERVICE MAINTENANCE INTERVAL WARNING**. This event is explained in the following Chapter.

NOT IN AUTO

Another event that can cause confusion is **NOT IN AUTO**. This event is Present whenever the control is in either RUN or STOP. As a result, it **can not** be reset in STOP (as the event is present). The event will reset when the control is returned to **AUTO** .

If Event Warning Condition Response Auto Reset Enable Status is set to Disabled (so that warning events do not auto-reset) and the event response configuration for **NOT IN AUTO** is set to a Warning then it will not be possible to reset the **NOT IN AUTO** event.

It will be Active when the control is in Auto and Present when the control is in **STOP**. If it is a requirement for Event Warning Condition Response Auto Reset Enable Status to be Disabled then it is strongly recommended to make the event response configuration of Not in Auto **ACTIVE ONLY** rather than Warning.

SERVICE MAINTENANCE INTERVAL

If a **SERVICE MAINTENANCE INTERVAL WARNING** is **PRESENT**, it **cannot** be reset. The warning is **PRESENT** because the countdown timer has reached zero. To clear the warning, the timer must be reset, rather than the event. When the timer is reset, it returns to the programmed interval (default is 180 calendar days or 500 engine hours). This timer must be reset from the display; it cannot be reset by using the Service Tool alone.

TO RESET THIS TIMER:

Start by pressing

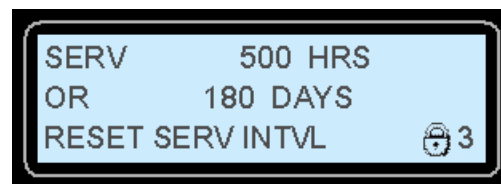
ENGINE OVERVIEW 

SCROLL DOWN 

until you reach

SERVICE MAINTENANCE INTERVAL
screen

Accessible by pressing the **ENGINE OVERVIEW**  shortcut key which is just below the display, on the right: see 0.



The security level required is level 3 but, the required security level can be changed by using the Service Tool.

On the Service Tool, enter the Configuration screen, and select the group on the left called **SERVICE MAINTENANCE INTERVAL**. The third setpoint in that block is:

Change that to a lower level.

PASSWORD LEVEL REQUIRED TO RESET SERVICE MAINTENANCE INTERVAL.

To **RESET** the service interval

Press **ENTER KEY** 



Then the service maintenance interval can be reset from the display. Once at this screen, **RESET SERV INTVL** is highlighted

Going back into the event log should show that the **SERVICE MAINTENANCE INTERVAL WARNING** has become **INACTIVE**.

CAUTION: Be sure to change the password level (using the Service Tool) back to **LEVEL 3** after the reset, to prevent inadvertently resetting the timer at other times!

6 SECURITY

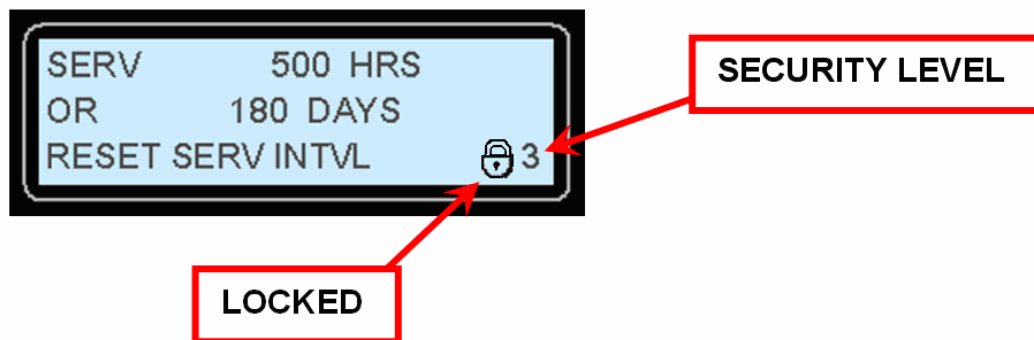
There are five levels of security access on EMCP 3 GSC display. **LEVEL 0**, **LEVEL 1**, **LEVEL 2**, **LEVEL 3**, and **SERVICE TOOL** are the five levels. Any configurable parameter or function that is set to Level 0 can be accessed by anyone at any time, and there will never be any security information on the display screen.

LEVEL 1 ACCESS and **LEVEL 2 ACCESS** represent increasing levels of access to the setpoints and functions of the controller. Both levels 1 and 2 can be password protected with separate user-defined passwords.

LEVEL 3 ACCESS is password protected at the factory, and requires contacting the Caterpillar **DEALER TC** to obtain a password.

If the present security level of the controller is below the level needed to perform a desired function, a padlock and a number will be displayed at the bottom right hand corner of the display. The number represents the level of security that is required in order to perform the desired function; 1, 2, or 3.

If there is a padlock but no number, then the Caterpillar® Service Tool is required in order to perform the desired function; or the setpoint may be read only and cannot be changed.



All of the adjustable parameters are associated with a specific level of security required to make an adjustment to the parameter. Certain functions, such as resetting the number of crank attempts, are also associated with a specific level of security. The passwords only affect actions taken at the EMCP 3 GSC. Access of the EMCP 3 GSC remotely via the Caterpillar® Service Tool or via the SCADA data link is not affected by the security level on the EMCP 3 GSC display.

Changing parameters with the Caterpillar® Service Tool does not require passwords, since the Service Tool is already at the Service Tool security level.

When connecting via the **SCADA DATA LINK**, passwords can also be used. The levels of access granted via SCADA are identical to the levels of access granted at the EMCP 3 GSC. However, the passwords themselves may differ. Further more, the EMCP 3 GSC and the SCADA data link may be at different levels of access at any given time. For more information about SCADA security see Chapter 21.1 DATA LINK SECURITY.

Level 1 and Level 2 passwords are **DISABLED** when shipped from the factory. Level 1 and Level 2 passwords can be user defined if desired. If the Level 1 and Level 2 passwords are not user defined, the Level 2 will be the **MINIMUM LEVEL**. All parameters that require Level 0, Level 1, or Level 2 security will be able to be changed by anyone at any time.

NOTE: The EMCP 3 GSC will always move up in security level to the highest level of access that is not password protected when a certain level of access is requested. For example, if a Level 1 password has been defined, but a Level 2 password has not, the GSC will start at Level 0 on power up. When the Level 1 password is entered, the GSC will move up to Level 2 access.

THE SECURITY MENU

To get to the security menu:

At the **MAIN MENU** screen

SCROLL DOWN  to:

CONFIGURE

Press **ENTER KEY** 

At **SECURITY**

Press **ENTER KEY** 



The **SECURITY MENU** will show the current level of security at the top of the screen.

There are six options on the security menu:

DROP TO MIN LEVEL

ENTER LEVEL 1 or 2

ENTER LEVEL 3

CHANGE LVL 1 PSWD

CHANGE LVL 2 PSWD

CHANGE SCADA PSWD

Selecting **DROP TO MIN LEVEL** will make the control go to the minimum level of security. As previously discussed, if the level 1 and level 2 passwords are not defined by the user, the minimum level of security will be level 2. If a level 2 password is defined by the user, but not a level 1 password, then the minimum level of security will be level 1.

In contrast, if a level 1 password is defined by the user, but not a level 2 password, then the minimum level of security will be level 0.

Selecting **ENTER LEVEL 1 OR 2** will open up a password entry screen. The password entry screen will have 16 spaces. In each space a numbers from 0 through 9 can be entered. The password can be from 1 to 16 digits and is entirely user defined. Enter the password for either level 1 or level 2 if either of those passwords have been defined.

Selecting **ENTER LEVEL 3** will cause the display to say **PHONE IN WITH** and a 16 digit number will be displayed. Under that, **ENTER RESPONSE** will be highlighted. Record the 16 digit number and call the Caterpillar Dealer TC with this number. The TC will reply with another 16 digit number.

Press **ENTER**  from the **PHONE IN WITH** screen, and a password entry screen will be displayed. Enter the password that was supplied by the TC.

Press **ENTER**  after entering the number and the current level should be 3. The control will remain in level 3 security level until no key presses have been made for 10 minutes. After 10 minutes of inactivity the control will revert back to the minimum level of security.

NOTE: To change a level 3 parameter requires either a level 3 password from the TC or a PC connection using a Service Tool. Therefore, if you have a Service Tool, try to change the parameter using the Service Tool rather than calling the TC.

Selecting **CHANGE LVL 1 PSWD** will allow for the level 1 password to be changed. The control must be at level 1 security in order to select **CHANGE LVL 1 PSWD**. The **CHANGE LVL 1 PSWD** screen looks just like the password entry screen. It has 16 blank spaces that can each be set to a number from 0 to 9. The password can use as few as one digit and can use as many as 16 digits. It is entirely up to the user. If a password has been set but, it is now desired to **not** have level 1 password protection, the level 1 password can be disabled by setting the password to be a single 0.

Once the desired password is entered, press the **ENTER KEY**  and the control will go back to the security screen and the level 1 password will be set.

Selecting **CHANGE LVL 2 PSWD** will allow for the level 2 password to be changed. The control must be at level 2 security in order to select **CHANGE LVL 2 PSWD**. The **CHANGE LVL 2 PSWD** screen looks just like the password entry screen. It has 16 blank spaces that can each be set to a number from 0 to 9. Selecting a password is entirely up to the user and can use as few as one digit or as many as 16 digits.

The level 2 password can be disabled by setting the password to be a single 0.

Once the desired password is entered, press the **ENTER KEY**  and the control will go back to the **SECURITY SCREEN** and the level 2 password will be set.

Selecting **CHANGE SCADA PSWD** will allow for the SCADA password to be changed.

This password, if **ENABLED**, will require a SCADA system to first enter the password into the **WRITE ACCESS PASSWORD** register prior to conducting any other reads and writes. The control must be at level 2 security in order to select **CHANGE SCADA PSWD**. The **CHANGE SCADA PSWD** screen looks just like the password entry screen. It has 8 blank spaces that can each be set to a number from 0 to 9. The password can use as few as one digit and can use as many as 8 digits.

Just as with level 1 and level 2 passwords, entering a single 0 will **DISABLE** the SCADA password. See Chapter 21.1 Data Link Security for more information.

7 SETPOINTS

The EMCP 3.1, 3.2, and 3.3 have a variety of setpoints (for example: there are over 500 setpoints on EMCP 3 GSC) that can be programmed or adjusted. These setpoints can be adjusted via the display, the Caterpillar® Service Tool, or over the SCADA data link (not available on EMCP 3.1). For more information about programming setpoints over the SCADA data link, see EMCP 3 GSC SETPOINTS Chapter 21.10. In order to program the setpoints via the display, go through the following menu options.

MAIN MENU

SCROLL DOWN  to:



CONFIGURE

Press ENTER KEY 



SCROLL DOWN  to:

SETPOINTS

Press ENTER KEY 



7.1 THREE TYPES OF SETPOINTS

Setpoints can be three different types; **NUMERICAL ENTRY**, **MENU**, or **EVENT RESPONSE**. In the case of the event response configurations there are **OPTIONS** with check boxes next to them.

NUMERICAL ENTRY setpoints are parameters like time delays, thresholds, etc. For these setpoints the display will show the current value. If that value is to be changed, first the control must be in the proper level of security. See **SECURITY** Chapter 6 for more information about the level of security.

1. To change the value of a setpoint, press the **ENTER KEY** . The current value of the setpoint will be shown with the rightmost digit highlighted.
2. Use the **UP**  and **DOWN**  arrow keys to adjust that digit to the desired value.
3. Once that digit is set to the desired value, use the **LEFT**  arrow key to move the cursor to the next digit.
4. Then use the **UP**  and **DOWN**  arrow keys to adjust that digit to the desired value.
5. Continue this process until the desired value for the setpoint is set.
6. Then press the **ENTER KEY**  to save the value.

MENU type setpoints, such as generator configuration, have options that are not numerical. For these setpoints, the display will show the current setting.

If that setpoint is to be changed:

1. The control must be in the proper level of security. See Chapter 6 SECURITY for more information about the level of security.
2. Then, to change the value of the setpoint, press the **ENTER KEY** .
3. The current setting will be highlighted. Use the **UP**  and **DOWN**  arrow keys to scroll through the options that are available for that setpoint.
4. When the desired option is displayed, press the **ENTER KEY**  to save the setting.

EVENT RESPONSE setpoints configurations are a little different from the previously discussed setpoints. Selecting **EVENT RESPONSE CONFIG** will display four more submenus.

Those four submenus contain all of the possible events that can be generated by the EMCP 3 GSC. Two of the submenus, **DIAGNOSTICS CONFIG**, and **ENG PROTECT CONFIG**, each have four more submenus.

DIAGNOSTICS CONFIG

PRESSURES
TEMPERATURES
LEVELS
OTHERS

ENG PROTECT CONFIG

PRESSURES
TEMPERATURES
LEVELS
OTHERS

GEN PROTECT CONFIG

OTHER EVENTS CONFIG

OTHERS
CUSTOM EVENT #1 - #6

Inside the submenus are the **EVENTS**. Use the **UP**  and **DOWN**  arrow keys to scroll through the events. For each event the display will have **VIEW** and **EDIT** at the bottom of the display. **VIEW** will be highlighted at first.

1. To view the **RESPONSE CONFIGURATION** for that event, press the **ENTER KEY** . All of the possible event response options will be shown. There will be check boxes to the left of the options. The boxes with checkmarks in them are the options that are selected.
2. To edit the configurations, press the **ESCAPE KEY**  once if the event is being viewed.
3. Then use the **RIGHT**  arrow key in order to select **EDIT**. The edit screen looks just like the view screen, but the highlighted option can be checked or unchecked by using the **RIGHT**  arrow or **LEFT**  arrow keys.

If the response configuration is changed, press the **ENTER KEY**  to save the settings.

NOTE: The control must be in **STOP** to edit any of the event response configurations. This applies when programming setpoints over SCADA also.

For a detailed example of changing an Event Response Configuration, see Chapter 5.2. For more information on the names, ranges, and descriptions of all of the setpoints, see APPENDIX C or use the RENR7902: Systems Operation, Troubleshooting, Testing and Adjusting manual for the EMCP 3.1 through 3.3.

7.2 SETPOINT SUB-MENUS

In the setpoints menu there are seven submenus to choose from:

- CONTROL
- ENG MONITOR/PROTECT
- EVENTS
- GEN MONITOR/PROTECT
- I/O
- NETWORK
- OTHER

Each of these submenus have additional submenus which contain setpoints. The list shown below is for all available menus under any configuration, for an EMCP 3.3. Menus may not contain all submenus shown here.

CONTROL

AUTOMATIC START/STOP
AVR DESIRED VOLTAGE
GOV DESIRED
ENG SPEED
SHUTDOWN OVERRIDE

ENG MONITOR/PROTECT

BATTERY VOLT MONITOR
CRANK/START COUNTERS
ENG COOLANT TEMP MON
ENG OIL PRES MONITOR
ENG SPEED MONITOR
ENHANCE ENG MONITOR
SERV MAINT INTERVAL

EVENTS

EVENT I/P FUNCTIONS
EVENT O/P FUNCTIONS
EVENT RESPONSE CONFIG
EVENT SYSTEM

GEN MONITOR/PROTECT

ENHANCED GEN MONITOR
GEN AC MONITOR
GEN AC POWER MONITOR
GEN OVERCURRENT
GEN OVER/UNDER FREQ
GEN OVER/UNDER VOLT
GEN REVERSE POWER

I/O

DIGITAL INPUTS
DIGITAL OUTPUTS
RELAY OUTPUTS
SPARE ANALOG INPUT

NETWORK

DATA LINK – SCADA

OTHER

DIGITAL SELECTORS
REDUCED POWER MODE
PROGRAMMABLE TRIP POINT

7.3 SETPOINTS ON THE CATERPILLAR® SERVICE TOOL

EMCP 3 setpoints can also be configured using the Caterpillar® Service Tool (ET). To access setpoints, enter the Configuration Tool by connecting to the EMCP 3 GSC and selecting Service > Configuration from the menu, FIGURE 17.

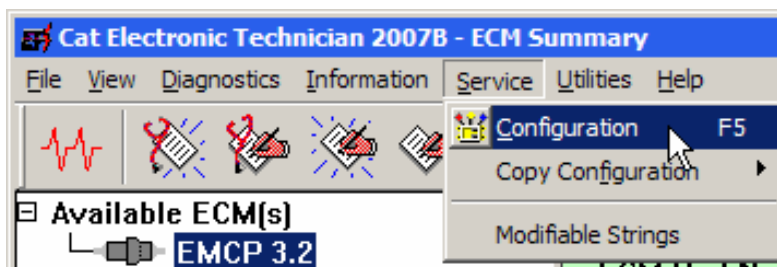


FIGURE 17 SELECTING CONFIGURATION

Categories of setpoints are listed along the left pane, and clicking on one of them will bring up that list in the right pane.

The EMCP 3.1, 3.2, and 3.3 have different numbers of setpoints. The EMCP 3.3 has more setpoints than the 3.2, which has more than the EMCP 3.1. The categories shown here match those in ET version 2006B-v1.0. Older versions may have less, and newer versions may have more.

NOTE: Any setpoint with a value given as Disabled or Not Installed or Unavailable is not applicable to that level of EMCP 3.

SETPOINT CATEGORIES

Here are the categories of setpoints as found in the left pane of the ET Configuration Tool:

AUTOMATIC START/STOP	3.1, 3.2, 3.3
Setpoints related to starting and stopping the generator set, as well as engine configuration.	
AVR DESIRED VOLTAGE REQUEST	3.1, 3.2, 3.3
Setpoints related to voltage regulation (for EMCP 3 calculation and reporting only, not for voltage control).	
BATTERY VOLTAGE MONITOR	3.1, 3.2, 3.3
Setpoints related to monitoring battery voltage from the battery power input to the EMCP 3 GSC.	
CRANK ATTEMPT/SUCCESSFUL START COUNTER	3.2, 3.3
Setpoints related to crank/start counters.	
SCADA DATA LINK	3.2, 3.3
Setpoints related to SCADA (Modbus) data link communications. See Chapter 18.	
DIGITAL INPUTS	3.1, 3.2, 3.3
Setpoints related to the polarity of digital inputs. See Chapter 8.	
DIGITAL OUTPUTS	3.2, 3.3
Setpoints related to the polarity of digital outputs. See Chapter 10.	
DIGITAL SELECTORS	3.1, 3.2, 3.3
Setpoints related to selecting conditions that control the behavior of relay outputs or digital outputs using digital selectors. See Chapter 10.1.	
ENGINE COOLANT TEMPERATURE MONITOR	3.1, 3.2, 3.3
Setpoints related to monitoring engine coolant temperature using Analog Input 2.	
ENGINE OIL PRESSURE MONITOR	3.1, 3.2, 3.3

Setpoints related to monitoring engine oil pressure using Analog Input 1.	
ENGINE SPEED MONITOR	3.1, 3.2, 3.3
Setpoints related to monitoring engine speed using the Magnetic Pick-Up (MPU) input.	
EVENT INPUT FUNCTIONS	3.1, 3.2, 3.3
Setpoints related to configuring digital inputs to trigger different events. See Chapter 8.	
EVENT OUTPUT FUNCTIONS	3.1, 3.2, 3.3
Setpoints related to configuring events to trigger relay outputs or digital outputs via digital selectors. Chapter 10.1.	
EVENT CONFIGURATION - DIAGNOSTIC EVENT CONFIGURATION	3.1, 3.2, 3.3
Setpoints used to configure the EMCP 3 response to diagnostic events. See Chapter 5.7.	
EVENT CONFIGURATION - ENGINE PROTECTION EVENT RESPONSE CONFIGURATION	3.1, 3.2, 3.3
Setpoints used to configure the EMCP 3 response to engine protection events. See Chapter 5.	
EVENT CONFIGURATION - GENERATOR PROTECTION EVENT RESPONSE CONFIGURATION	3.1, 3.2, 3.3
Setpoints used to configure the EMCP 3 response to generator protection events. See Chapter 5.	
EVENT CONFIGURATION - OTHER SYSTEM EVENT RESPONSE CONFIGURATION	3.1, 3.2, 3.3
Setpoints used to configure the EMCP 3 response to events that do not fit into the category of diagnostics, engine protection, or generator protection. See Chapter 5.	
GENERATOR AC MONITOR	3.1, 3.2, 3.3
Setpoints related to generator configuration (for EMCP 3 calculation and reporting).	
GENERATOR AC POWER MONITOR	3.2, 3.3
Setpoints related to generator power monitoring.	
GENERATOR BREAKER CONTROL	3.2, 3.3
Setpoints related to the configuration and monitoring of the generator circuit breaker.	
GENERATOR OVERCURRENT	3.2, 3.3
Setpoints related to generator AC overcurrent monitoring.	
GENERATOR OVER/UNDER FREQUENCY	3.2, 3.3
Setpoints related to generator overfrequency and underfrequency monitoring.	
GENERATOR OVER/UNDER VOLTAGE	3.2, 3.3
Setpoints related to generator AC overvoltage and undervoltage monitoring.	
GOVERNOR DESIRED ENGINE SPEED REQUEST	3.1, 3.2, 3.3
Setpoints related to adjusting the governor speed from the EMCP 3.	
PROGRAMMABLE CYCLE TIMER	3.2, 3.3
Setpoints related to configuring Programmable Cycle Timers. See Chapter 13.	
ELECTRONIC CONTROL MODULE REDUCED POWER MODE	3.1, 3.2, 3.3
Setpoints related to a power-saving mode of the EMCP 3 called Reduced Power Mode. See Chapter 14.	

RELAY OUTPUTS	3.1, 3.2, 3.3
Setpoints related to the polarity of relay outputs. These are read-only. See Chapter 10.	
REMOTE CALLBACK	3.2, 3.3
This feature is not available. The setpoints will appear as “Unavailable”.	
SERVICE MAINTENANCE INTERVAL	3.2, 3.3
Setpoints related to configuring and resetting the timers used to indicate a service needed warning. See Chapter 21.7.	
SPARE ANALOG INPUT	3.2, 3.3
Setpoints related to configuring the spare analog input and monitoring the associated parameter. See Chapter 21.2.	
PROGRAMMABLE TRIP POINT FUNCTION	3.1, 3.2, 3.3
Setpoints related to configuring the behavior of the Trip Point function, which is used to indicate that the generator is approaching overload.	
TRANSFER SWITCH	3.2, 3.3
This feature is not available in standard software. The setpoints will appear as “Disabled or Not Installed”.	
UTILITY BREAKER CONTROL	3.2, 3.3
This feature is not available in standard software. The setpoints will appear as “Disabled or Not Installed”.	
CONFIGURATION DATA	3.1, 3.2, 3.3
Contains the Engine Serial Number setpoint, which is read-only.	
DISPLAY PREFERENCES	3.1, 3.2, 3.3
Setpoints determining the units used on the EMCP 3 display. Note that this does not affect the data as viewed on the Caterpillar® Service Tool. See Chapter 4.2	

8 DIGITAL INPUTS

The EMCP 3.1 has 6 digital inputs.

The EMCP 3.2 and EMCP 3.3 both have 8 digital inputs. The first and second digital inputs are dedicated and cannot be programmed on all three levels of controls.

Digital input #1 is dedicated for **EMERGENCY STOP**

Digital input #2 is dedicated for **REMOTE INITIATE**.

The other inputs are linked to functions that are called **EVENT INPUT FUNCTIONS** and can be configured to trigger warnings or shutdowns in the EMCP 3. Event Response Configurations determine the EMCP 3 response to any supported event. For more information on Event Response Configurations, Chapter 5.1 - 5.2.

Because digital inputs #1 and #2 are dedicated inputs:

- digital input #3 is linked to event input function #1
- digital input #4 is linked to event input function #2
- and so on.

This is illustrated in the figure at the right.

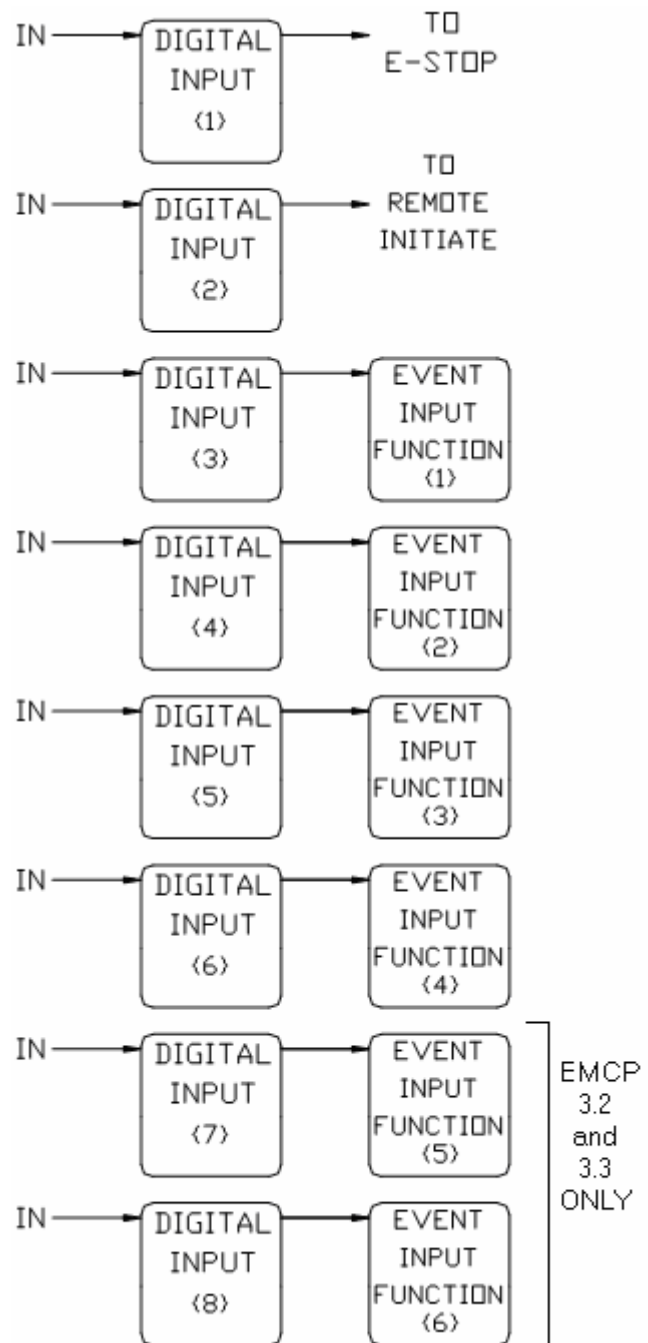


Figure 18: Digital Inputs And Event Input Functions

The digital inputs of the EMCP 3 GSC are tied to an internal pull-up resistor inside the control. Therefore, if a digital input is **UNCONNECTED**, the digital input will sit at a **LOGICAL HIGH** state.

A ground or battery negative input should be wired to each EMCP 3 GSC Digital Input.

If an **ACTIVE HIGH** configuration is desired, the ground or battery negative input should be wired through a normally-closed switch.

If an **ACTIVE LOW** configuration is desired, the ground or battery negative input should be wired through a normally-open switch.

8.1 PROGRAMMING THE DIGITAL INPUTS

There are three parts to programming the Digital Inputs. The first part involves programming the **DIGITAL INPUT ACTIVE STATE** (which can be **ACTIVE HIGH** or **ACTIVE LOW**). The second involves programming the **EVENT INPUT FUNCTIONS**. The third involves checking or programming Event Response Configurations. The first two parts are described below. For information on programming Events Response Configurations, Chapter 5.1 - 5.2.

PROGRAMMING DIGITAL INPUT ACTIVE STATE

To program the **ACTIVE STATE** of the Digital Input, go through the following menu options:

MAIN MENU

SCROLL DOWN  to:



CONFIGURE

Press ENTER KEY 



SCROLL DOWN  to:

SETPOINTS

Press ENTER KEY 



SCROLL DOWN  to:

I/O

Press ENTER KEY 



DIGITAL INPUTS

Press ENTER KEY 



Select the **DIGITAL INPUT** that you want to program and

Press ENTER KEY 

The current configuration will be highlighted (**ACTIVE HIGH** or **ACTIVE LOW**).

Press ENTER KEY 

To SAVE the setting

Press ENTER KEY 

PROGRAMMING EVENT INPUT FUNCTIONS

To program the **EVENT INPUT** functions go through the following menu options:

MAIN MENU

SCROLL DOWN  to:



CONFIGURE

Press ENTER KEY 



SCROLL DOWN  to:



SETPOINTS

Press ENTER KEY 

SCROLL DOWN  to:



EVENTS

Press ENTER KEY 

EVENT I/P FUNCTIONS

Press ENTER KEY 



Once in the **EVENT INPUT FUNCTION** menu, the first setting is the **ACTIVE STATE**. The **ACTIVE STATE** should always be set to **ACTIVE HIGH**.

To edit **TIME DELAY**

SCROLL DOWN  to:

TIME DELAY

Press ENTER KEY  and use the arrow keys to enter the desired value

NOTE: Event Input Function #1 corresponds to Digital Input #3, Event Input Function #2 corresponds to Digital Input #4, etc. See FIGURE 18.

To edit the **SUSPECT PARAMETER NUMBER (SPN)**

SCROLL DOWN  to:

SUSPECT PARAMETER NUMBER

Press the **ENTER KEY**  to edit the **SPN**. The available SPN values are separated by category.

CHOOSING THE SPN

Use the scroll keys to choose the category from the table below and

press **ENTER KEY**  then use the scroll keys to choose the SPN and

press **ENTER KEY** 

EVENT INPUT FUNCTION SPN AND FMI OPTIONS

Category	Suspect Parameter Number	Failure Mode Identifier valid options				Status
		High Shutdown	Low Shutdown	High Warning	Low Warning	
Pressures	Starting Air Pressure	y	y	y	y	
	Fuel Filter Differential Pressure	y	y	y	y	
	Engine Oil Filter Differential Pressure	y	y	y	y	
	Engine Oil Pressure		y		y	
	Air Filter Differential Pressure	y	y	y	y	
	Fire Extinguisher Pressure	y	y	y	y	
	Gas Pressure	y	y	y	y	
Temperatures	Engine Coolant Temperature	y		y	y	
	Ambient Air Temperature	y	y	y	y	
	Exhaust Temperature	y	y	y	y	
	Engine Oil Temperature	y	y	y	y	
	Generator Rear Bearing Temperature	y	y	y	y	
	Generator Winding #1 Temperature	y		y		
	Generator Winding #2 Temperature	y		y		
	Generator Winding #3 Temperature	y		y		
	Right Exhaust Temperature	y	y	y	y	
	Left Exhaust Temperature	y	y	y	y	
Levels	External Tank Fuel Level	y	y	y	y	
	Fuel Level	y	y	y	y	
	Engine Oil Level	y	y	y	y	
	Engine Coolant Level	y	y	y	y	
Others	Battery Charging System Voltage				y	
	Battery Voltage	y		y	y	
	Custom Event	y	y	y	y	y
	Fuel Leak					y
	Generator Frequency	y	y	y	y	
	Generator Voltage	y	y	y	y	
	Generator Current	y		y		
	Generator Power		y		y	
	Inlet Manifold Charge Combustion					y
	Air Damper Closed					y
	ATS in Normal Position					y
	ATS in Emergency Position					y

Category	Suspect Parameter Number	Failure Mode Identifier valid options				
		High Shutdown	Low Shutdown	High Warning	Low Warning	Status
	Battery Charger Failure					y
	Utility to Generator Transfer Failure	y		y		
	Generator to Utility Transfer Failure			y		
	Loss of Utility					y
	Earth Fault					y
	Earth Leakage					y

After the SPN is chosen, the **FAILURE MODE IDENTIFIER** (FMI) is the next setting. The following **FMI** are available:

- HIGH WARNING (example: High Temperature Warning)
- LOW WARNING (example: Low Temperature Warning)
- HIGH SHUTDOWN (example: Engine Overspeed Shutdown)
- LOW SHUTDOWN (example: Low Generator Voltage Shutdown)
- STATUS (example: Fuel Leak Detected condition exists)

However, all SPN and FMI combinations are not valid. The above table indicates which FMIs are valid for which SPNs. If a combination other than one indicated with a y in the table above is configured, the event will not trigger any response by the EMCP 3.

NOTE: If your software has a release date prior to October 2006, all SPNs listed in the above table may not be present in your software.

9 ANALOG INPUTS

The EMCP 3.1 has two analog inputs. The EMCP 3.2 and 3.3 both have three analog inputs. Each input consists of two connector pins for use with two-wire resistive senders. One-wire senders can be used if the passive analog return pin is connected to the common chassis ground. See ELECTRICAL CONNECTIONS Chapter 3.5 for illustrations on how to connect the sensors to the control.

The first and second analog inputs have dedicated parameters. They cannot be programmed for other functions. The third analog input on EMCP 3.2 and 3.3 is called the **SPARE ANALOG INPUT**.

- Analog input #1 is dedicated for ENGINE OIL PRESSURE.
- Analog input #2 is dedicated for ENGINE COOLANT TEMPERATURE.
- Analog Input #3 is configured to monitor ENGINE OIL TEMPERATURE by default.

The first and second analog inputs will not be used for electronic engines that use ADEM™ A3, A4 or newer, engine ECM. On these engines, the engine oil pressure sensor and the engine coolant temperature sensors are wired to the engine ECM and not to the generator set control. In order to receive the sensor information from the data link instead of from sensors wired into the EMCP 3, the setpoints Engine Oil Pressure Sensor Configuration and Engine Coolant Temperature Sensor Configuration must be set to Data Link. If they are not set this way, the event log will contain diagnostics for the sensors, and the sensor values on the Engine Overview screen on the EMCP 3 GSC display will show ******** (asterisks).

Note: These setpoints are protected by a Level 3 password. For help on programming the Level 3 password prior to running this procedure, see Chapter 6 Security. Alternately, the Caterpillar® Service Tool can be used to program these setpoints.

PROGRAMMING USING DISPLAY

To program the EMCP 3 sensors for Data Link input using the display, go through the following menu options (once Level 3 access has been obtained):

At MAIN MENU

SCROLL DOWN  to:



CONFIGURE

SCROLL DOWN  to:



SETPOINTS

SCROLL DOWN  to:



ENG MONITOR/PROTECT

SCROLL DOWN  to: ENG COOL TEMP MON

If the setpoint is set to SENSOR then, to change Press ENTER KEY 

SCROLL DOWN  to: DATA LINK Press ENTER KEY 

Press ESCAPE KEY  and SCROLL DOWN  to: ENG OIL PRES MON

If the setpoint is set to SENSOR then, to change Press ENTER KEY 

SCROLL DOWN  to: choose DATA LINK, then Press ENTER KEY 

PROGRAMMING USING CATERPILLAR® SERVICE TOOL

To program the EMCP 3 sensors for Data Link input using the Caterpillar® Service Tool as shown in FIGURE 19, do the following steps:

1. Connect to the EMCP 3 GSC using the Caterpillar® Service Tool
2. Enter the Configuration Tool
3. Select Engine Coolant Temperature Monitor on the left
4. If the Engine Coolant Temperature Sensor Configuration is set to Sensor, change it to Data Link.
5. Select Engine Oil Pressure Monitor on the left
6. If the Engine Oil Pressure Sensor Configuration is set to Sensor, change it to Data Link.

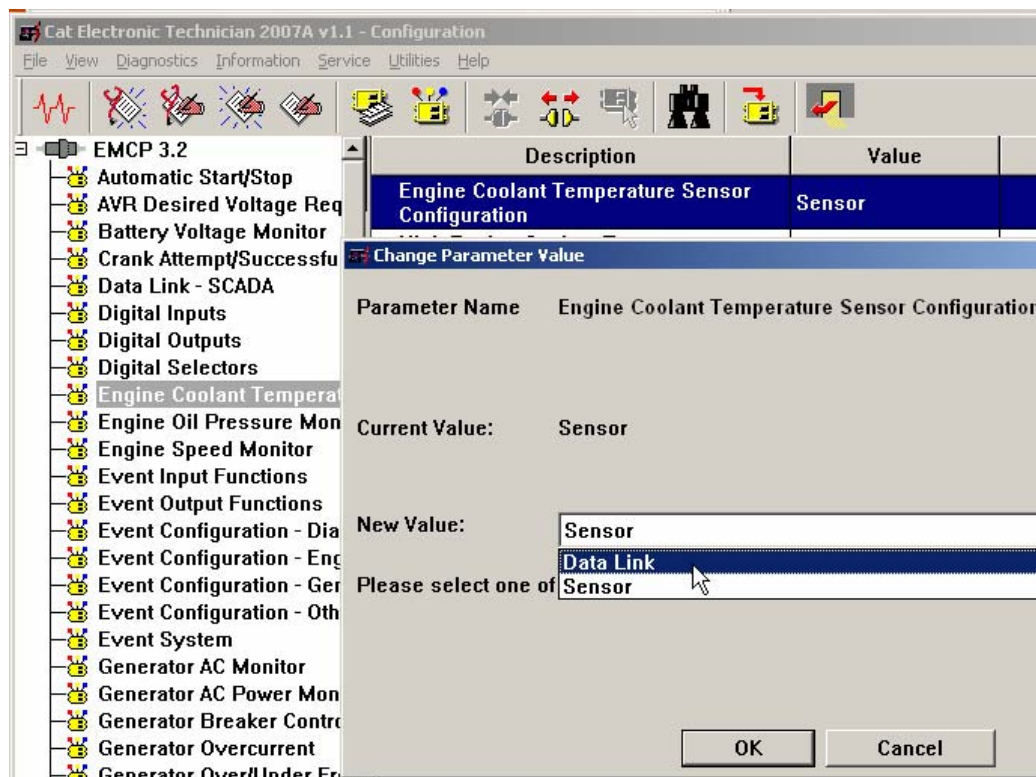


FIGURE 19: SENSOR CONFIGURATION USING CATERPILLAR[®] SERVICE TOOL

NOTE: 3500 MUI Generator sets that have EMCP3 GSC software with a release date of Oct. 2006 or earlier are using a flash file that is different from the standard flash file. This flash file has different maps from the standard flash file to support the 3500 MUI engine. From Oct. 2006 released software supports both the standard and the 3500 MUI maps in the one flash file. The map that is used is determined by a setpoint corresponding to each analog input; Oil Pressure Sensor Map Selection Number and Coolant Temperature Sensor Map Selection Number.

9.1 SPARE ANALOG INPUT (EMCP 3.2 & 3.3)

The **SPARE ANALOG INPUT** has a sensor map in the software for **ENGINE OIL TEMPERATURE**. This input can be programmed to monitor other parameters such as:

TEMPERATURES

Ambient Air Temperature
 Engine Oil Temperature
 Exhaust Temperature
 Right Exhaust Temperature
 Left Exhaust Temperature
 Generator Rear Bearing Temperature

PRESSURES

Air Filter Differential Pressure
 Fire Extinguisher Pressure
 Fuel Filter Differential Pressure
 Oil Filter Differential Pressure
 Starting Air Pressure

LEVELS

Engine Coolant Level
 Engine Oil Level
 Fuel Level
 External Tank Fuel Level

NOTE: There are 3 sensor maps in the software. Two of the maps are for temperature and the third map is for fuel level. A pressure map is not currently included in the software.

The spare Analog input is capable of reading resistance from 5 ohms up to 2000 ohms. There are three in-built maps to convert from the measured resistance to a value, these are:

- 1) VDO Oil Temperature Map
- 2) 3500MUI Oil Temperature Map
- 3) Fozmula Fuel level Map

Any value below the bottom point on the map or above the highest point on the map will raise a corresponding diagnostic event.

WARNINGS AND SHUTDOWNS

Each of these inputs can be configured to have **HIGH WARNINGS**, **LOW WARNINGS**, **HIGH SHUTDOWNS** and **LOW SHUTDOWNS** with configurable thresholds. Also, all of the events associated with the analog inputs have programmable time delays. For information on how to program these thresholds and time delays can be found in Chapter 7, Setpoints.

10 OUTPUTS

The EMCP 3 has several outputs that can be configured for different behavior. This chapter defines the outputs and explains how to configure them.

RELAY OUTPUTS

The EMCP 3.1 has six relay outputs and the EMCP 3.2 and 3.3 have eight relay outputs. Each relay is capable of handling 2 A @ 30 V DC. All six relays on the EMCP 3.1 GSC are type-A. The EMCP 3.2 and 3.3 have six relays which are type-A and two relays that are type-C.

Note: Type-A relays have one normally-open contact and a common. Type-C relays have one normally-open contact, one normally-closed contact, and a common.

CAUTION: These relays are VOLT FREE meaning that the commons are not referenced to anything within the GSC. The relay contacts are **not** protected against shorts to battery or ground.

RELAY OUTPUT #1 is dedicated to control the starter motor on MUI engines. On EUI engines, this relay may or may not be connected.

RELAY OUTPUT #2 is dedicated to enable fuel on MUI engines. On EUI engines, this relay may or may not be connected. Consult your Genset package manuals.

The six remaining Relay Outputs on the EMCP 3.2 and EMCP 3.3 (four remaining Relay Outputs on EMCP 3.1) are programmable for various other applications.

DIGITAL OUTPUTS

The EMCP 3.1 does not have any digital outputs. The EMCP 3.2 has one digital output, and the EMCP 3.3 has two digital outputs. Each output is a discrete 300 mA sinking driver output. These outputs are programmable for various applications.

DIGITAL SELECTORS

Relay outputs #3 and higher as well as digital outputs (on EMCP 3.2 and 3.3) are programmable and can be set to operate based on different conditions. In order to select which condition controls the output, there are functions called **DIGITAL SELECTORS** associated with each relay output (#3 and higher) and digital output. This is shown in FIGURE 20, FIGURE 21, and FIGURE 22.

- EMCP 3.1 has four (4) Digital Selectors (connected to Relay Outputs 3-6)
- EMCP 3.2 has seven (7) Digital Selectors (connected to Relay Outputs 3-8 and Digital Output 1)
- EMCP 3.3 has eight (8) Digital Selectors (connected to Relay Outputs 3-8 and Digital Outputs 1-2)

The Digital Selector software acts like a 12 position switch for each relay and is used to determine which one of those conditions will actually be associated with each *output*. For each *output* there are 10 different options of conditions that can make the output go **ACTIVE**, one option that will allow the output to be controlled with a SCADA data link command, and one condition to **DISABLE** the output altogether. These options are shown in FIGURE 20, FIGURE 21, and FIGURE 22. Definitions for these options are in Chapter 10.1, Digital Selector Options.

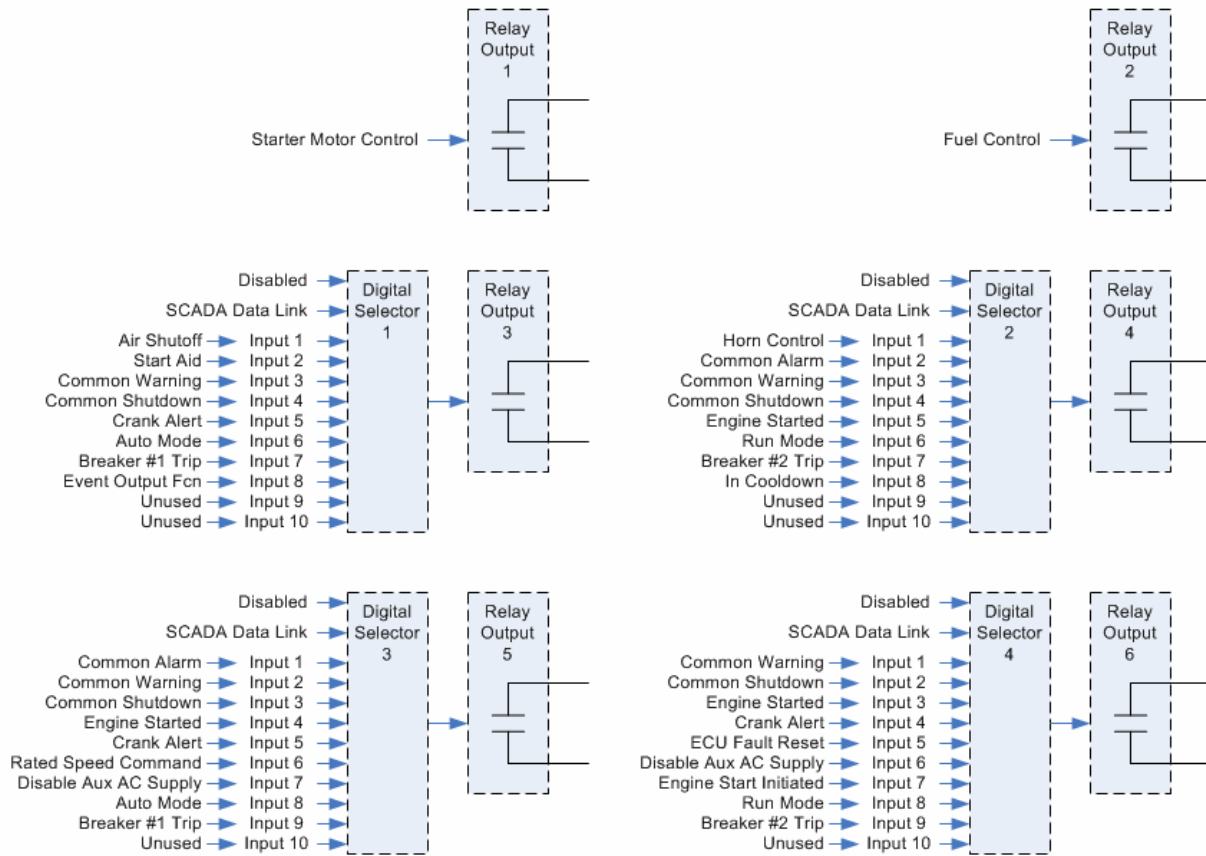


FIGURE 20 EMCP 3.1 OUTPUTS

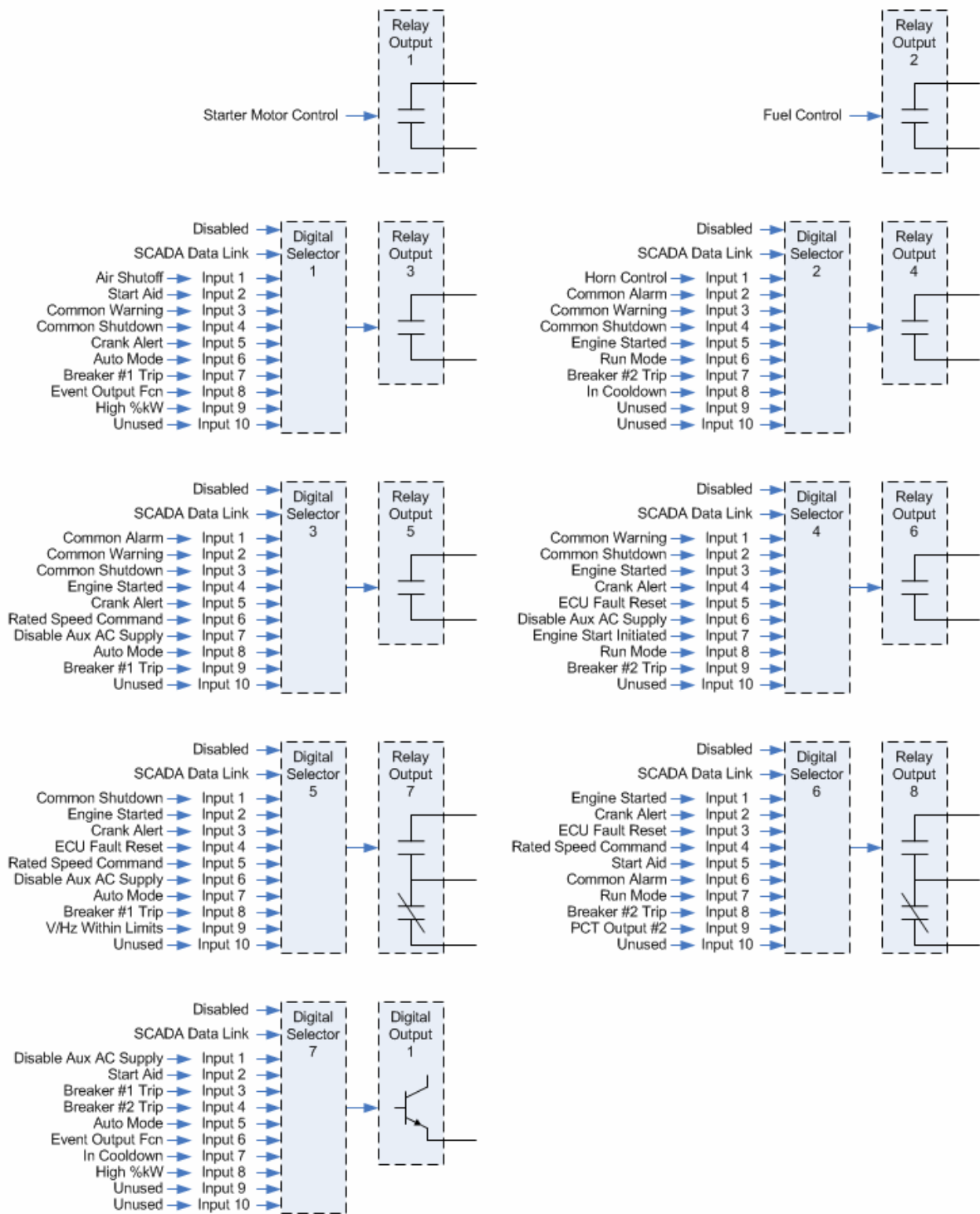


FIGURE 21 EMCP 3.2 OUTPUTS

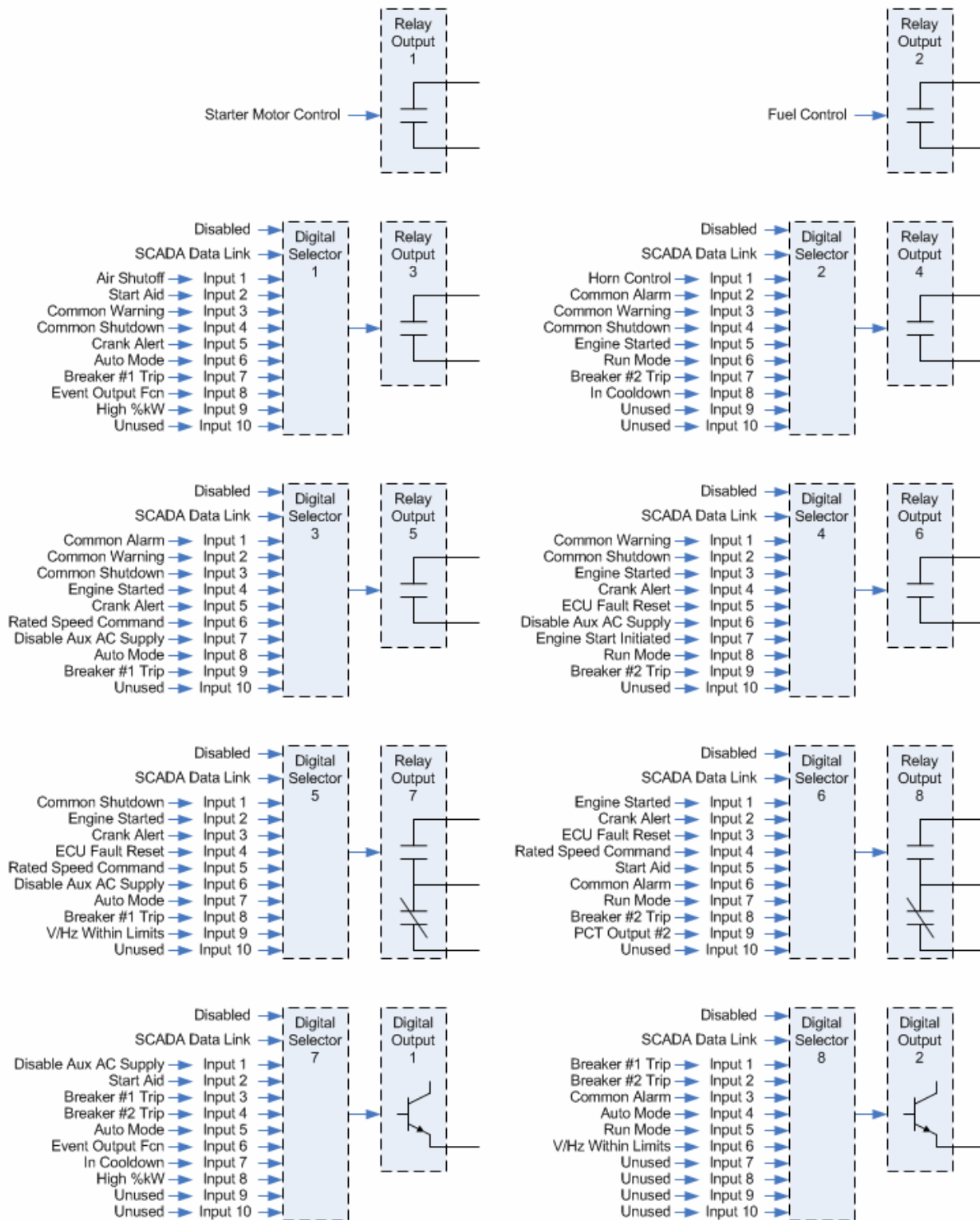


FIGURE 22 EMCP 3.3 OUTPUTS

10.1 DIGITAL SELECTOR OPTIONS

The digital selector is a software function that acts like a 12 position switch, to determine the behavior of an output. For each selector there are 10 unique conditions that can make the output go active, an option to control the output via the SCADA data link, and one option to disable the output altogether. The 10 unique conditions for each selector are shown in FIGURE 20, FIGURE 21, and FIGURE 22 above.

The Disabled option causes the output to stay Inactive. Inactive for the relay outputs means that the Normally Open relay contacts will remain open. Inactive behavior for the digital outputs is determined by the Active State Configuration setpoint. For more information on Setpoints and Configuring Outputs see the following Chapters; 10.2, Programming Outputs Using The Service Tool and 10.3, Programming Outputs Using The Display.

The SCADA Data Link option allows outputs to be activated by commands sent via the Modbus (SCADA) Data Link. These commands are sent via registers 628 through 636. For more information, refer to Chapter 21.3, Discrete Inputs and Outputs.

DEFINITIONS OF DIGITAL SELECTOR OPTIONS

As shown in FIGURE 20, FIGURE 21, and FIGURE 22, the Digital Selectors can be configured to be driven by one of the following conditions (all conditions not available on all Digital Selectors):

AIR SHUTOFF

Activated by Emergency Stop condition

Activated by Overspeed condition

Automatically deactivates after 15 second delay

AUTO MODE

Activated after the Auto Key has been pressed (or a Modbus command is given to set Engine Operating Mode to Auto - register 302) and while the EMCP 3 GSC remains in the Auto mode

BREAKER #1 TRIP

Activated when any event occurs that has an event response configuration set for breaker trip 1. See Chapter 5.1, Configuring Event Responses for more information.

Deactivates when the event is neither present nor active.

NOTE: This output does not control a circuit breaker unless the user makes the connections to do so.

BREAKER #2 TRIP

Activated when any event occurs that has an event response configuration set for breaker trip 2. See section Chapter 5.1, Configuring Event Responses for more information.

Deactivates when the event is neither present nor active

NOTE: This output does not control a circuit breaker unless the user makes the connections to do so.

COMMON ALARM

Activated anytime the EMCP 3 GSC has a present or active warning or shutdown event in the event system.

Deactivates when no warnings or shutdowns are present or active

COMMON WARNING

Activated anytime the EMCP 3 GSC has a present or active warning event in the event system.

Deactivates when no warnings are present or active.

COMMON SHUTDOWN

Activated anytime the EMCP 3 GSC has a present or active shutdown event in the event system.

Deactivates when no shutdowns are present or active

CRANK ALERT

Requires setpoint Crank Alert Activation Time set greater than zero

Activated when engine start is initiated, before engine begins to crank

Deactivates after Crank Alert Activation Timer expires

DISABLE AUX AC SUPPLY

Intended to be used to disconnect the battery charger, heaters etc when the engine is running

Activated when engine start is initiated

Deactivates when engine is stopped: RPM=0

ECU FAULT RESET

For electronic engines that do not support J1939 communication.

When Reset Engine Events is selected in the Event logs, it will activate for one second and then deactivate. This option is only available when the engine is set to Electronic and the communication is set to No J1939 communication.

ENGINE START INITIATED

Activated when engine start is initiated (engine is going to start, even when engine speed is still 0)

Deactivates when engine stop is initiated (engine is going to stop, even when engine speed is still at rated speed)

ENGINE STARTED

Activated when engine has reached crank terminate speed

Deactivates when engine is stopped: RPM=0

EVENT OUTPUT FUNCTION

Requires setpoint configuration for Event Output Function #1

Activated while the event(s) configured for Event Output Function #1 is (are) active

For more information on configuring and using the Event Output Function, see Programming Event Output Functions in Chapters; 10.2, Programming Outputs Using The Service Tool and 10.3, Programming Outputs Using The Display below.

HIGH %kW

Activated when Programmable Trip Point #1 is active. Programmable Trip Point #1 activates based on high %kW, according to user-configurable thresholds. For more information on configuring the Programmable Trip Point function, see Chapter 15, Programmable Trip Point function.

HORN CONTROL

Activated when any event occurs that has an event response configuration set for audible alert

Deactivates when event is neither present or active or when the alarm acknowledge key is pressed

IN COOLDOWN

Requires setpoint Cooldown Duration set greater than zero

Activated when engine stop has been initiated and cooldown cycle begins

Deactivates when cooldown timer has expired and remains deactivated any time the genset is not in cooldown

PCT OUTPUT #2

Activated any time Output #2 of the Programmable Cycle Timer is Active

For more information on configuring Programmable Cycle Timers, see Chapter 13, Programmable Cycle Timer.

RATED SPEED COMMAND

Activated when Rated Speed is commanded. Will always be active unless Idle Speed is commanded.

NOTE: Intended to give a rated speed permissive signal to a governor

RUN MODE

Activated after the Run Key has been pressed (or a Modbus command is given to set Engine Operating Mode to Run - register 302) and while the EMCP 3 GSC remains in the Run mode.

START AID

Requires setpoint Start Aid Activation Time set greater than zero

Activated when engine start is initiated before the engine begins to crank

Deactivates after Start Aid Activation Timer expires

V & Hz WITHIN LIMITS

Activated when measured generator voltage and frequency are both within the Warning thresholds for their respective parameters

Deactivates when either measured generator voltage or frequency are outside of the Warning thresholds for their respective parameters

10.2 PROGRAMMING OUTPUTS USING THE SERVICE TOOL

Outputs can be configured by using the Caterpillar[®] Service Tool. To begin, connect to the EMCP 3 GSC and select Service > Configuration from the menu to enter the Configuration Tool, FIGURE 23.

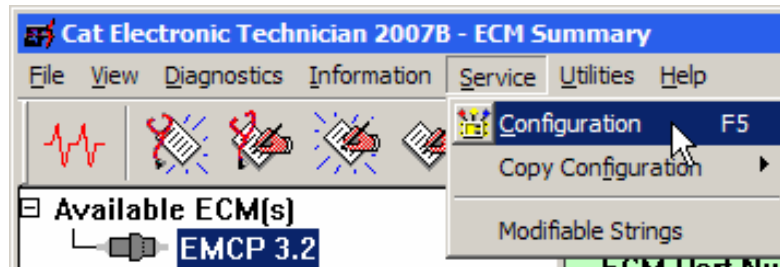


FIGURE 23 SELECTING CONFIGURATION

The following sections will explain the steps involved in configuring an output, and walk through an example of configuring Relay Output 3 to Breaker #1 Trip and Digital Output 1 to Event Output Function on the EMCP 3.2. The steps are identical for EMCP 3.1 and 3.3 (Digital Output 1 doesn't apply to the 3.1).

NOTE: Some setpoint values may be different from the screenshots; those may not be important to this example. However, be aware that changing other setpoints will cause the EMCP 3 to behave differently, so any changes should be done carefully. As always, it is recommended to save a setpoint configuration file before making any changes as shown in Chapter 12, Saving and Restoring Setpoints.

PROGRAMMING DIGITAL SELECTORS

To program a Digital Selector, select Digital Selectors from the left pane. Edit the Digital Selector Source Configuration for the appropriate Digital Selector. The options given are Disabled, Data Link, and Input #1 through Input #10. Refer to in FIGURE 20, FIGURE 21, and FIGURE 22 to determine which input corresponds to which option.

The EMCP 3.2 has seven (7) Digital Selectors. As the screenshot shows FIGURE 24, more are listed, but are given as Disabled or Not Installed. This means they don't apply to the EMCP 3.2.

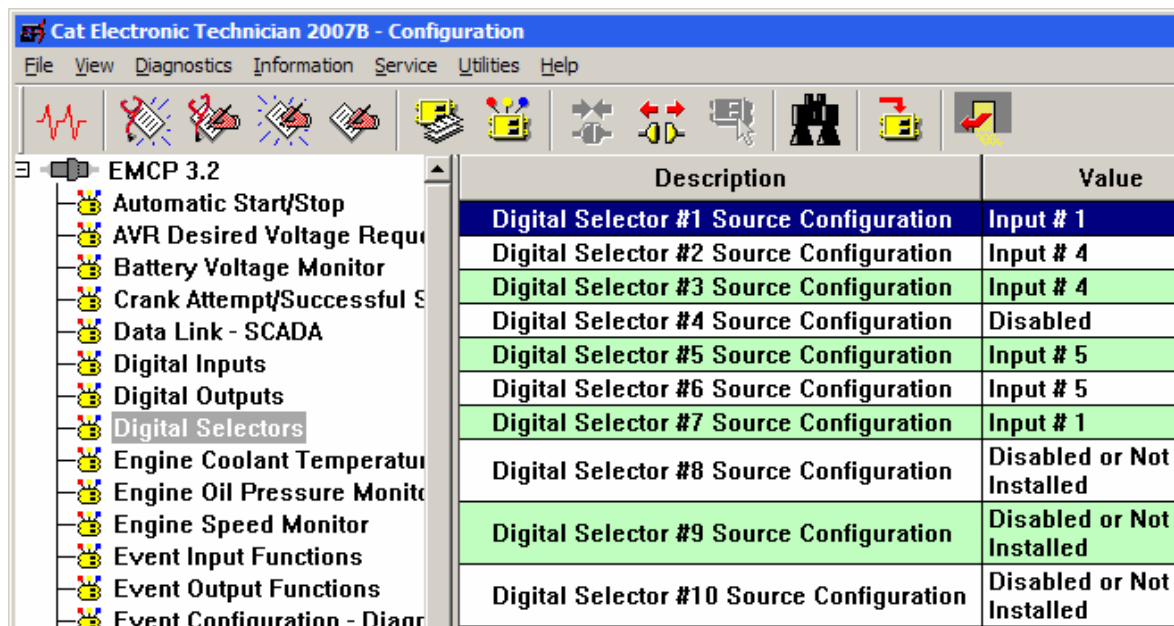


FIGURE 24 SELECTING DIGITAL SELECTOR

To configure Relay Output 3 to Breaker #1 Trip, the corresponding Digital Selector must be configured. Referring back to FIGURE 21, note that Digital Selector 1 is tied to Relay Output 3. Breaker #1 Trip is Input 7.

Modify Digital Selector #1 Source Configuration, selecting Input #7, Figure 25.

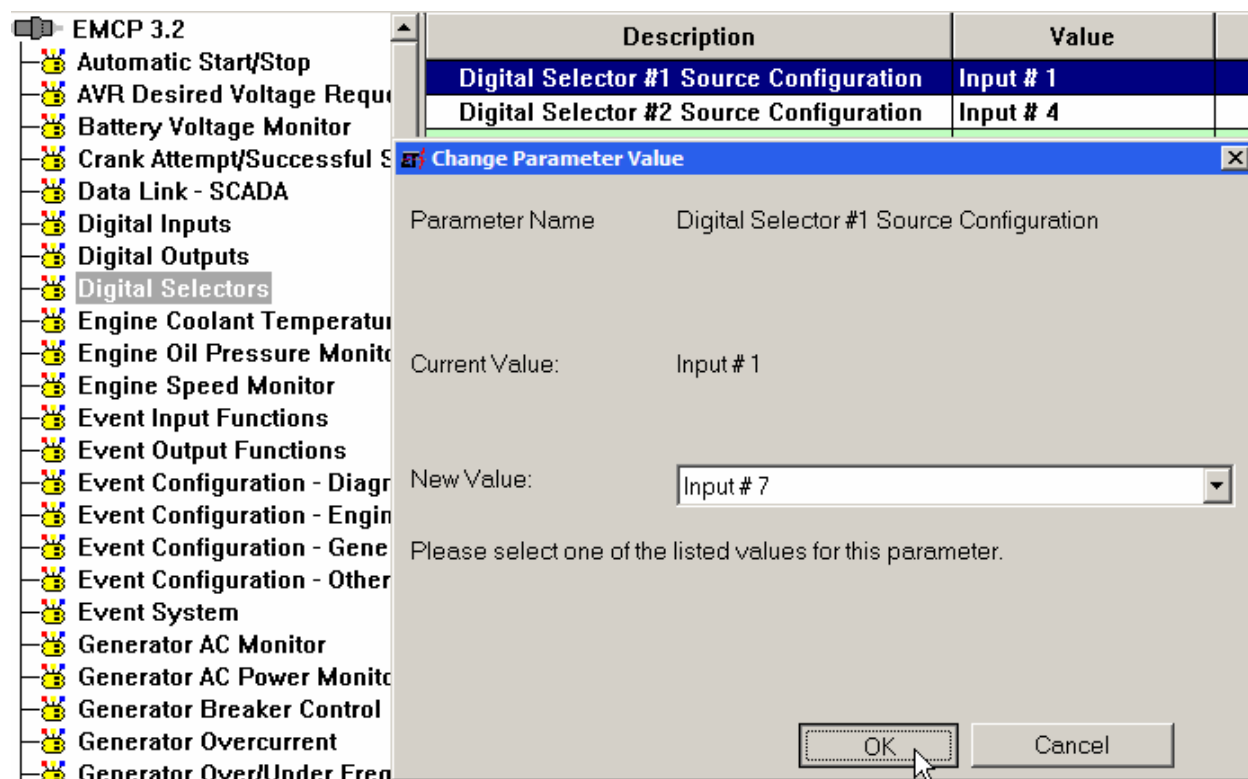


FIGURE 25 SELECTING INPUT #7

Similarly, note that Digital Selector #7 is tied to Digital Output 1, and Event Output Function is Input 6. So modify Digital Selector #7 Source Configuration, selecting Input #6. The resulting settings are shown below, FIGURE 26.

EMCP 3.2	
Automatic Start/Stop	
AVR Desired Voltage Requ	
Battery Voltage Monitor	
Crank Attempt/Successful S	
Data Link - SCADA	
Digital Inputs	
Digital Outputs	
Digital Selectors	
Engine Coolant Temperatu	
Engine Oil Pressure Monito	
Engine Speed Monitor	
Event Input Functions	
Event Output Functions	
Event Configuration - Diaqr	
Event Configuration - Engin	
Event Configuration - Gene	
Event Configuration - Other	
Event System	
Generator AC Monitor	
Generator AC Power Monito	
Generator Breaker Control	
Generator Overcurrent	
Generator Over/Under Freq	

Description	Value
Digital Selector #1 Source Configuration	Input # 7
Digital Selector #2 Source Configuration	Input # 4
Digital Selector #3 Source Configuration	Input # 4
Digital Selector #4 Source Configuration	Disabled
Digital Selector #5 Source Configuration	Input # 5
Digital Selector #6 Source Configuration	Input # 5
Digital Selector #7 Source Configuration	Input # 6
Digital Selector #8 Source Configuration	Disabled or Not Installed
Digital Selector #9 Source Configuration	Disabled or Not Installed
Digital Selector #10 Source Configuration	Disabled or Not Installed

FIGURE 26 SELECTOR #7 RESULTS

PROGRAMMING EVENT OUTPUT FUNCTIONS

If it is desired to trigger an output based on an event or a set of events, then an additional step is required after one of the Digital Selectors is configured for Event Output Function (as was done for Digital Selector 7 in the example above). This is to define the type of event(s) that will activate the output.

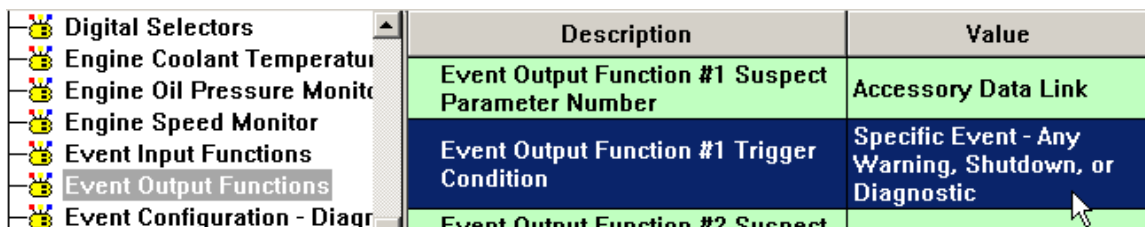
The EMCP 3.2 only has one (1) Event Output Function. Two setpoints define the Event Output Function.

EVENT OUTPUT FUNCTION #1 SUSPECT PARAMETER NUMBER: Every event in the EMCP 3 system is defined with an SPN and FMI. This is the SPN. The Caterpillar® Service Tool shows the parameter list, allowing any one to be selected. The SPN selected here does not matter if it is used to drive the output based on a general type of event such as warnings, shutdowns, etc.

EVENT OUTPUT FUNCTION #1 TRIGGER CONDITION: This setpoint defines the FMI (Failure Mode Identifier) or set of FMIs that will trigger the output. It is also used to determine whether the output should be driven only by an event with a specific SPN (called a Specific Event), or any SPN that has a certain FMI (called a General Event). The General Event options are meant for special cases. If it is used to drive an output based on any warning or shutdown, it is recommended to configure a Digital Selector to Common Warning, Common Shutdown, or Common Alarm, instead of using the General Event options.

EXAMPLE 1: Configuring the Event Output Function for any fault related to the Accessory Data Link.

Set Event Output Function #1 Suspect Parameter Number to Accessory Data Link, and set Event Output Function #1 Trigger Condition to Specific Event - Any Warning, Shutdown, or Diagnostic, FIGURE 27 .

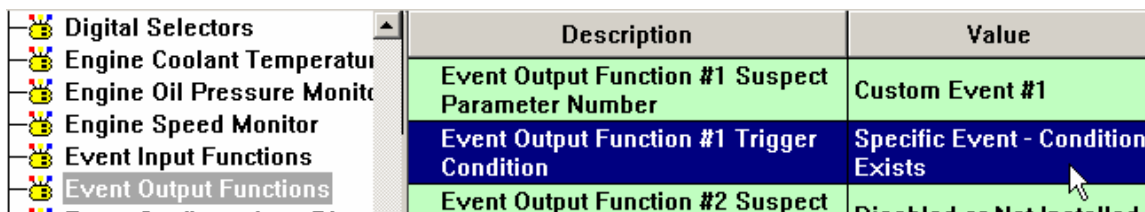


Description	Value
Event Output Function #1 Suspect Parameter Number	Accessory Data Link
Event Output Function #1 Trigger Condition	Specific Event - Any Warning, Shutdown, or Diagnostic
Event Output Function #2 Suspect	

Figure 27 Configuring the Event Output Function

EXAMPLE 2: Configuring the Event Output Function for Custom Event #1 Condition Exists (for example, if using the Custom Event from Event Input Function #1).

Set Event Output Function #1 Suspect Parameter Number to Custom Event #1 (the number matches with the Event Input Function number), and set Event Output Function #1 Trigger Condition to Specific Event - Condition Exists, FIGURE 28.



Description	Value
Event Output Function #1 Suspect Parameter Number	Custom Event #1
Event Output Function #1 Trigger Condition	Specific Event - Condition Exists
Event Output Function #2 Suspect	Disabled or Not Installed

FIGURE 28 SPECIFIC EVENT

PROGRAMMING RELAY OUTPUTS

Relay Outputs 1-6 are Form-A relays, which means they only have Normally Open contacts. The polarity of these relays are not configurable. They are viewable on the Caterpillar® Service Tool, by selecting Relay Outputs in the left pane. All of the outputs are configured with an active state of High, indicating that the contacts are closed when the condition is active (indicating that the relays behave as Normally Open relays), Figure 29.

	Description	Value
Event Input Functions	Relay Output #1 Active State Configuration	High
Event Output Functions	Relay Output #2 Active State Configuration	High
Event Configuration - Dia	Relay Output #3 Active State Configuration	High
Event Configuration - Eng	Relay Output #4 Active State Configuration	High
Event Configuration - Gen	Relay Output #5 Active State Configuration	High
Event Configuration - Oth	Relay Output #6 Active State Configuration	High
Event System	Relay Output #7 Active State Configuration	High
Generator AC Monitor	Relay Output #8 Active State Configuration	High
Generator AC Power Moni		
Generator Breaker Contro		
Generator Overcurrent		
Generator Over/Under Fre		
Generator Over/Under Vo		
Governor Desired Engine		
Programmable Cycle Tim		
Electronic Control Module		
Relay Outputs		
Remote Control		

FIGURE 29 RELAY OUTPUTS

NOTE: Read-only setpoints do not look different from other setpoints on the Caterpillar® Service Tool. However, if the setpoint is modified, the Service Tool will return an error, as shown below in the following set of screenshots, FIGURES 30, 31, and 32.

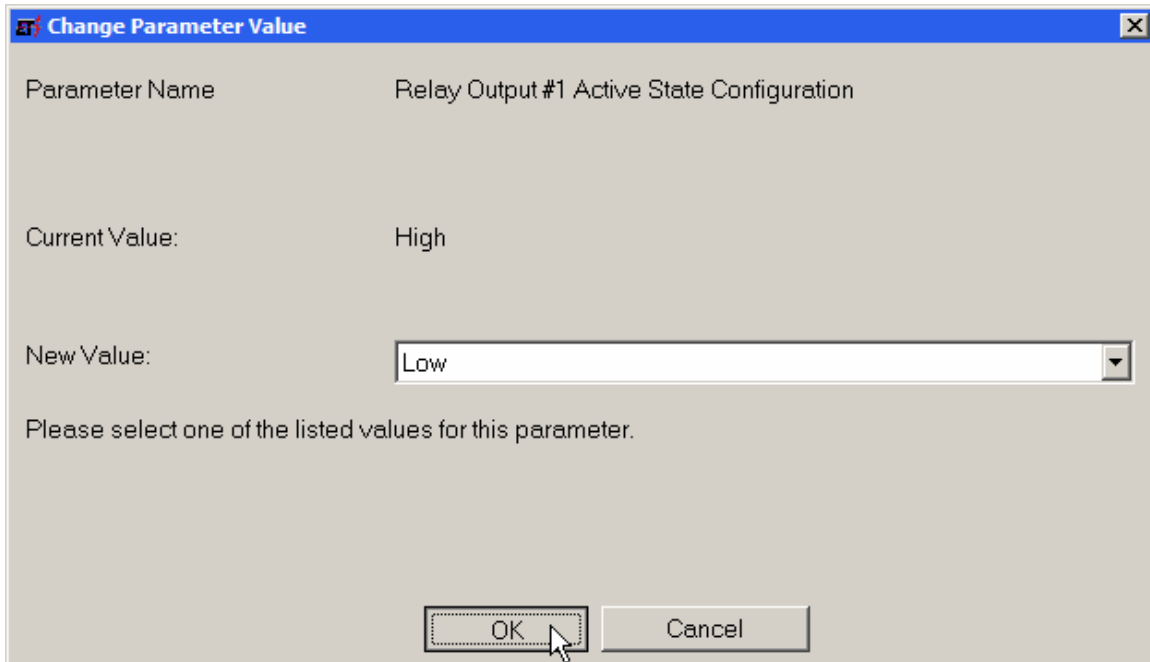


FIGURE 30 READ-ONLY SETPOINT ERROR

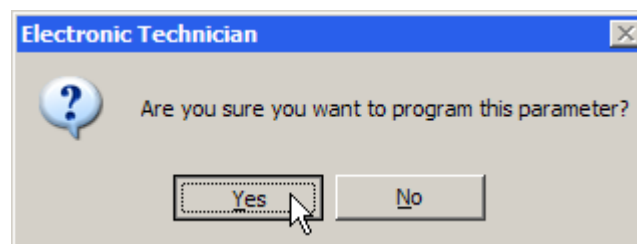


FIGURE 31 READ-ONLY SETPOINT ERROR



FIGURE 32 READ-ONLY SETPOINT ERROR

Relay Outputs 7 and 8 (available on 3.2 and 3.3) are Form-C relays, which means that both Normally Open and Normally Closed contacts are available. Changing the polarity involves rewiring to the opposite pin. The pins for Relay Outputs 7 and 8 are listed here.

EMCP 3 70-PIN AMP CONNECTOR	
Pin #	Function
1	Relay 8 Normally Open (NO) Contact
2	Relay 7 Normally Open (NO) Contact
14	Relay 8 Normally Closed (NC) Contact
15	Relay 7 Normally Closed (NC) Contact
24	Relay 8 Common
25	Relay 7 Common

For more wiring details, see Figure 2 and Figure 3 in Chapter 3.7, EMCP 3.1, 3.2, 3.3 Electrical Diagrams.

PROGRAMMING DIGITAL OUTPUTS (EMCP 3.2 AND 3.3)

Digital Outputs have a sinking driver output. When the condition controlling the output becomes active, the default setting of High for the Digital Output Active State Configuration causes the output to be pulled to battery negative voltage. This will turn on a circuit that is wired between the output and battery voltage. When the condition controlling the output is inactive, the default setting of High for the Digital Output Active State Configuration causes the output to be floating. This will turn off the circuit that is wired between the output and battery voltage.

To reverse this polarity (i.e. turn **on** a circuit when the controlling condition is **inactive**), select Digital Outputs from the left pane and change the Active State Configuration for the desired output to Low, FIGURE 33.



FIGURE 33 ACTIVE STATE CONFIGURATION

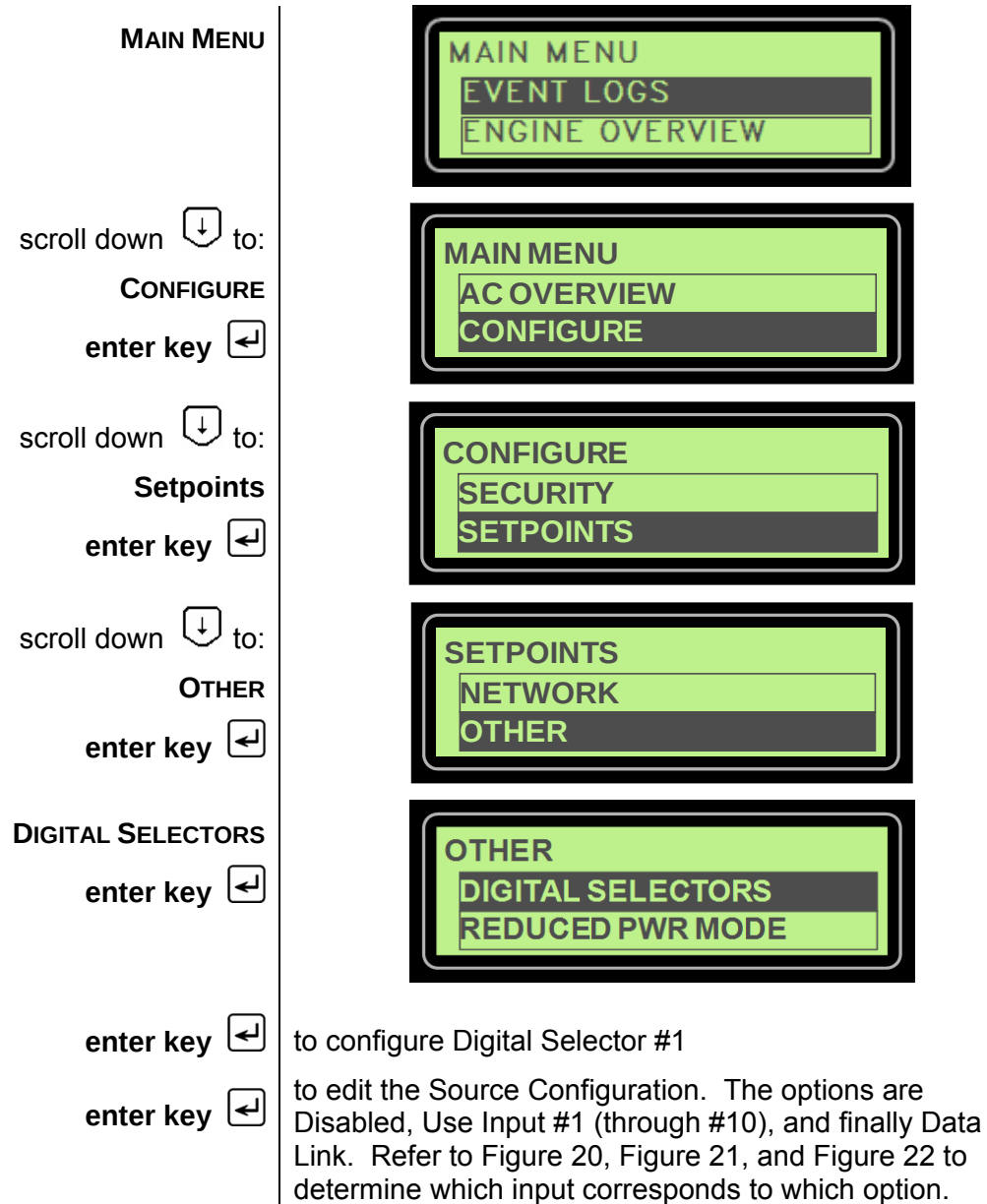
10.3 PROGRAMMING OUTPUTS USING THE DISPLAY

Outputs can be configured by using the EMCP 3 display. For some of the setpoints, LEVEL 2 ACCESS is required. For information on obtaining Level 2 Access refer to Chapter 6, Security. This section will assume that Level 2 Access has already been obtained.

The following explains the steps involved in configuring an output, and includes a walk through example for configuring Relay Output 3 to Breaker #1 Trip and Digital Output 1 to Event Output Function on the EMCP 3.2. The steps are identical for EMCP 3.1 and 3.3 (except Digital Output 1 doesn't apply to the 3.1) although the screens may look slightly different.

PROGRAMMING DIGITAL SELECTORS

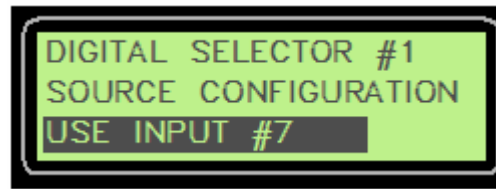
To program the Digital Selectors, go through the following menu options.



In order to configure Relay Output 3 to Breaker #1 Trip, the corresponding Digital Selector must be configured. Referring back to Figure 21, note that Digital Selector 1 is tied to Relay Output 3. Breaker #1 Trip is Input 7. So

scroll down  to:

USE INPUT #7



to select Use Input #7.

enter key 

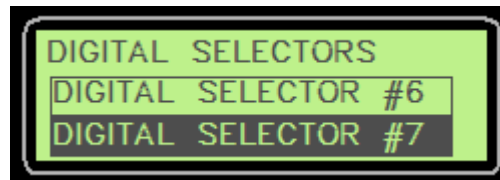
Similarly, note that Digital Selector #7 is tied to Digital Output 1, and Event Output Function is Input 6.

ESCAPE KEY 

to return to the list of Digital Selectors

scroll down  to:

DIGITAL SELECTOR #7



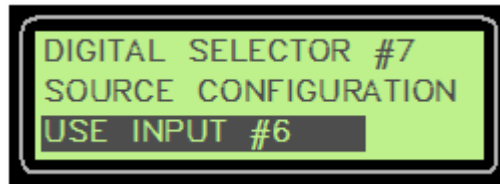
enter key 

enter key 

to edit the Source Configuration.

SCROLL DOWN  TO:

USE INPUT #6



enter key 

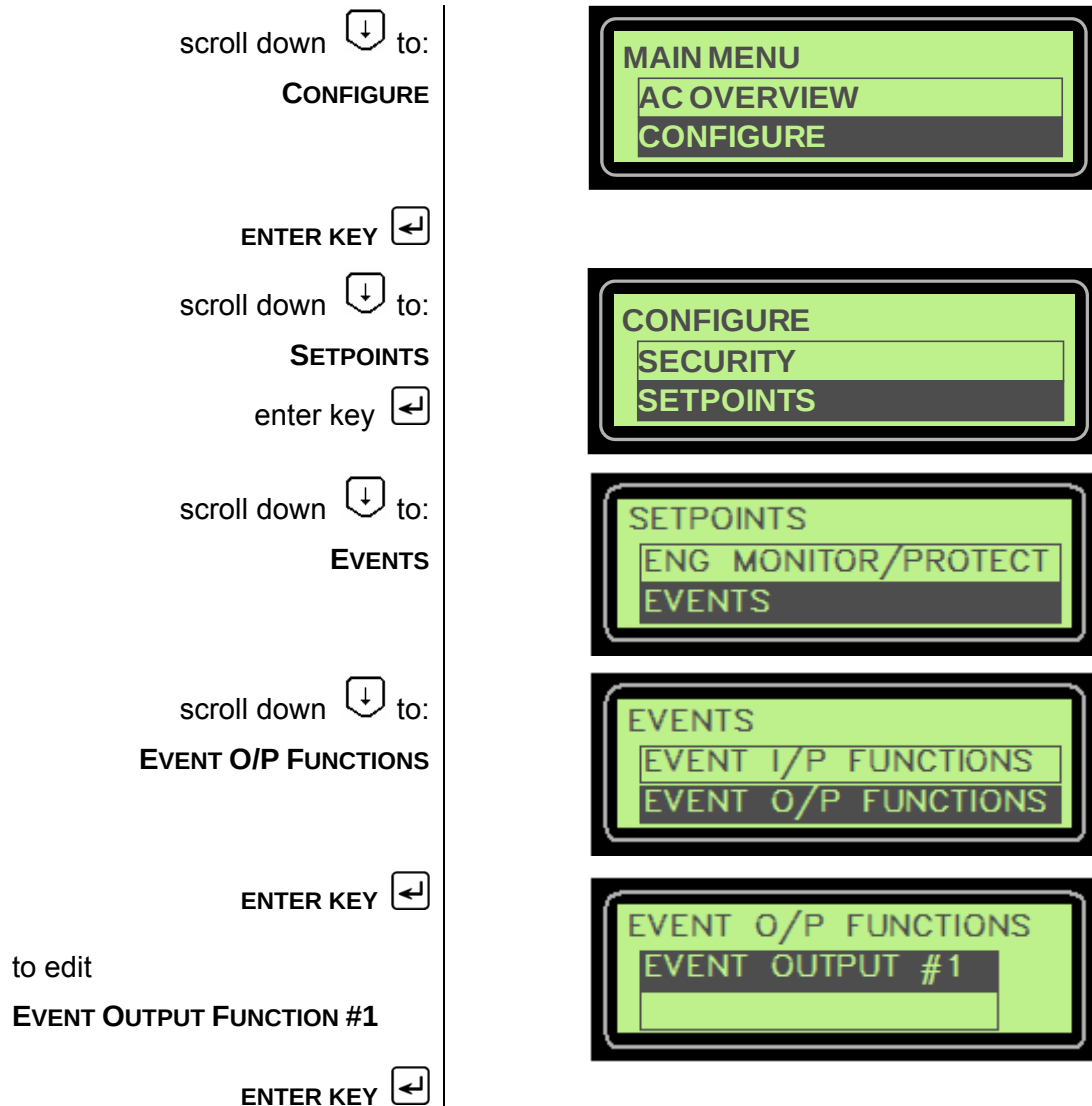
PROGRAMMING EVENT OUTPUT FUNCTIONS

If it is desired to trigger an output based on an event or a set of events, then an additional step is required after one of the Digital Selectors is configured for Event Output Function (as was done for Digital Selector 7 in the example above). This is to define the type of event(s) that will activate the output.

TO PROGRAM EVENT OUTPUT FUNCTIONS, go through the following menu options:

MAIN MENU





The EMCP 3.2 only has one (1) Event Output Function. Two setpoints define the Event Output Function.

EVENT OUTPUT FUNCTION #1 TRIGGER CONDITION: This setpoint defines the FMI or set of FMIs that will trigger the output. It is also used to determine whether the output should be driven only by an event with a specific SPN (called a Specific Event), or any SPN that has a certain FMI (called a General Event). The General Event options are only intended for special cases. If it is desired to drive an output based on any warning or shutdown, it is recommended to configure a Digital Selector to Common Warning, Common Shutdown, or Common Alarm, instead of using the General Event options.

EVENT OUTPUT FUNCTION #1 SUSPECT PARAMETER NUMBER: Every event in the EMCP 3 system is defined with an SPN and FMI. This is the SPN. The Caterpillar® Service Tool shows the parameter list, allowing any one to be selected. If it is desired to drive the output based on a general type of event (for example, any warning, any shutdown, etc), then the SPN selected here does not matter.

EXAMPLE 1: Configuring the Event Output Function for any fault related to the Accessory Data Link.

Set Event Output Function #1 Suspect Parameter Number to Accessory Data Link, and set Event Output Function #1 Trigger Condition to Specific Event - Any Warning, Shutdown, or Diagnostic.

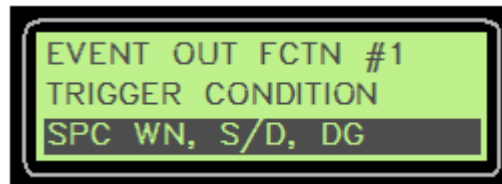
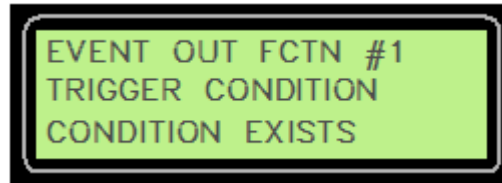
to edit

TRIGGER CONDITION

ENTER KEY 

Scroll Up  or Scroll Down  until Specific Event - Any Warning, Shutdown, or Diagnostic is shown (an abbreviated text is shown due to space limitations).

ENTER KEY 



EXAMPLE 2: Configuring the Event Output Function for Custom Event #1 Condition Exists (for example, if using the Custom Event from Event Input Function #1).

Set Event Output Function #1 Suspect Parameter Number to Custom Event #1 (the number matches with the Event Input Function number), and set Event Output Function #1 Trigger Condition to Specific Event - Condition Exists (this options reads CONDITION EXISTS on the EMCP 3.1 or 3.2 display, and SPC CONDITION EXISTS on the EMCP 3.3 display).

PROGRAMMING RELAY OUTPUTS

Relay Outputs 1-6 are Form-A relays, which means they only have Normally Open contacts. The polarity of these relays are not configurable. They are viewable on the display by going through the following menu options:

MAIN MENU

scroll down  to:

CONFIGURE

enter key 



scroll down  to:

Setpoints

enter key 

scroll down  to:

I/O

ENTER KEY 

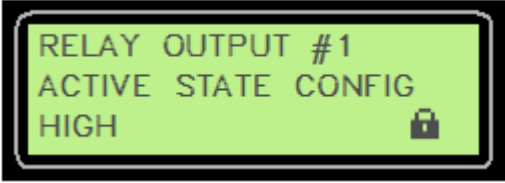
scroll down  to:

RELAY OUTPUTS

ENTER KEY 

Select any of the outputs

ENTER KEY 

All of the outputs are configured with an active state of High, indicating that the contacts are closed when the condition is active (indicating that the relays behave as Normally Open relays).

NOTE: The lock icon with no number after it indicates that the setpoint can not be changed from the display.

Relay Outputs 7 and 8 (available on 3.2 and 3.3) are Form-C relays, which means that both Normally Open and Normally Closed contacts are available. Changing the polarity involves rewiring to the opposite pin. The pins for Relay Outputs 7 and 8 are listed here. For more wiring details, see Figure 2 and Figure 3 in Chapter 3.7, EMCP 3.1, 3.2, 3.3 Electrical Diagrams.

EMCP 3 70-PIN AMP CONNECTOR	
Pin #	Function
1	Relay 8 Normally Open (NO) Contact
2	Relay 7 Normally Open (NO) Contact
14	Relay 8 Normally Closed (NC) Contact
15	Relay 7 Normally Closed (NC) Contact
24	Relay 8 Common
25	Relay 7 Common

PROGRAMMING DIGITAL OUTPUTS (EMCP 3.2 AND 3.3)

Digital Outputs have a sinking driver output. When the condition controlling the output becomes active, the default setting of High for the Digital Output Active State Configuration causes the output to be pulled to battery negative voltage. This will turn on a circuit that is wired between the output and battery voltage. When the condition controlling the output is inactive, the default setting of High for the Digital Output Active State Configuration causes the output to be floating. This will turn off the circuit that is wired between the output and battery voltage.

To reverse this state (i.e. turn **on** a circuit when the controlling condition is **inactive**), go through the following menu options:

MAIN MENU

scroll down  to:

CONFIGURE

enter key 

scroll down  to:

Setpoints

enter key 

scroll down  to:

I/O

ENTER KEY 

scroll down  to:

DIGITAL OUTPUTS

ENTER KEY 

to edit

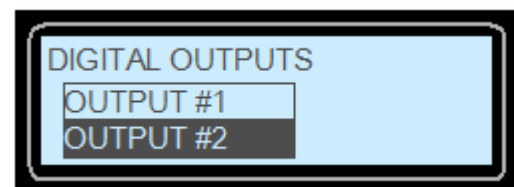
DIGITAL OUTPUT #1

ENTER KEY 



EMCP 3.2

(or scroll down to select Digital Output #2, EMCP 3.3 only)



EMCP 3.3

to edit

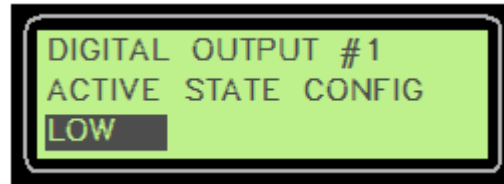
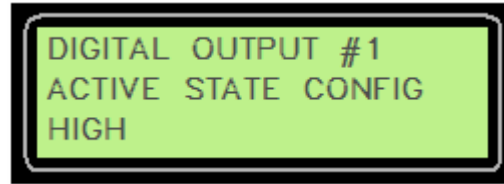
ACTIVE STATE CONFIGURATION

to select

ENTER KEY 

Low
scroll up 

ENTER KEY 



11 MODIFIABLE TEXT STRINGS

The EMCP 3 GSC supports the customization of event names in the event log. This feature called **MODIFIABLE TEXT STRINGS**.

The **MODIFIABLE TEXT STRINGS** feature uses events called **CUSTOM EVENTS**. These are special events that can be configured to display a custom text string in the event log, which is useful when an existing SPN and text string does not exist for the required event. These events can be configured and triggered similar to other events. However, these events are unique in that their displayed text strings can be customized via the Caterpillar® Service Tool using any character in the supported character set of the EMCP 3 GSC software flash file. Furthermore, the Caterpillar® Service Tool has the capability to upload a Modifiable Text Strings configuration file (containing previously saved custom event text strings) from the computer, or download a configuration from the EMCP 3 GSC to the computer.

In order to display a custom text string for an event, following steps must be taken:

1. One of the Event Input Functions must be configured with a Suspect Parameter Number (SPN) of Custom Event and a Failure Mode Identifier (SPN) of Status (or Condition Exists). For more information on configuring Event Input Functions, see Chapter 8.1.
2. A custom string must be entered, using the Modifiable Text Strings tool in the Caterpillar® Service Tool, as described in Chapter 11.2.
3. The language must be set to the customer language, *not* to Technician English.

An example of the modifiable text strings is given below. FIGURE 34 shows the setting within the Caterpillar® Service Tool that customizes the text description of Custom Event #1. FIGURE 35 shows the event log view of the event when it has become present, as viewed in Technician English. FIGURE 36 shows the same as above, viewed in the secondary language (in this case, English).

FORCED SHUTDOWN	
Input	Value
☐ Display	
—Event 1 Line 1	BUILDING FIRE DETECTED
—Event 1 Line 2	FORCED SHUTDOWN
—Event 2 Line 1	

FIGURE 34 : CUSTOMIZING A TEXT STRING IN CATERPILLAR® SERVICE TOOL

CUSTOM EVENT #1	
STATUS	1 / 14
PRESENT	OCC 1

FIGURE 35 : BEFORE CUSTOMIZING THE TEXT STRING

BUILDING FIRE DETECTED	
FORCED SHUTDOWN	1 / 14
PRESENT	OCC 1

FIGURE 36: AFTER CUSTOMIZING THE TEXT STRING

The Modifiable Text Strings functionality differs between EMCP 3 GSC platforms and language sets. The EMCP 3.1 supports up to six Custom Events; the EMCP 3.2 and 3.3 support up to eight Custom Events. Because of their differences in screen resolution, the display platforms also differ in the number of pixels allowed (characters vary in width) in the custom event name.

Different language sets support a different set of characters. Due to all of these differences, Modifiable Text String configuration files have limited portability between EMCP 3 GSC modules.

11.1 LANGUAGE SUPPORT

The primary language for the EMCP 3 GSC control will always be U.S. (Technician) English. The user will always be able to revert back to Technician English from the selected language that is supported by the flash file. However, when the EMCP 3 GSC display is viewed in Technician English, the user will not be able to view the custom text strings and will only be able to view the default strings (as in FIGURE 35) for a given input.

The EMCP 3 GSC has the capability of supporting one flash file containing one secondary language at any particular time. If the user is interested in having a new secondary language, a new flash file to configure the new language must be installed. Therefore, the user will not be allowed to install multiple flash files supporting different languages.

The EMCP 3 GSC supports Unicode characters from the English character set, as well as the character set from the local language supported by the file. It is the user's responsibility to install the preferred flash file with the correct language support that will allow the modification of text strings.

The user is also responsible for choosing the appropriate operating system or Unicode text entry system for the chosen language. The Caterpillar[®] Service Tool software accepts input from the PC keyboard settings. If, for example, the PC keyboard setting is for U.S. English, it may be difficult to enter Russian (or other non-English) characters.

11.2 MODIFIABLE TEXT STRING CONFIGURATION FILE

The user will have the capability of transferring the custom text string data to and from the EMCP 3 GSC by means of the Caterpillar[®] Service Tool, and the capability of modifying the configuration file offline. When not connected to the Caterpillar[®] Service Tool, the user has the ability to make changes to a saved configuration file by navigating to the menu File > Open > Modifiable String Data File, as shown in the FIGURE 37 below.

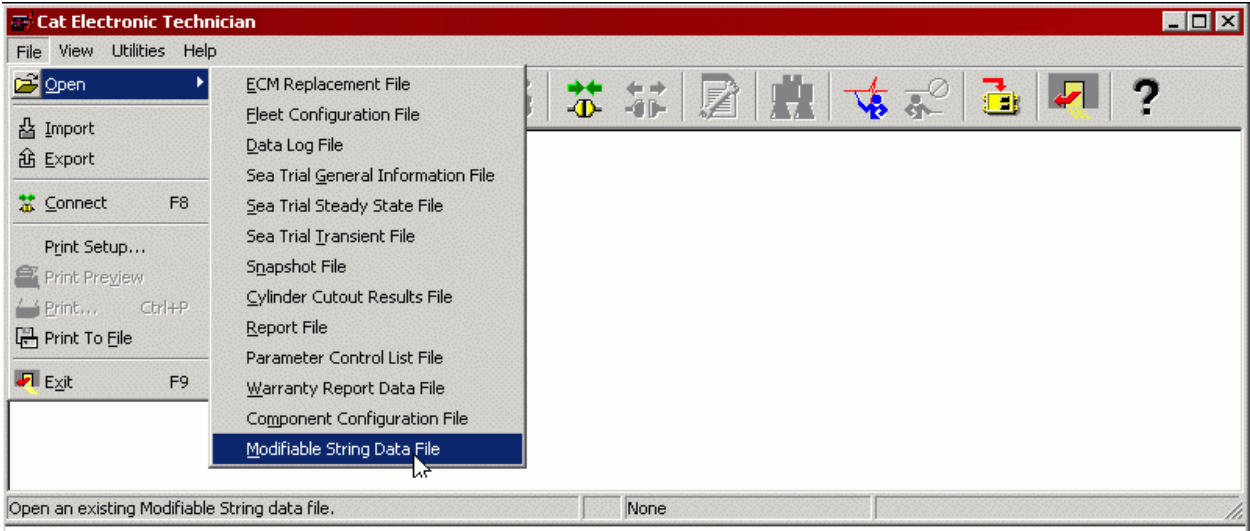


FIGURE 37: CATERPILLAR SERVICE TOOL EMCP 3 GSC OFFLINE EDITING

The user is prompted to select a previously saved file in XML format, to edit, as shown in FIGURE 38.

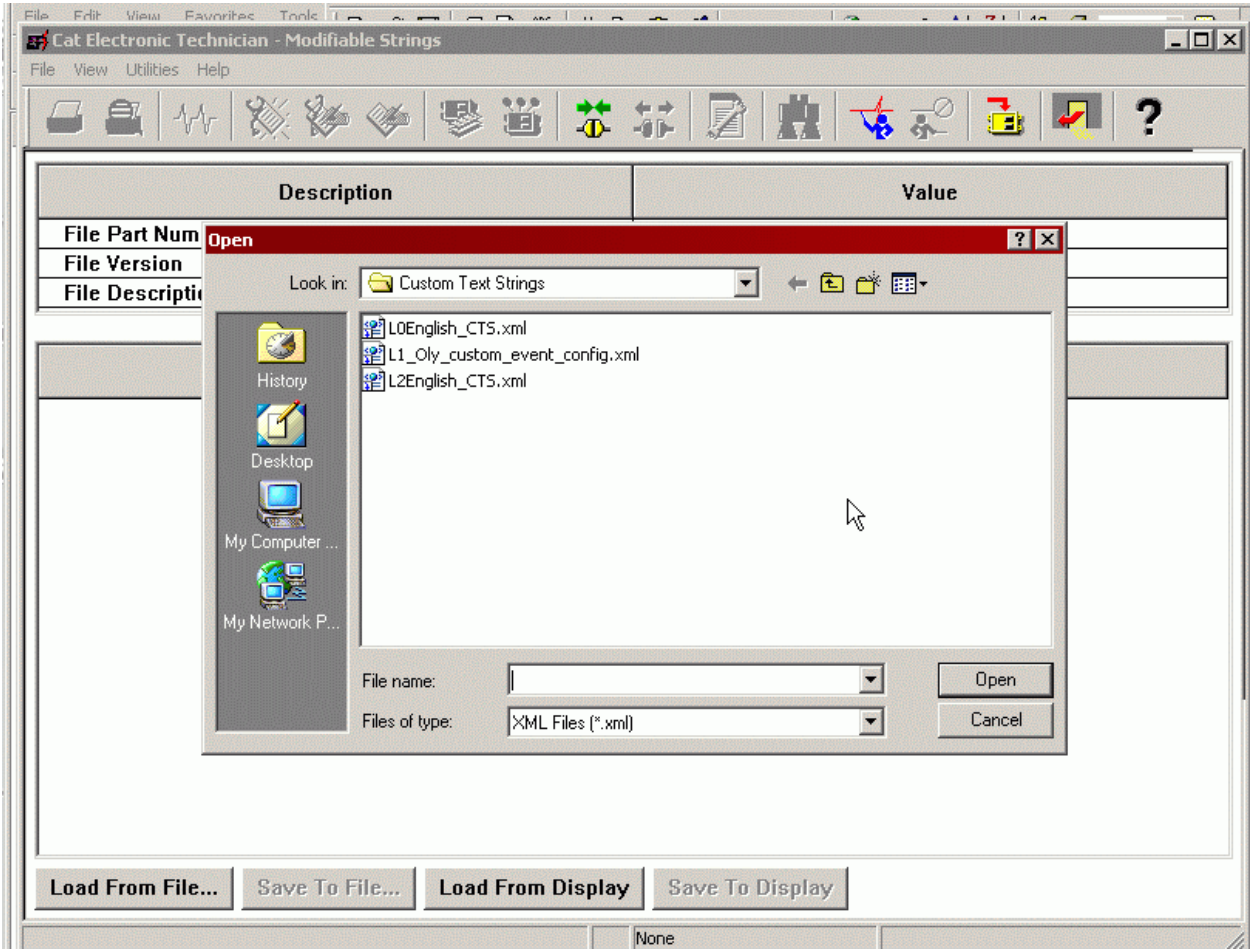


FIGURE 38 : CATERPILLAR® SERVICE TOOL EMCP 3 GSC OFFLINE CONFIGURATION FILE SELECTION

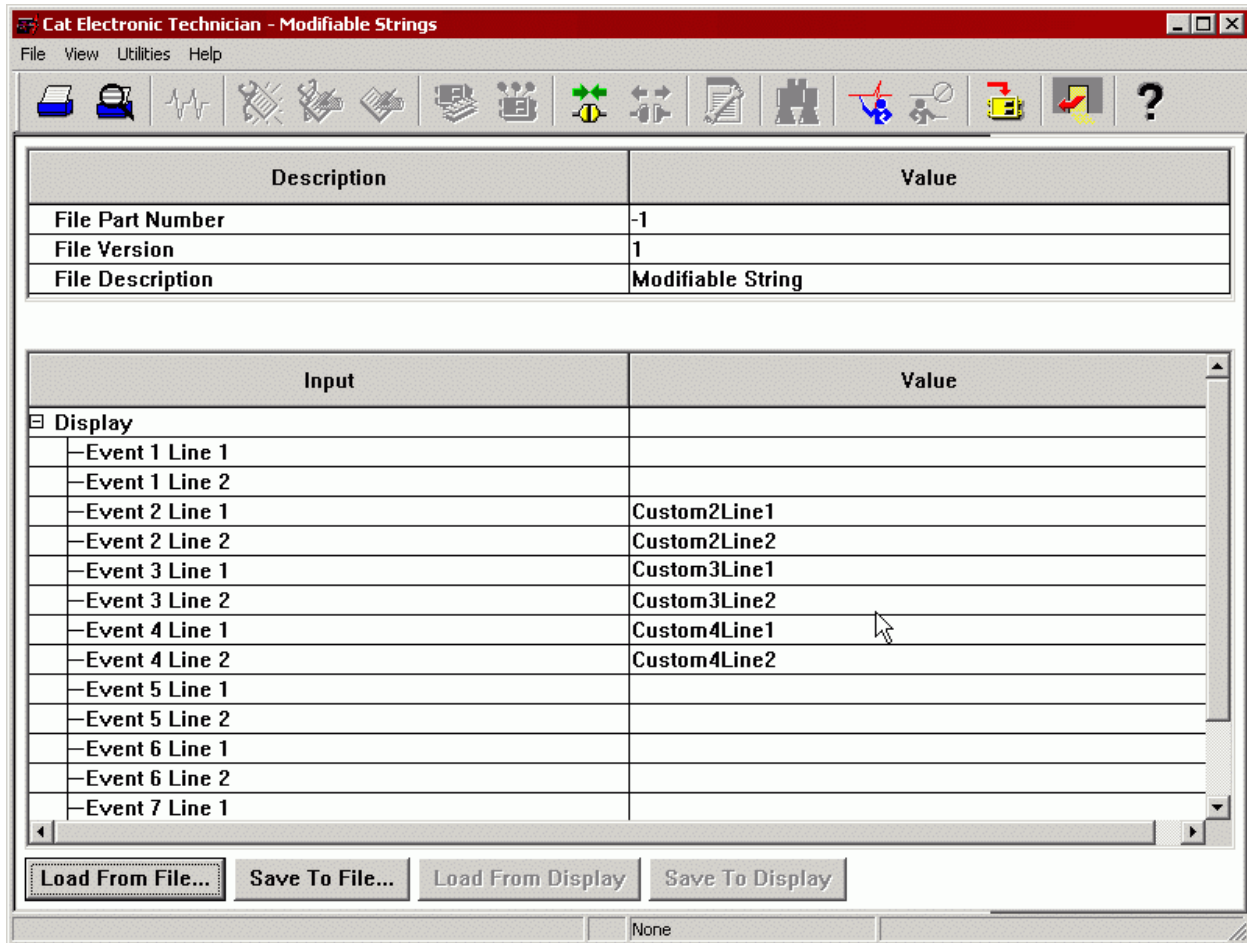


FIGURE 39 : CATERPILLAR[®] SERVICE TOOL EMCP 3 GSC OFFLINE CONFIGURATION FILE EDITING

NOTE: The user must Save any offline changes before attempting to connect the Service Tool to the EMCP 3 GSC, or the changes will not be saved as shown in **FIGURE 39**.

Besides Offline Editing, the user will have the capability of uploading and downloading a configuration data when Online. The configuration file (same file for offline or online editing) includes but is not limited to, the following data:

- The language ID
- Configurable parameter value name current strings
- List of Unicode characters that the EMCP 3 GSC supports
- Pixel Width of each Unicode character

11.3 PROGRAMMING MODIFIABLE TEXT STRINGS USING CATERPILLAR[®] SERVICE TOOL

The Modifiable Text Strings are programmable via the Caterpillar[®] Service Tool, version 2005B v2.0 or later.

In order to update or change the Modifiable Text String values, the following menu options are accessible via the Caterpillar's Service Tool, keeping in mind that the Modifiable Text String parameters can **ONLY** be updated when the EMCP 3 GSC is in the STOP position. After connecting to the EMCP 3 GSC, navigate to the menu Service > Modifiable Strings.

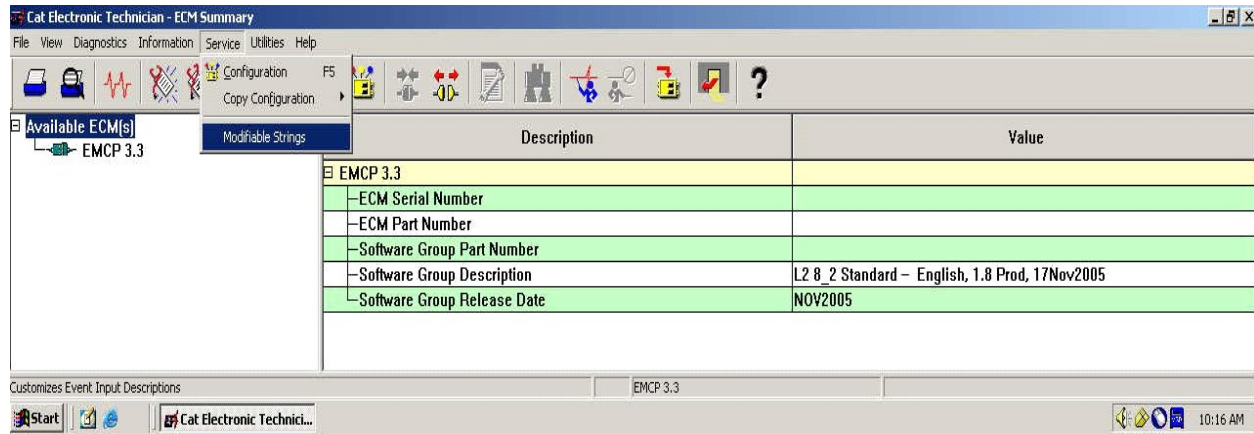


FIGURE 40 : CATERPILLAR[®] SERVICE TOOL EMCP 3 GSC SUMMARY SCREEN

There are two options accessible from the Modifiable String screen (Load from ECM and Load from File). The user must select one of the options before editing the Modifiable Text Strings. Considering that the option of programming Modifiable Text String is usually completed upon initial setup, the user should access the Load from ECM option. The service tool is now collecting information from the control and will display the following message: Loading Data From ECM.

After the downloading of data from the EMCP 3 GSC to the service tool, the user is now able to enter the modifiable text strings. The Modifiable Text String are considered a pair, and the user has the option of customizing the pair of text strings. Therefore, the user is allowed to enter two lines of Custom Text as displayed in the figure below. The user is able to save the entered custom text strings and has the option of saving the Custom text strings to the display or a file.

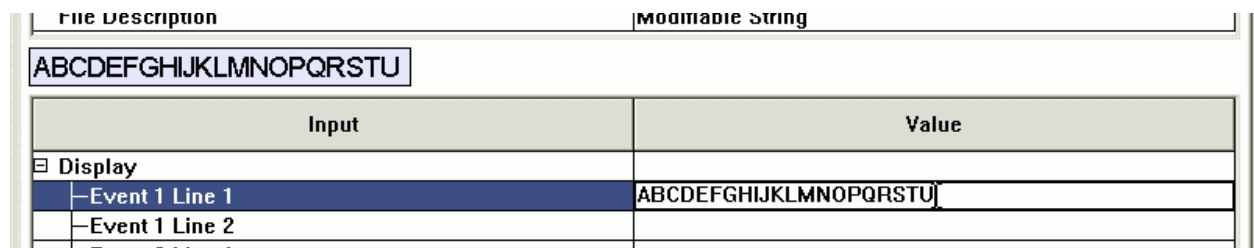


FIGURE 41: ENTERING A STRING IN THE CATERPILLAR[®] SERVICE TOOL MODIFIABLE TEXT STRING SCREEN

The lavender box at the left near the top of the service tool Modifiable Strings screen shows the entered text in the final font and character spacing, and indicates how much space is remaining on the EMCP 3 GSC display line. The second line has less available space, because the event log index is also displayed on that line (see FIGURE 41).

NOTE: The Modifiable Text String parameter value's field is initially blank until it is replaced with a custom text string parameter value. The custom text string parameter value entered will replace the default strings.

Remember only when you Save To ECM will the changes made be uploaded to the EMCP 3 GSC and take effect. Then the EMCP 3 GSC will display the custom text string parameter value(s) in the flash file secondary language. The user's custom text string parameter(s) are displayed only when an event FMI 31 for the custom event is triggered.

When viewing the display in Technician English, the user will only have access to the Default Strings. Since the Modifiable Text Strings are offered as a string pair, the default strings will be displayed as Custom Event #1 on the first line, and Status on the second line.

The user's Custom Text Strings are displayed in the user's preferred language. If the service tool doesn't support the user's preferred language, US English will be used.

11.4 TROUBLESHOOTING MODIFIABLE TEXT STRINGS

The following are a common problems with Modifiable Text String and the steps you can take to resolve them.

PROBLEM: I AM UNABLE TO VIEW THE CUSTOM EVENT AT ALL

TEST STEP 1. CHECK FOR WIRING PROBLEMS.

From the Main Menu, select I/O Status. When you activate the input, does the appropriate input indication change? If not, check your wiring. The input should be wired between the appropriate digital input pin and ground (-BATT).

EXPECTED RESULT:

When you flip the switch that is wired between the proper input pin and (-BATT), the I/O Status screen indication changes from a hyphen (-) to a number (depending on which number input you are switching).

RESULTS:

OK - The wiring and indication on the EMCP 3 GSC are okay. Proceed to Test Step 2.
NOT OK - The wiring needs correction. Stop and repair.

TEST STEP 2. IS THE EVENT INPUT FUNCTION CONFIGURED FOR THE CUSTOM EVENT?

In order to show the custom text string in the event log, the **EVENT INPUT FUNCTION #X SUSPECT PARAMETER NUMBER** must be configured for a special type of event called **CUSTOM EVENT**, and the **FAILURE MODE IDENTIFIER** must be set to **CONDITION EXISTS**.

Be aware of a numbering offset. Digital Input #3 triggers Event Input Function #1, which (if configured properly) triggers Custom Event #1. For higher numbered Digital Inputs, the numbers increase correspondingly.

EXPECTED RESULT:

The Event Input Function #1 Suspect Parameter Number (if using Digital Input #3) is configured for Custom Event, and the Event Input Function #3 Failure Mode Identifier is configured for Condition Exists (called Status on the Service Tool)

RESULTS:

OK - The setpoints are configured correctly. Proceed to Test Step 3.

NOT OK - The setpoints need to be changed. You need either security level 2 access, or access to the Service Tool, to change these setpoints. If changing the Suspect Parameter Number setpoint from the control panel display, first the category Others must be selected, and then Custom Event (the items are not in alphabetical order).

TEST STEP 3. IS THE EVENT RESPONSE ENABLED?

Each type of event, such as Custom Event #1 Condition Exists, has an associated Event Response Configuration, which must be enabled for the event to show up in the event log.

EXPECTED RESULT:

Custom Event #n Condition Exists Event Response Configuration (the setpoint name may or may not include the words Condition Exists) for the particular custom event you are trying to trigger, should be set to Warning, Soft Shutdown, Hard Shutdown or Active Only (other settings are optional).

RESULTS:

OK - The setpoint is already configured for one of those (warning, soft shutdown, hard shutdown or Active Only). Please, call your customer support representative for further assistance.

NOT OK - The setpoint needs to be changed. You need either security level 2 access, or access to the Service Tool, to change this setpoint. Make sure the ECS is set to STOP before attempting to change this setpoint.

PROBLEM: THE CUSTOM EVENT IS VIEWABLE BUT, THE DEFAULT TEXT IS SHOWN ON THE EMCP 3 GSC DISPLAY INSTEAD OF THE USER'S CUSTOM STRING

TEST STEP 1. VERIFY THAT THE CONTROL PANEL DISPLAY IS SET TO THE PRIMARY LANGUAGE.

The control panel display supports a user language (which may be English, or perhaps a different language) as well **TECHNICIAN ENGLISH**. If your primary language is English, you may not notice that the display is set to **TECHNICIAN ENGLISH**.

NOTE: User language of **ENGLISH** and **TECHNICIAN ENGLISH** look nearly identical.

You can change the language setting from the Main Menu by selecting Preferences > Language.

NOTE: **PREFERENCES** is the bottom item in the Main Menu, and **LANGUAGE** is the bottom item in the Preferences menu. This facilitates changing from a language the user does not understand to a language the user does understand.

EXPECTED RESULT:

Check the language setting. **TECHNICIAN ENGLISH** should NOT be selected.

RESULTS:

OK - The language is not set to **TECHNICIAN ENGLISH**. Proceed to Test Step 2.

NOT OK - Scroll down to the primary language and press the Enter key on the EMCP 3 GSC display to change the language. Go back into the event log and verify that the custom string is being displayed for the Custom Event when the corresponding input is activated.

TEST STEP 2. VERIFY A CUSTOM STRING

Verify that a custom string was created and uploaded using the Caterpillar® Service Tool Modifiable Text Strings tool.

Enter the Modifiable Text Strings tool and press the button reading Load from ECM (the button may read Load from Display instead). Verify that the Custom Event you are trying to display with a custom text string has the custom string displayed here.

EXPECTED RESULT:

There is a text string shown to the right of the custom event you are trying to configure. For example, in FIGURE 39, Custom Event #1, #5, and #6 DO NOT have a custom string defined, but Custom Event #2, #3, and #4 DO have custom strings defined.

RESULTS:

OK - There is a custom string defined for the Custom Event I am trying to configure. Proceed to Test Step 3.

NOT OK - A custom string needs to be entered. Double-click to the right of either Line 1 or Line 2 of the Custom Event, and type in your custom string. When you are finished, press the button reading Save To ECM to upload your changes to the EMCP 3.2

TEST STEP 3. VERIFY THAT YOU ARE TRIGGERING A STATUS EVENT.

The Event Input Function Failure Mode Identifier corresponding to the Custom Event you are trying to trigger should be set to Condition Exists or Status (even if the custom event you is a high or low warning or shutdown).

EXPECTED RESULT:

Check the event log entry for the Custom Event. Does it read STATUS on the second line? The others, LOW WARNING, LOW SHUTDOWN, HIGH WARNING, or HIGH SHUTDOWN, cannot be displayed with custom text.

NOTE: This does not mean you cannot configure the custom event to trigger a warning or shutdown. Simply configure the Custom Event #x Condition Exists Event Response Configuration (the setpoint name may or may not include the words Condition Exists) to trigger a Warning, Soft Shutdown, or Hard Shutdown. You may want to indicate the type of action taken in your custom text string. For example BUILDING FIRE DETECTED WARNING versus BUILDING FIRE DETECTED SHUTDOWN.

RESULTS:

OK - The event does read CUSTOM EVENT on line 1 and STATUS on line 2. Please, call your customer support representative for further assistance.

NOT OK - Reconfigure the desired Event Input Function Failure Mode Identifier to Condition Exists or Status.

12 SAVING AND RESTORING SETPOINTS

The EMCP 3 GSC supports the saving and uploading of the EMCP 3 GSC setpoints through a setpoint configuration file. This file, called the ECM Replacement File, is accessible via the ECM Replacement tool of the Caterpillar® Service Tool software. The file contains information specific to the EMCP 3 GSC, and includes the setpoint values that are specific to a given EMCP 3 GSC module. The user has the option of saving the data to an ECM Replacement File from an EMCP 3 GSC module or uploading the data from the ECM Replacement File to another EMCP 3 GSC module. The user also has the option of uploading general configuration data to several EMCP 3 GSC modules by means of a similar tool called Fleet Configuration. Both of these options are accomplished through the Caterpillar® Service Tool software.

NOTE: This Chapter only addresses setpoints residing in the EMCP 3 GSC. To save and restore setpoints for other (optional) modules on the EMCP 3 J1939 data links, a similar procedure must be followed for each individual module. For more information refer to Chapter 17, Optional Modules.

12.1 SAVING EMCP 3 CONFIGURATION DATA

To save an EMCP 3 GSC configuration use the Caterpillar® Service Tool.

The EMCP 3 GSC configuration should be saved upon initial access or after the initial configuration. This will be required for future accessibility when exchanging or replacing the EMCP 3 GSC module.

After connecting to the EMCP 3 GSC, navigate to the Menu Service > **COPY CONFIGURATION**. There are two options: (See FIGURE 42).

- Fleet Configuration
- ECM Replacement

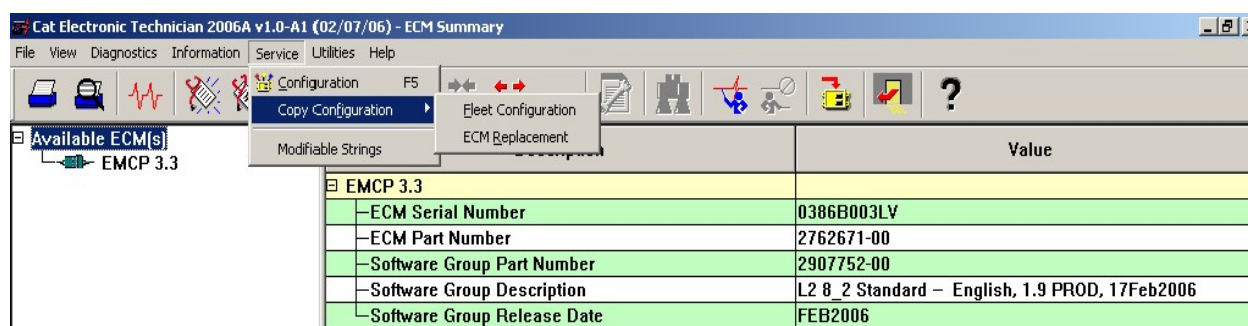


FIGURE 42: CATERPILLAR® SERVICE TOOL EMCP 3 GSC SUMMARY SCREEN

FLEET CONFIGURATION OPTION

Select the **FLEET CONFIGURATION** option when there is a need to save and copy **GENERAL DATA** to several ECMs (non-module-specific).

The **FLEET CONFIGURATION** tool works very similar to the ECM Replacement tool, with the exception of module-specific data such as **ENGINE SERIAL NUMBER**.

ECM REPLACEMENT OPTION

To save EMCP 3 GSC configuration data to an ECM Replacement file:

Select from the Service Tool menu:

SERVICE >

COPY CONFIGURATION >

ECM REPLACEMENT

If there are no previously saved field replacement files, the following message is displayed: **No Data Is Available. Load From ECM Now.**

Select which ECM's configuration data is to be viewed and/or saved for future use. This configuration data to be saved in the ECM Replacement file is shown in FIGURE 43.

NOTE: The option of deselecting certain setpoints can be chosen at this screen.

After any selection changes are completed, the user must choose **SAVE TO FILE**. The ECM replacement file is now saved for future access. Make sure to note what directory and folder the file is stored at.

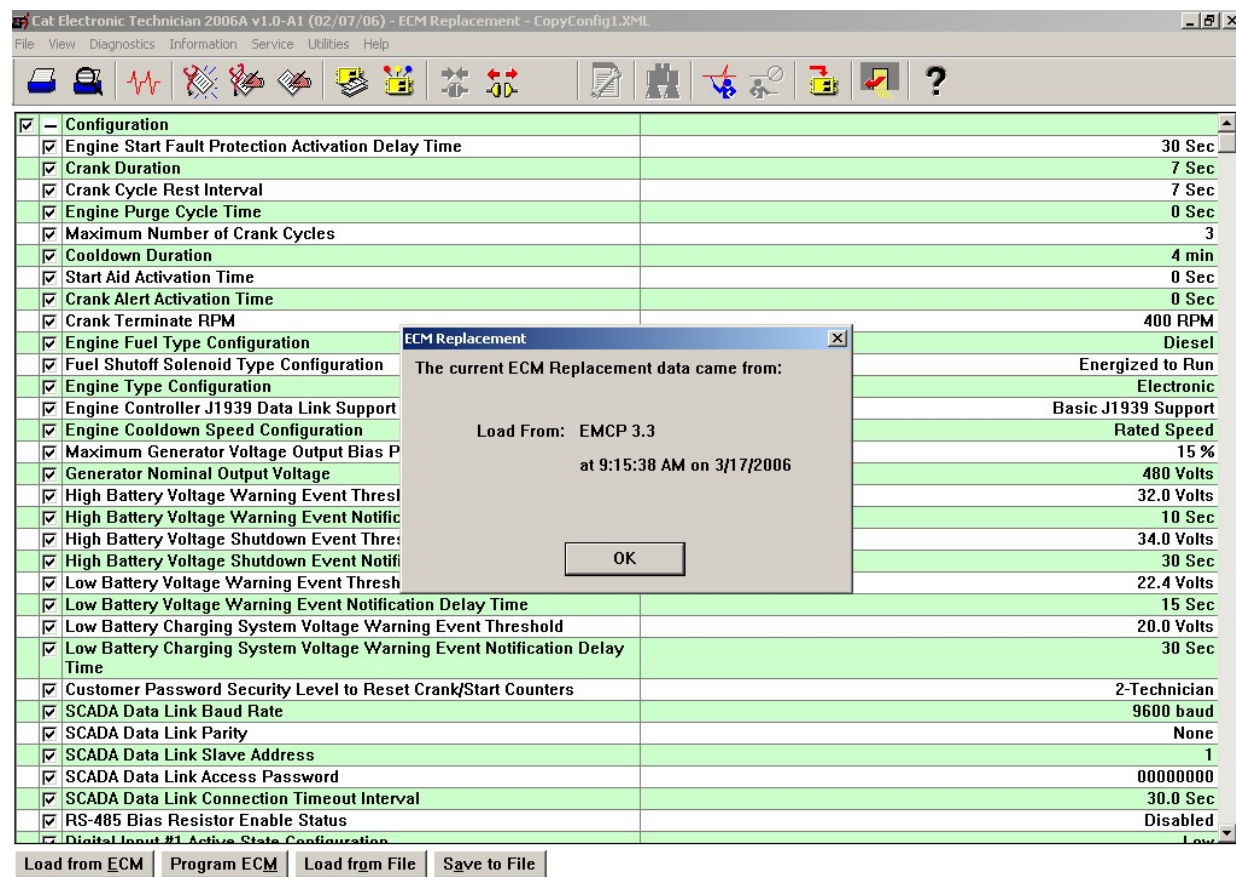


FIGURE 43: CATERPILLAR® SERVICE TOOL ECM REPLACEMENT SCREEN

NOTE: The configuration data must be saved to a file before disconnecting from the service tool or the data **WILL BE LOST** and must be re-loaded from the source module again.

12.2 LOADING EMCP 3 CONFIGURATION DATA

The loading of EMCP 3 GSC configuration data is very similar between **ECM REPLACEMENT** and **FLEET CONFIGURATION**. For illustration purposes, the **ECM REPLACEMENT** option will be described here.

CONFIGURATION DATA

To load EMCP 3 GSC configuration data from an ECM Replacement file, the user must select from the Service Tool menu:

Service >

Copy Configuration >

ECM Replacement

If there exists a previously saved ECM Replacement file, the tool will allow the user to select between them, as shown in FIGURE 44. If there are no previously saved ECM Replacement files, the user must first load configuration data from an EMCP 3 GSC module. For instructions on loading configuration data from an EMCP 3 GSC module, see Chapter 12.1, SAVING EMCP 3 CONFIGURATION DATA.

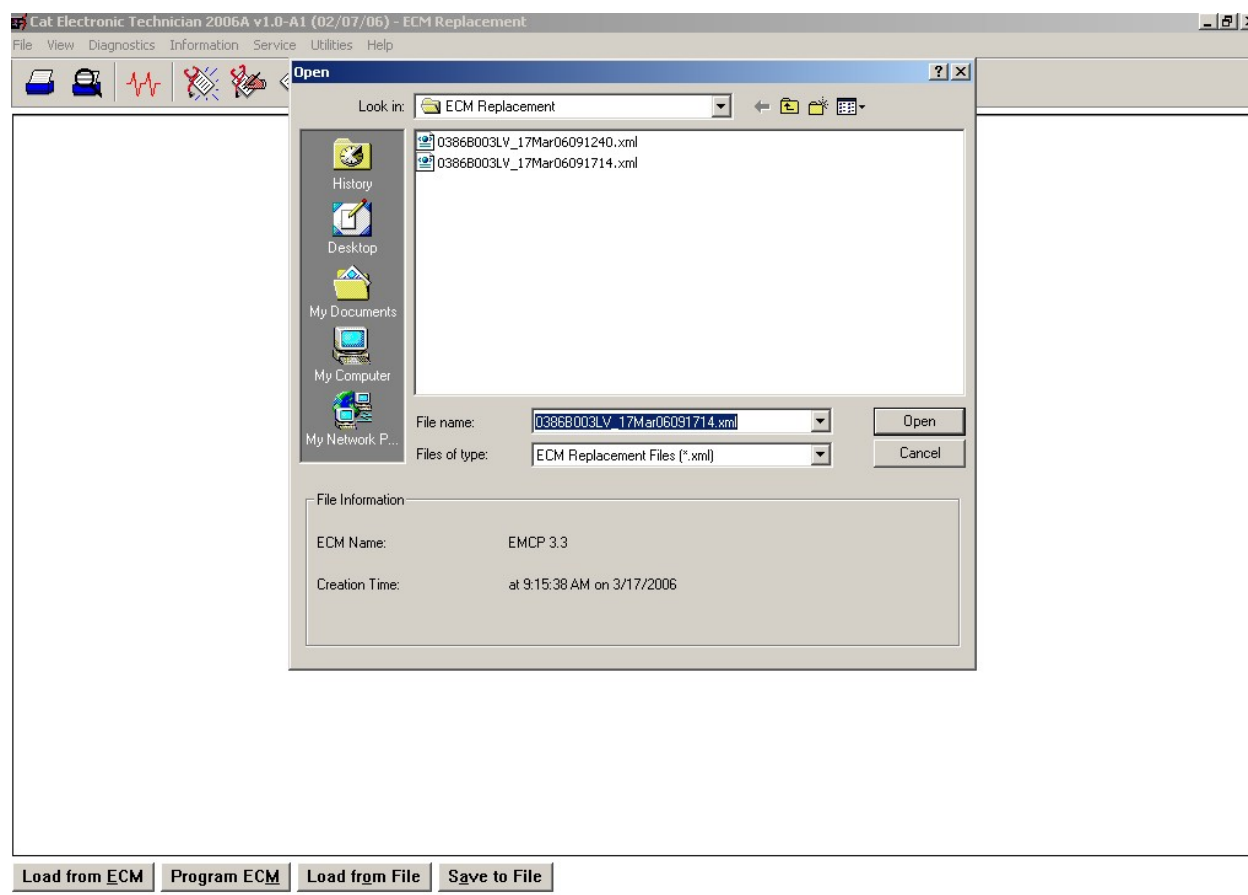


FIGURE 44 : CATERPILLAR® SERVICE TOOL FIELD REPLACEMENT FILE SELECTION

NOTE: ECM Replacement files are stored in the ECM Replacement folder, while Fleet Configuration files are stored in the Fleet Configuration folder.

The list of setpoints and values are shown after opening an ECM Replacement file.

DESELECTING SETPOINTS

The user has the option of deselecting certain setpoints, if the user wants to keep the values currently configured into the connected EMCP 3 GSC module. The user may upload the selected setpoints into the new EMCP 3 GSC by pressing the **PROGRAM ECM** button. The user is then prompted with the ECM selector box. The EMCP 3 GSC should be highlighted since it is being programmed. FIGURE 45 below displays the programming of an EMCP 3 GSC with the setpoint values from an ECM Replacement file.

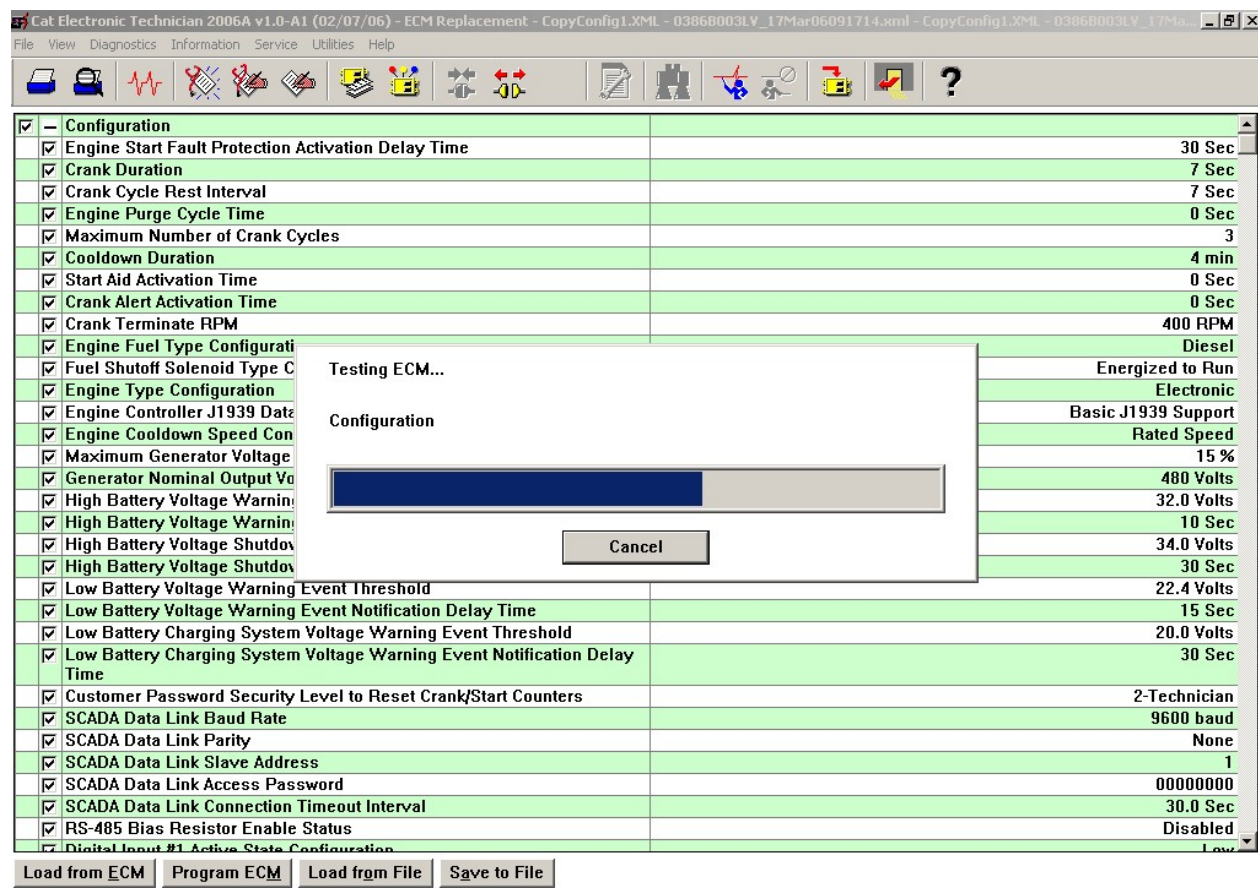


FIGURE 45: CATERPILLAR® SERVICE TOOL

When the field replacement file has been successfully programmed to the new EMCP 3 GSC, a **PROGRAMMING COMPLETE** box will display. Press **OK**.

The above steps, for uploading saved configuration data, will need to be repeated for each EMCP 3 GSC module needing same or similar setpoint configurations.

NOTE: When programming **EVENT RESPONSE CONFIGURATION** setpoints, the control must be in **STOP** mode. If the control is not in **STOP**, there will be a message after the programming is complete. The message will show that none of the Event Response Configuration setpoints were changed.

13 PROGRAMMABLE CYCLE TIMER (EMCP 3.2 & 3.3)

The Programmable Cycle Timer (PCT) feature allows the operator to program seven independent times when tasks, called PCT Outputs, will be activated or deactivated automatically during the week. This is useful for cases where two or more generators are required to automatically share the duty of supplying a load throughout the week.

Using PCT, each genset can be programmed to start and stop at pre-set times.

For example: if a standby set does not have access to a utility supply to power a trickle charger, the PCT can be set for an hour a week to keep the battery well charged.

CAUTION: The co-operation of a transfer switch is required to ensure that the gensets are not stopped on load.

The **PCT FEATURE** consists of seven independent timers; each timer has the following setpoints (setpoints shown are for PCT #1):

PROGRAMMABLE CYCLE TIMER #1: Activation Day of the Week:

This permits independent selection of each day (Sun -> Sat) that the timer will activate.

PROGRAMMABLE CYCLE TIMER #1: Activation Start Time

The time of day (in hours and minutes) that the timer will activate.

PROGRAMMABLE CYCLE TIMER #1: Active Time

The duration (in hours and minutes) for which the timer will be active (up to 24 hours).

PROGRAMMABLE CYCLE TIMER #1: Output #1 Activation Configuration

Whether the Programmable Cycle Timer's first output will be activated when this timer is active.

PROGRAMMABLE CYCLE TIMER #1: Output #2 Activation Configuration

Whether the Programmable Cycle Timer's second output will be activated when this timer is active.

The PCT has two internal outputs; these should not be confused with the physical outputs of the control. The outputs are connected internally to the control module. In the standard configuration, **PCT OUTPUT #1** is connected to a Remote Initiate command. **OUTPUT #2** is connected via **DIGITAL SELECTOR #6** to **RELAY OUTPUT #8**. This effectively allows the operator to configure a timed relay, for external connectivity.

The status of the PCTs can be found within the menu structure at:

CONTROL -> PROG CYCLE TIMER -- (See FIGURE 46).

The **TOP ROW** displays the seven PCTs (#1 through #7).

The **MIDDLE** row is for **OUTPUT #1**.

The **LAST** row is for **OUTPUT #2**.

13.1 CONTROLLING THE OUTPUTS

The status of each output is indicated by a **1**, **0**, or **-** in the **PROG CYCLE** column under #1 through #7.

The number **ONE 1** means that this PCT is driving that output to be **TRUE**

The number **ZERO 0** means that this PCT is **NOT** driving this output true now, but, this output is programmed to be TRUE at another time.

A **HYPHEN -** means that this PCT is **NOT** programmed to activate this output.

PROG CYCLE :	1	2	3	4	5	6	7
OUTPUT 1 :	1	0	-	-	-	-	-
OUTPUT 2 :	-	0	0	-	-	-	-

FIGURE 46: PCT DISPLAY EXAMPLE

PCT #1 is **ACTIVE**, **1** -- Output #1. Output #2 is **NEVER** enabled (the '-' in the bottom row).

PCT #2 is **NOT** active, **0** -- however, when it is active, it activates both Output #1 and Output #2. The two zeroes show that this PCT will **ENABLE** both outputs when it becomes active.

PCT #3 is **NOT** active. When it becomes active it will **ONLY** activate Output #2.

PCT #4, PCT #5, PCT #6, and PCT #7 are **DISABLED**. They **NEVER** activate Output #1 or Output #2.

SETPOINTS associated with Programmable Cycle Timer are configured from this screen by scrolling **LEFT**  and **RIGHT**  until the desired PCT is within the selection box and then pressing the **ENTER KEY** .

INTERNAL OUTPUTS

The PCT has two internal outputs; these should not be confused with the physical outputs of the control. The outputs are connected to internal logic.

In the standard logic configuration, PCT Output #1 is connected to a **REMOTE INITIATE** command and PCT Output #2 is connected via Digital Selector #6 to Relay Output #8. This effectively allows the operator to configure a timed relay, for external connectivity.

The status of the PCTs can be found within the menu structure at Control -> Prog Cycle Timer, an example is shown in FIGURE 47.

The seven times are displayed across the top row. For the Output 1 and Output 2 rows, the number one 1 means that this Programmable Cycle Timer is driving that output to be true. The number zero 0 means that this Programmable Cycle Timer is not driving this output true but, that it would at other times. A hyphen - means that this Programmable Cycle Timer never activates this output.

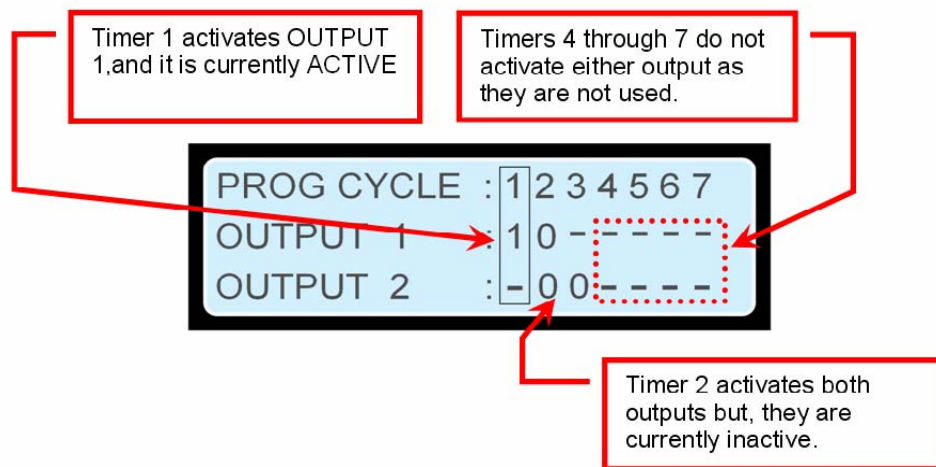


FIGURE 47: PROGRAMMABLE CYCLE TIMER STATUS SCREEN

The setpoints associated with Programmable Cycle Timer are configured from this screen by scrolling left and right until the desired Programmable Cycle Timer is within the selection box and then pressing **ENTER KEY** .

14 REDUCED POWER MODE

REDUCED POWER MODE (RPM) is a feature that puts the control into a state where the power consumption is reduced. RPM is intended to extend the amount of time the generator can sit between runs before the control drains the batteries too low to crank the generator in cases where a battery trickle charger is not fitted.

In order to reduce the power consumed when in RPM, many functions within the control are turned **OFF**.

TURNED OFF DURING RPM

- ☒ The display
- ☒ The communication lines
- ☒ Most inputs
- ☒ All outputs
- ☒ LEDs (lamps) on the front of the control blink briefly every second (rather than being on continuously).

When RPM is enabled, the control will only enter RPM after a programmable time delay provided the generator is stopped and no keys have been pressed during the delay time.

The control will wake from RPM on any one of the following conditions:

WAKE FROM RPM

- ☒ Input 1 (Emergency-Stop) is grounded
- ☒ Input 2 (Remote Initiate) is grounded
- ☒ A key on the keypad is pressed
- ☒ The Programmable Cycle Timer is about to enter a period when it will activate an output.

CAUTION: Cat generator sets normally use an active high contact of E-Stop to the control. When there is no E-Stop, input 1 (E-Stop) is normally in the grounded state. This is one of the conditions to leave RPM or the control would never enter RPM. Therefore, in order to make use of Reduced Power Mode on a Cat genset, the customer/dealer needs to be aware that they are giving up the fail-safe nature of E-Stop and they have to re-wire any E-Stop contacts connected to the control.

NOTE: In many cases there is a redundant fail-safe contact of the E-Stop switch controlling the fuel or connected to the Engine ECU on electronic engines)

ACTIONS TO ENABLE RPM

1. Ensure all the contacts of Emergency-Stop that are wired to the EMCP3 are normally open (Normally Open switch). This will cause an E-Stop event, this resolved in the next step.

2. Set the active state of Digital Input #1 to active low. Reset the E-Stop event.
3. Change the setpoint Reduced Power Mode Enable Status to **ENABLED**. This can be done with either ET or using a level 3 password to navigate Configure -> Setpoints -> Other -> Reduced Power Mode.
4. The setpoint Reduced Power Mode Delay Time should be checked. It should be at a desirable value. This value is the amount of time (once the generator is at rest and after the last key-press) before the control will go into Reduced Power Mode.

Semi-Awake

The EMCP 3 becomes **SEMI-AWAKE** when in Reduced Power Mode. Approximately every 30 minutes it will do status checks of the control for about 40 seconds. The control checks the status of the resistive senders, Magnetic Pick-Up, raise any **SHORTED** or **OPEN** events (if detected), and will activate any relays (such as common alarm).

During **SEMI-AWAKE** the display remains off and the LEDs (lamps) continue to blink.

Once the **SEMI-AWAKE** time is completed the control will return to full RPM (deactivating any relays that are active).

15 PROGRAMMABLE TRIP POINT FUNCTION

The standard configuration on EMCP 3.2 and 3.3 has one Programmable Trip Point function block configured to respond to the %KW of the genset (this feature is not available on EMCP 3.1. It is not capable power monitoring).

NOTE: The Programmable Trip Point function cannot be configured to act upon a different parameter from %KW. In order to obtain such a capability, a custom flash file must be ordered. Contact your Caterpillar dealer for details.

The setpoints of this block are configured by default such that, if the %KW exceeds 90% for 10 seconds then the output of the block will become true and remain true until the %KW drops below 85% for 1 second.

The output of the Programmable Trip Point function block can be configured through Digital Selector #2 to Relay output #4 or through Digital Selector 7 to Digital (transistor) Output #1.

The setpoints in the Programmable Trip Point function can be changed from the display, they are as follows:

PROGRAMMABLE TRIP POINT FUNCTION TRIGGER CONDITION

[Default = Trip Above Threshold]

This selects whether the output will be active if the value is above or below the threshold.

PROGRAMMABLE TRIP POINT FUNCTION PERCENTAGE THRESHOLD

[Default = 90%]

This is the threshold that the measured parameter must pass to change the state of the output, in the default case (%KW) this is 90% of rated kW.

PROGRAMMABLE TRIP POINT FUNCTION HYSTERESIS PERCENTAGE

[Default = 5%]

Once the output is on, the value must return by thus much *past* the Threshold before the output turns off again, in the default case (%KW) this 5% causes the relay to not turn off again until 85% of rated kW (90-5). This hysteresis is used to ensure that a value close to the threshold does not cause the output to rattle on and off.

PROGRAMMABLE TRIP POINT FUNCTION TRIP ACTIVATION DELAY TIME

[Default = 10 seconds]

This is the time that the value must exceed the threshold before the output of the block becomes active. It is used to ensure that the momentary transients are ignored.

PROGRAMMABLE TRIP POINT FUNCTION TRIP DEACTIVATION DELAY TIME

[Default = 1 seconds]

This is the time that the value must return past the threshold before the output of the block becomes inactive again. It is used to ensure that the momentary transients are ignored.

16 J1939 DATA LINKS

16.1 PRIMARY J1939 DATA LINK

The Primary J1939 Data Link is supported by all levels of the EMCP 3 GSC.

The Primary J1939 Data Link is used for local communication among modules associated with a single genset. These include one or two engine Electronic Control Modules (ECM), the Caterpillar Digital Voltage Regulator (CDVR), and a Thermocouple Module. The EMCP 3 GSC can interface with both EUI and MUI engines; in MUI engines, the engine sensors are wired directly to the EMCP 3 GSC.

The Primary J1939 Data Link utilizes the Society of Automotive Engineers (SAE) J1939 protocol and requires hardware compliant to the high-speed Controller Area Network (CAN) 2.0B protocol defined in the International Standards Organization (ISO) 11898-2 document, running at 250k bits per second.

The Primary J1939 Data Link supports appropriate SAE J1939 Broadcast Parameter Group Numbers (PGN) and Suspect Parameter Numbers (SPN) for engine and genset data and diagnostics.

PRIMARY J1939 WIRING

The Primary J1939 communication wires are brought out of the EMCP 3 GSC as part of the 70-pin AMP connector. The pins, as designated on the AMP connector, are shown in **TABLE 1**.

TABLE 5: PRIMARY J1939 DATA LINK ON 70-PIN CONNECTOR

AMP CONNECTOR		
Pin #	Name	Description
34	CAN1 -	Differential (-) for CAN
42	CAN1 SH	Shield for CAN
50	CAN1 +	Differential (+) for CAN

NETWORK TOPOLOGY

The physical topology of the CAN network used in the Primary J1939 Data Link is a bus topology, consisting of a main trunk and small drops.

- The maximum allowable trunk length is 130 ft (40 m), and the maximum drop length is 3 ft (1 m).
- The CAN network requires a termination resistor on the extreme ends of the main trunk.

The topology for the EMCP 3.1 is illustrated in FIGURE 48.

The topology for the EMCP 3.2 and EMCP 3.3 is illustrated in FIGURE 49 (without optional modules) and FIGURE 50 (with optional modules).

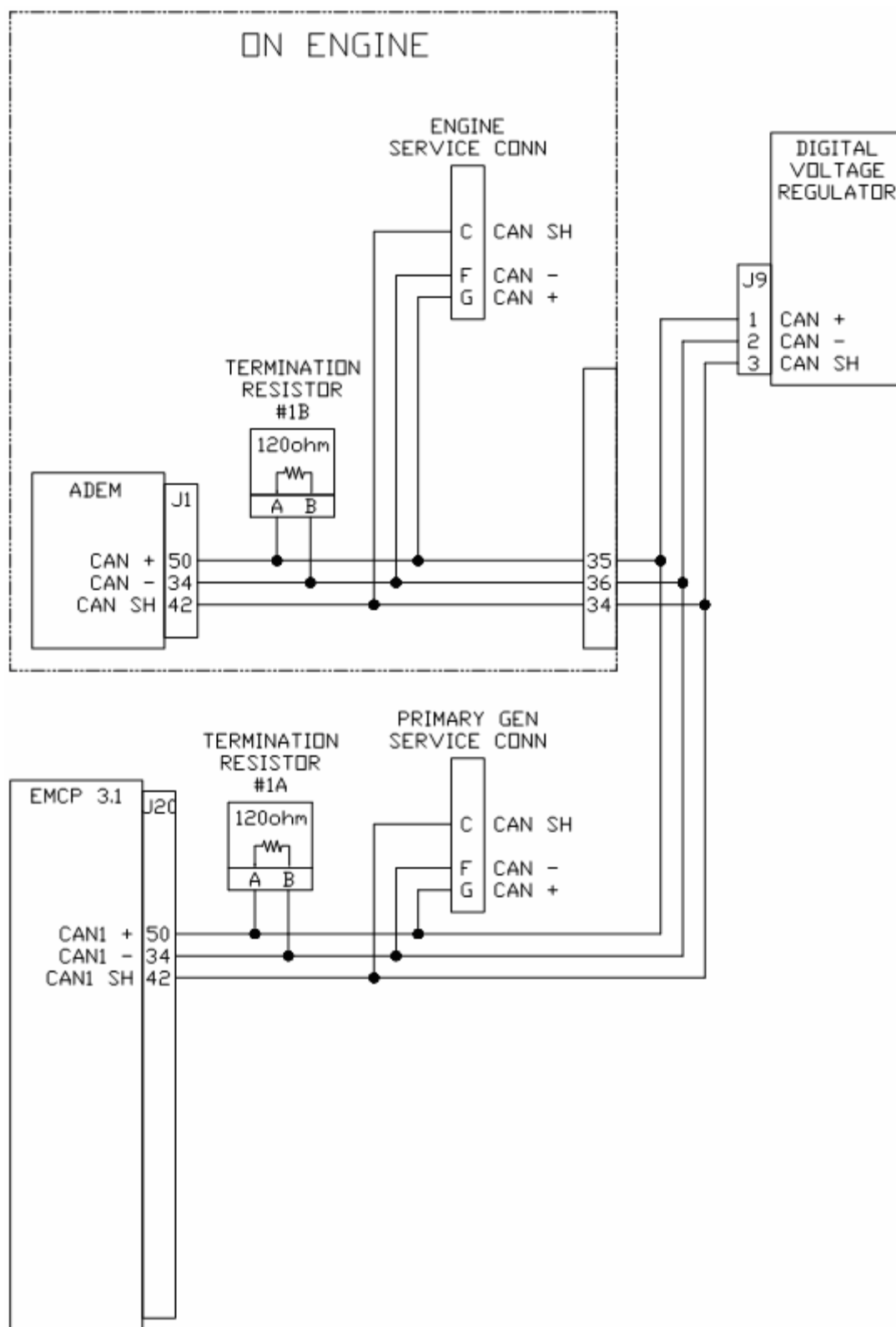


FIGURE 48: EMCP 3.1 CAN WIRING DIAGRAM

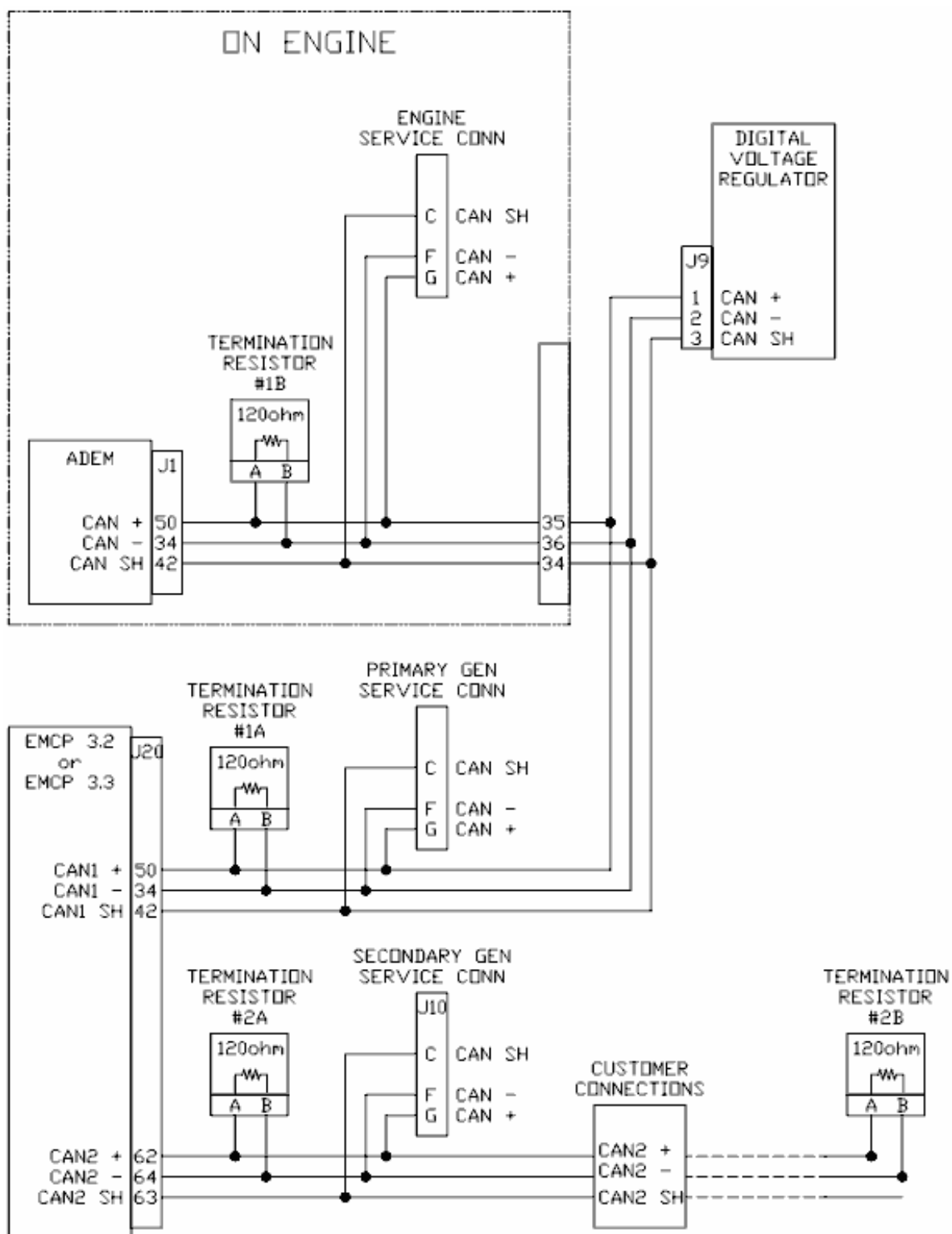


FIGURE 49: EMCP 3.2 GSC AND EMCP 3.3 GSC CAN WIRING DIAGRAM

(with no optional modules)

16.2 ACCESSORY J1939 DATA LINK (EMCP 3.2 & 3.3)

The Accessory J1939 Data Link is supported by the EMCP 3.2 and EMCP 3.3.

The Accessory Data Link is used for local or remote communication among modules associated with a single genset. These include a Resistance Temperature Device (RTD) Module, a Thermocouple Module, up to four Digital Input/Output Modules, and up to four Annunciators.

The Accessory J1939 Data Link utilizes the Society of Automotive Engineers (SAE) J1939 protocol and requires hardware compliant to the high-speed Controller Area Network (CAN) 2.0B protocol defined in the International Standards Organization (ISO) 11898-2 document, running at 250k bits per second.

The Accessory J1939 Data Link supports appropriate SAE J1939 Broadcast Parameter Group Numbers (PGN) and Suspect Parameter Numbers (SPN) for engine and genset data and diagnostics.

ACCESSORY J1939 WIRING

The Accessory J1939 communication wires are brought out of the EMCP 3 GSC as part of the 70-pin AMP connector. The pins, as designated on the AMP connector, are shown in Table 6 .

TABLE 6 ACCESSORY J1939 DATA LINK ON 70-PIN CONNECTOR

ACCESSORY J1939 COMMUNICATION WIRES		
Pin #	Name	Description
62	CAN2 +	Differential (+) for CAN
63	CAN2 SH	Shield for CAN
64	CAN2 -	Differential (-) for CAN

NETWORK TOPOLOGY

The physical topology of the CAN network used in the Accessory J1939 Data Link is a bus topology, consisting of a main trunk and small drops.

- The maximum allowable trunk length is 800 ft (250 m), and the maximum drop length is 9 ft (3 m).
- The CAN network requires a termination resistor on the extreme ends of the main trunk.

The topology for the EMCP 3.2 and EMCP 3.3 in the default configuration, with no remote devices connected, is illustrated in FIGURE 49 above.

The topology for the EMCP 3.2 and EMCP 3.3 with some remote devices connected is illustrated in FIGURE 50.

NOTE: The devices shown in FIGURE 50 are only representative; more remote devices can be connected, as long as the proper lengths are maintained, and the termination resistor is placed at the end of the trunk. Refer to Table 7 Number of Optional Modules Supported in Chapter 17 for the maximum number of devices supported on each level.

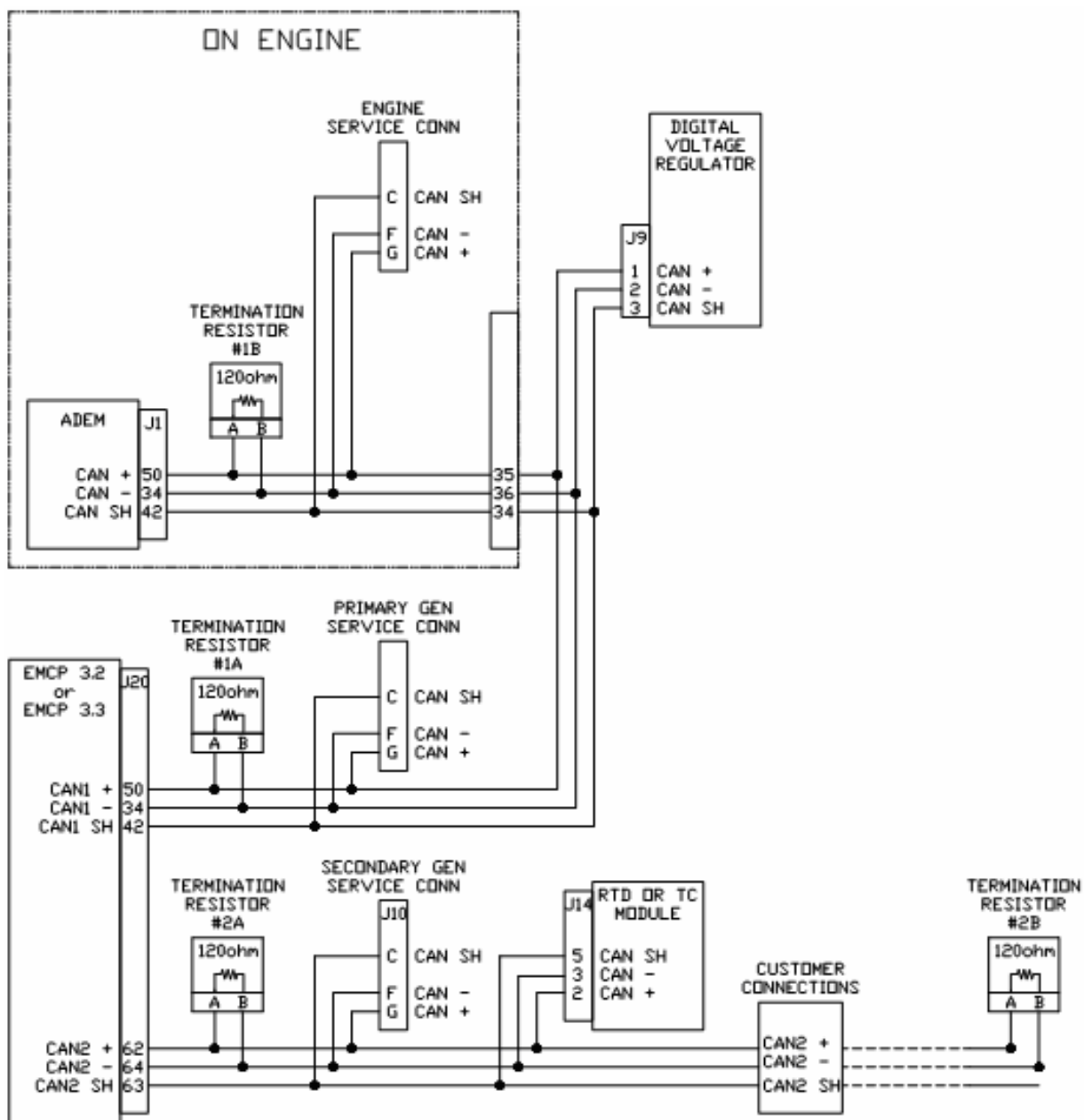


FIGURE 50: EMCP 3.2 AND EMCP 3.3 CAN WIRING DIAGRAM (WITH OPTIONAL MODULES)

17 OPTIONAL MODULES

The EMCP 3 consists of the EMCP 3 GSC, as well as some optional auxiliary modules. These modules connect to the EMCP 3 GSC via either the primary or accessory J1939 data link. The EMCP 3 GSC can also communicate with a Caterpillar electronic engine controller. Though this is not considered an optional module.

Different numbers of modules are supported for different levels of EMCP 3 GSC. The numbers are given below in Table 7 Number of Optional Modules Supported.

For J1939 compliance, all modules comply with the applicable portions of the following:

SAE J1939-21, July 1998, Data Link Layer

SAE J1939-71, January 2002, Application Layer

SAE J1939-73, May 2000, Application Layer – Diagnostic

SAE J1939-81, July 1997, Network Management

For more information about connecting modules to the J1939 data links, refer to Chapter 16.2 Accessory J1939 Data Link.

THE ANNUNCIATOR

The Annunciator module is an auxiliary alarm indication device, consisting of 16 pairs of indicator LEDs, and an audible horn. Each pair can be individually configured based for an application, and a custom film kit is available to customize the graphic/text indication. For further information see Chapter 17.1 below.

THE THERMOCOUPLE, RTD, & DIO

EMCP 3 GSC uses a common design approach for the three modules known as the Thermocouple, RTD (Resistance Temperature Detector) and DIO (Discrete I/O) modules. The same hardware design is used for the power supply and CAN network communications board. Individual circuit board assemblies are used for the 20-channel thermocouple interface or 8-channel RTD interface board.

The Thermocouple module, RTD module and DIO module feature identical rugged packaging and watertight Deutsch IPD connectors. The only physical difference in packages between these three optional modules is that the DIO module has an LED to indicate communication network status.

Applications can include networked power generator set control systems.

For further information on the Thermocouple module see Chapter 17.2, for the RTD module see Chapter 17.3, and for the DIO module see Chapter 17.4 below.

THE CATERPILLAR DIGITAL VOLTAGE REGULATOR

The Caterpillar Digital Voltage Regulator (CDVR) module is an auxiliary voltage regulator device, regulating the generator voltage and engine speed to provide optimal response to various load types and changes in load. It is connected to the generator exciter and field, and communicates with the EMCP 3 GSC for monitoring purposes. For further information see RENR7941 Caterpillar Digital Voltage Regulator.

TABLE 7 NUMBER OF OPTIONAL MODULES SUPPORTED

MODULE	EMCP 3.1	EMCP 3.2		EMCP 3.3	
	Primary J1939	Primary J1939	Accessory J1939	Primary J1939	Accessory J1939
Electronic engine controller	1	1	0	1	0
CDVR	1	1	0	1	0
Annunciator	1	1	4	1	4
Thermocouple	0	0	0	1	1
RTD	0	0	0	0	1
DIO	0	0	4	0	4

J1939 COMPLIANCE

For J1939 compliance, all modules comply with the applicable portions of the following:

SAE J1939-21, July 1998, Data Link Layer

SAE J1939-71, January 2002, Application Layer

SAE J1939-73, May 2000, Application Layer – Diagnostic

SAE J1939-81, July 1997, Network Management

17.1 ANNUNCIATOR

The EMCP 3 Annunciator serves to display system alarm conditions and status indications. The Annunciator has been designed for use on the EMCP 3 GSCJ1939 Communication Network and may be used in either Local (Primary J1939) or Remote (Accessory J1939) applications, providing customers with enhanced site flexibility.

In Local application, the Annunciator may be mounted on the Package generator set with the EMCP 3.2 or 3.3 GSC to provide a complete package-mounted monitoring solution. One Annunciator can be mounted on the package and connected to the Primary J1939 data link.

The Annunciator may also be mounted separate from the generator set to provide Remote indication of system operating and alarm conditions. Up to four Annunciators can be mounted remotely and connected to the Accessory J1939 data link.



ANNUNCIATOR FEATURES

The Annunciator includes:

Sixteen (16) LED pairs for annunciation of up to 32 system events

An additional pair of LEDs provides status indication of the J1939 data link connection

Can annunciate alarm conditions received from any module on the J1939 data link

Alarm Horn with Lamp Test and Alarm Acknowledge pushbuttons

Configurable to NFPA 99/110 requirements for local and remote annunciation on Emergency Standby Generator Systems

Provides a simple means to change the labels for the annunciation LEDs for site specific requirements (Custom Label Kit purchased separately)

Provides superior visibility of the LEDs in direct sunlight.

Graphic symbols along with text labels are provided next to each LED pair to indicate various alarms and events.

Can be mounted either locally on the package generator set, on the Primary J1939 Data Link, or Remotely (up to 800 feet) on the Accessory J1939 Data Link

Designed and Tested to meet stringent Impulse Shock and Operating Vibration requirements

286 mm (11.26 in) High x 157 mm (6.18 in) Wide x 141 mm (5.55 in) Deep

ANNUNCIATOR SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

Control Power 12 V DC & 24 V DC nominal (9 – 32 V DC acceptable)

Over voltage capability is 32 V DC for 1 hour @ 85°C

Single, 6-pin connector provides both power and communication

Designed to meet relevant European standards for EMI/RFI/Immunity without the use of external filtering (Third party testing is being pursued).

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature -40 to 85°C (-40 to 185°F)

Storage Temperature -50°C to +120°C.

Relative Humidity 90%, non-condensing, 30°C to 60°C.

Failure Point 120°C. If the ambient temperature were to exceed 120°C, the device would **NOT** be expected to return to proper operation.

Can be mounted directly on the generator set panel or remotely

NETWORK COMMUNICATIONS INTERFACE

Incorporates an SAE J1939 communications port, able to operate on either the EMCP 3 GSC Primary or Accessory J1939 data link

Node address is auto configurable as per J1939-81

Optical isolation is provided for the CAN line.

Module operates normally with loss of communication link, retaining configured setpoints in non-volatile memory

Configuration and firmware updates are accomplished with the Caterpillar® Service Tool over the J1939 network

ANNUNCIATOR WIRING

The back of the Annunciator module contains a 8-terminal screw terminal block. Attached to the block is a 6-pin Deutsch adapter. The pin outs for both are shown in Figure 51 and Table 8 .

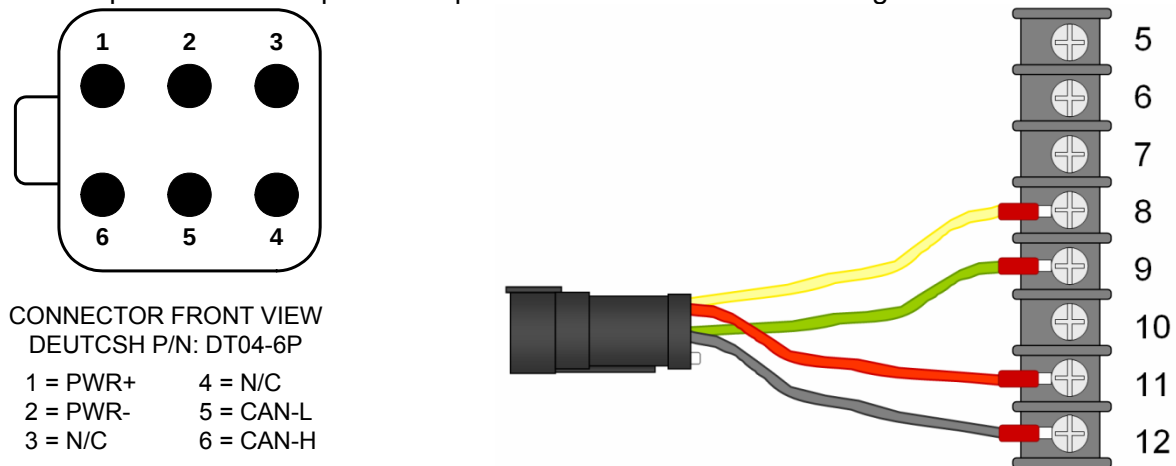


FIGURE 51: ANNUNCIATOR DEUTSCH CONNECTOR PIN CONFIGURATION AND TERMINAL BLOCK

TABLE 8 ANNUNCIATOR TERMINAL BLOCK PIN CONFIGURATION

ANNUNCIATOR TERMINAL BLOCK PIN CONFIGURATION		
Terminal #	Function	Description
1	N/C	Not Connected
2	N/C	Not Connected
3	N/C	Not Connected
4	N/C	Not Connected
5	Horn Drive	Connects to Horn(-)
6	Alarm Ack	Alarm Acknowledge
7	Lamp Test	Lamp Test
8	CAN-H	CAN Datalink HI
9	CAN-L	CAN Datalink LOW
10	N/C	Not Connected
11	PWR+	+ Battery Input, connects to Horn(+)
12	PWR-	- Battery Input

LED COLORS

Each pair of LEDs on the Annunciator consists of two of the following three colors: Green, Amber, and Red, which allows for custom configuration of **STATUS**, **WARNING** and **SHUTDOWN** conditions. The available colors and combinations are listed in Table 9 LED Colors:

TABLE 9 LED COLORS

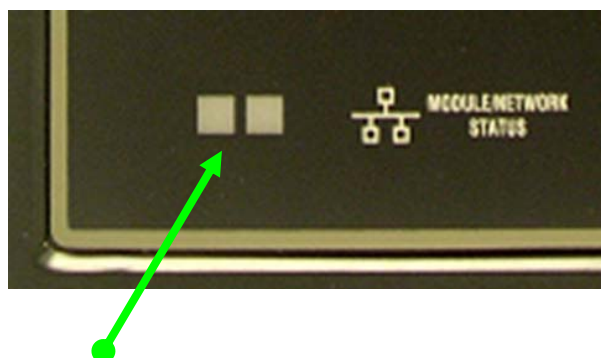
LED COLORS								
ROW	LED 1	LED 2	ROW	LED 1	LED 2	ROW	LED 1	LED 2
1	Red	Amber	7	Red	Amber	13	Green	Amber
2	Red	Amber	8	Red	Amber	14	Green	Amber
3	Red	Amber	9	Red	Amber	15	Red	Green
4	Red	Amber	10	Red	Amber	16	Red	Green
5	Red	Amber	11	Red	Amber			
6	Red	Amber	12	Red	Amber			

MODULE STATUS LED

A red/green pair located at the bottom of the EMCP 3 GSC, is used to report Module/Network Status. The various states indicated are explained in Table 10 below.

TABLE 10 ANNUNCIATOR MODULE / NETWORK STATUS LED BEHAVIOR

BEHAVIOR	EXPLANATION
Red solid	CAN data link diagnostic. For example: the module is wired wrong (Data Link), wrong cable, or no terminating resistor.
Green solid	CAN data link OK
Green flashing	No CAN data link diagnostic, but no communication detected. Hooking the Annunciator up with the power on.
Red/Green flashing	No application software loaded

**ANNUNCIATOR SOFTWARE CONFIGURATION**

The Annunciator is field-programmable using the Caterpillar® Service Tool. It is also flash programmable to update software using the Caterpillar® Service Tool.

The service tool software must be installed on a Windows PC. The Caterpillar communication adapter must be connected between the PC and the J1939 data link on which the target Annunciator is connected. (The service tool may be connected to the EMCP 3 GSC Accessory Data Link service connector).

When connecting to the Annunciator, the user will first see the Module Summary screen shown in FIGURE 52.

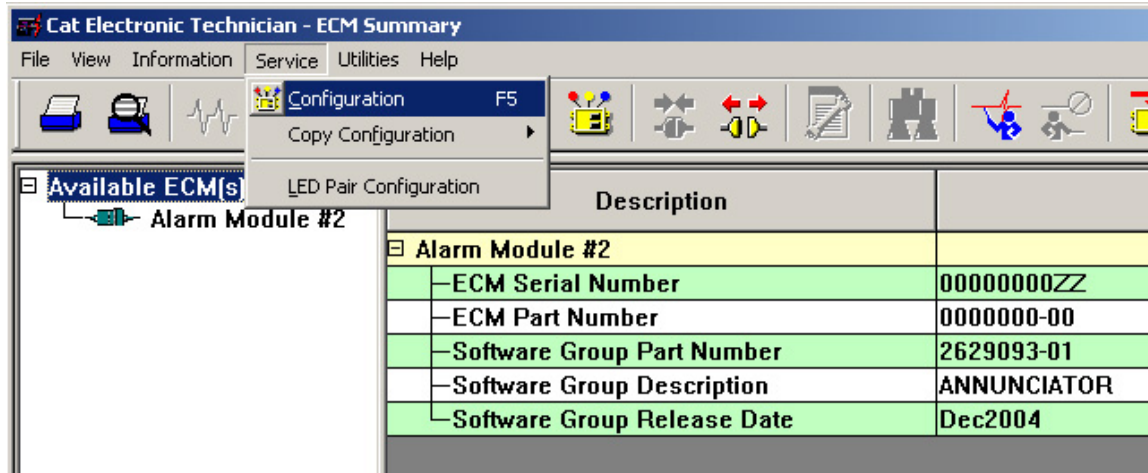


FIGURE 52: CATERPILLAR® SERVICE TOOL ANNUNCIATOR SUMMARY SCREEN

This screen shows module information such as Serial Number, Part Number, Software Group Number, and Software Release Date.

GLOBAL ACKNOWLEDGE

The Annunciator can be configured to both initiate and respond to an Event Acknowledge message over the J1939 data link. If this setpoint is enabled, the Annunciator events may be acknowledged directly on the Annunciator by pressing the Alarm Acknowledge button or remotely by pressing the Alarm Acknowledge button on the EMCP 3 GSC or by pressing the Acknowledge button on another Annunciator that is on the same data link. Acknowledging events also silences the horn.

The default setting for this setpoint is DISABLED, but it can be enabled from the Service → Configuration menu item.

ECU INSTANCE NUMBER

The Module Description will also indicate a number that identifies the Annunciator uniquely from any other Annunciator modules on the (Primary or Accessory) J1939 data link. In this example, the service tool is connected to Alarm Module #2.

This number is called the **ECU INSTANCE** and it is programmable. To program the Annunciator to a different ECU Instance number, enter the Configuration Screen by selecting the Service → Configuration, as shown in **FIGURE 53**.

The service tool configuration screen, shown in **FIGURE 54**, identifies the serial number of the Annunciator that is connected. This is important in matching the desired ECU Instance to the actual hardware. In this example, the Annunciator will be programmed to ECU Instance #1. To do this, select the ECU Instance row, and double click on the current ECU Instance. A dialog box will open, allowing entry of the new ECU Instance. Type a numeric value, 1, 2, 3, or 4 and click OK.

When you click OK, the service tool software will automatically restart and reconnect to the data link. Upon reconnecting, the summary screen will now show the new module name, based on the ECU Instance. In this example, the new module name will be Alarm Module #1.

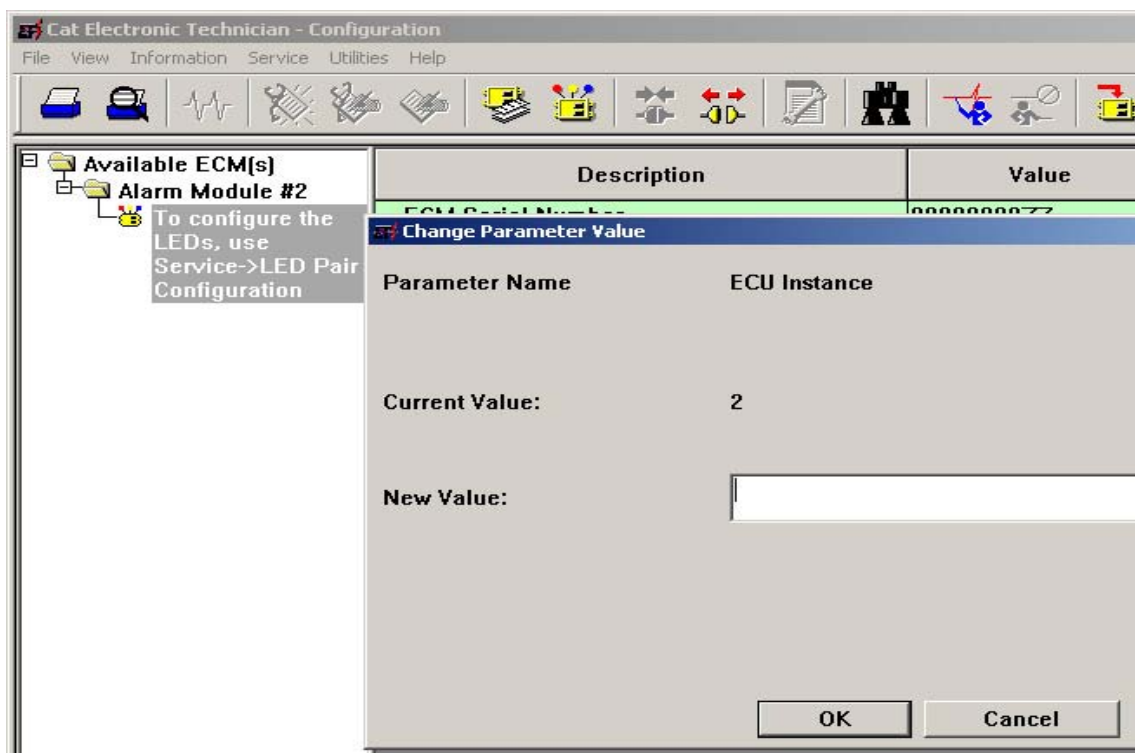


FIGURE 53: CATERPILLAR[®] SERVICE TOOL ANNUNCIATOR CONFIGURATION SCREEN

CONFIGURING ANNUNCIATOR LED BEHAVIOR

To configure the behavior of the LED pairs, enter the LED Pair Configuration screen by selecting Service → LED Pair Configuration. An example of the LED Pair Configuration screen is shown in FIGURE 54.

Each LED pair has four parameters required to configure it. It is best to configure the four columns in order from left to right; first Trigger Condition, next Severity Level, then Suspect Parameter Number, and finally Failure Mode Identifier (if required). The reason for the order is because the value set in one column affects the choices available in the subsequent columns. If a field is grayed out, it is not available due to conditions set in previous columns.

TRIGGER CONDITION

There are three possible selections for Trigger Condition: **SPECIFIC EVENT**, **GENERAL EVENT**, and **DISABLED**.

SPECIFIC EVENT is used to assign an LED pair to a specific data link parameter, such as Oil Pressure, Engine Speed, Coolant Temperature, etc. The desired parameter must be chosen in the Suspect Parameter Number column.

GENERAL EVENT is used to assign an LED pair as a general alarm or shutdown indicator. When configured as General Event, the LED will not be assigned to a particular parameter. It will respond to any event with a severity level chosen in the Severity Level column, regardless of the Suspect Parameter Number.

For this reason, when General Event is selected, the Suspect Parameter Number cannot be changed.

	Trigger Condition	Severity Level	Suspect Parameter Number	Failure Mode Identifier
LED Pair # 1	Specific Event	Condition Met, Red On, Other Not Used, Horn On	190	
LED Pair # 2	Specific Event	Condition Met, Red On, Other Not Used, Horn On	1664	
LED Pair # 3	Specific Event	High Warning or High Shutdown	190	
LED Pair # 4	Specific Event	High Warning or High Shutdown	110	
LED Pair # 5	Specific Event	Low Warning	110	
LED Pair # 6	Specific Event	Low Warning or Low Shutdown	111	
LED Pair # 7	Specific Event	Low Warning or Low Shutdown	100	
LED Pair # 8	Specific Event	Condition Met, Amber On, Other Not Used, Horn On	4007	
LED Pair # 9	Specific Event	Low Warning	168	
LED Pair # 10	Specific Event	Low Warning	96	
LED Pair # 11	Specific Event	High Warning	96	
LED Pair # 12	Specific Event	Condition Met, Red On, Other Not Used, Horn On	1239	
LED Pair # 13	Specific Event	High Warning	95	
LED Pair # 14	Specific Event	Condition Met, Amber On, Other Not Used	2648	
LED Pair # 15	Disabled	Condition Met, Red On, Other Not Used, Horn On	970	Condition Exists
LED Pair # 16	Disabled	Condition Met, Red On, Other Not Used, Horn On	970	Condition Exists

Submit

Alarm Module #1

FIGURE 54: CATERPILLAR® SERVICE TOOL ANNUNCIATOR LED CONFIGURATION SCREEN

DISABLED is used to disable the LED pair. The remaining three parameters will be grayed out when Disabled is selected.

SEVERITY LEVEL

Severity Level defines which types of events the LED pair will react to. Selections that begin with Condition Exists will respond to J1939 Event messages for Failure Mode Identifier (FMI) 31 Condition Exists.

For example, LED pair #2 is configured for Condition Exists, Red On, Other Not Used, Horn On with SPN 190 (Emergency Stop Active). This means that when the Annunciator received a J1939 message indicating Emergency Stop with FMI 31, the Red LED will turn on and the Horn will also turn on.

Other Not Used indicates that the other LED color in the pair is never used.

Green Off (for example) indicates that the green LED lights when the condition chosen for this LED pair is NOT active.

Most Severity Level selections imply (a) J1939 Failure Mode Identifier (FMI) code(s):

CONDITION EXISTS is equivalent to FMI 31

HIGH WARNING can be FMI 15 or FMI 16

LOW WARNING can be FMI 17 or FMI 18

HIGH SHUTDOWN is equivalent to FMI 0

LOW SHUTDOWN is equivalent to FMI 1

HIGH OR LOW SHUTDOWN is equivalent to FMI 0 or FMI 1

Since the FMI codes are implied by this column, the FMI column is grayed out for any of these selections.

The only option that will allow an FMI to be configured is **SPECIFIC DIAGNOSTIC**.

SUSPECT PARAMETER NUMBER

The Suspect Parameter Number column is used to select or type in the SPN for the parameter assigned to the LED pair. Most supported SPNs can be selected from the list. Refer to the SAE J1939 literature or RENR7902 Systems Operation Testing and Adjusting Manual for a complete list of supported SPNs.

NOTE: Remember to click the Submit button at the bottom of the LED Pair Configuration tool after making the selections for each LED pair. Only then will the new settings take effect. If you make selections and attempt to leave the LED Pair Configuration tool, a prompt will ask you if you wish to have your changes take effect. If you decline, your changes will be lost.

17.2 THERMOCOUPLE MODULE (EMCP 3.3)

THERMOCOUPLE FEATURES

Reads up to 20 Type J or K thermocouple inputs

Temperatures are configured to indicate the SAE J1939 SPN to be transmitted by that temperature input. Suspect Parameter Numbers (SPNs) for configuration of temperature inputs are customer specific. Resolution: One byte parameters have a resolution of 1 °C / bit and a range of -40 °C to 210 °C. Two byte parameters have resolution of 0.03125 °C / bit and a range of -273 °C to 1735 °C

Cold junction compensation is provided

System throughput has all 20 channels scanned in 2 seconds (100 ms/channel)

Overall drift with temperature is 0.015% / °C of span (maximum)

Module is fully functional during configuration and communications

Parameter values and diagnostic error codes are retained when the modules are de-energized

Open-circuit and short-circuit diagnostics are supported

Can be mounted directly on the generator set panel or remotely

Suitable for moist, high shock and vibration environments

Compact size (see mechanical drawing, FIGURE 55)



THERMOCOUPLE SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

Accept 5-32 V DC power (12 or 24 V DC nominal)

Over voltage capability is 32 V DC for 1 hour @ 85°C

Power supply inputs are protected against transient surges and short circuits and are isolated from I/O

Three way isolation is provided for the CAN line, inputs and power supply; isolation voltage is 1500 V AC (rms) or 2550 V for 1 sec

Burden is limited to less than 200 mA; inrush not to exceed 800 mA

Common mode rejection is -80 db@ 5V p-p (50-60 Hz)

Common mode input range is +/- 4 V minimum

Designed to meet relevant European standards for EMI/RFI/Immunity without the use of external filtering (Third party testing is being pursued)

ENVIRONMENTAL SPECIFICATIONS

Encapsulated in a rugged aluminum housing with watertight Deutsch connectors (IP65 rating)

Operating temperature range -40 to 85°C (-40 to 185°F) (for ambient temperatures exceeding 85°C, the temperature scanner may deviate in accuracy an additional $\pm 1^\circ\text{C}$)

The ambient storage temperature range is -50°C to +120°C

It is protected against 95% humidity non-condensing, 30°C to 60°C

NETWORK COMMUNICATIONS INTERFACE

Incorporates an SAE J1939 communications port with variable slew rate on the transceiver to accommodate different CAN (SAE J1939) connections (capable of working on both the EMCP 3 GSC Primary and Accessory J1939 data links)

Node address is auto configurable as per J1939-81

Optical isolation is provided for the CAN line

Retains current date and time relative to synchronization every 24 hours (or upon boot up) with equipment system time via an explicit command from the EMCP 3 GSC or Service Tool when the GSC is not available; synchronization time is accurate to within 1 sec

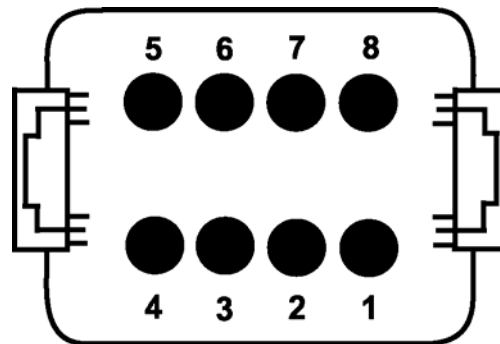
Includes a watchdog timer to atomically reboot should the microprocessor lock

Module operates normally with loss of communication link, retaining configured values and error codes in non-volatile memory

Configuration and firmware updates are accomplished with the Caterpillar[®] Service Tool over the J1939 network

THERMOCOUPLE WIRING

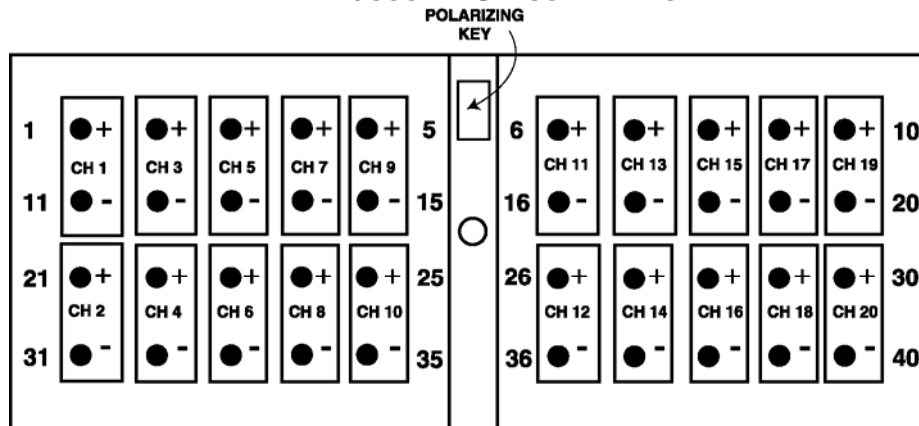
POWER AND CAN BUS WIRING



FRONT VIEW
MODULE MOUNTED CONNECTOR
DEUTSCH P/N: DT13-08PA

1 = PWR+ 5 = SHIELD
2 = CAN-H 6,7,8 = NOT USED
3 = CAN-L
4 = PWR-

THERMOCOUPLE SENSOR WIRING



FRONT VIEW OF
MODULE MOUNTED CONNECTOR
DEUTSCH P/N: DRC13-40PA

THERMOCOUPLE PHYSICAL LAYOUT

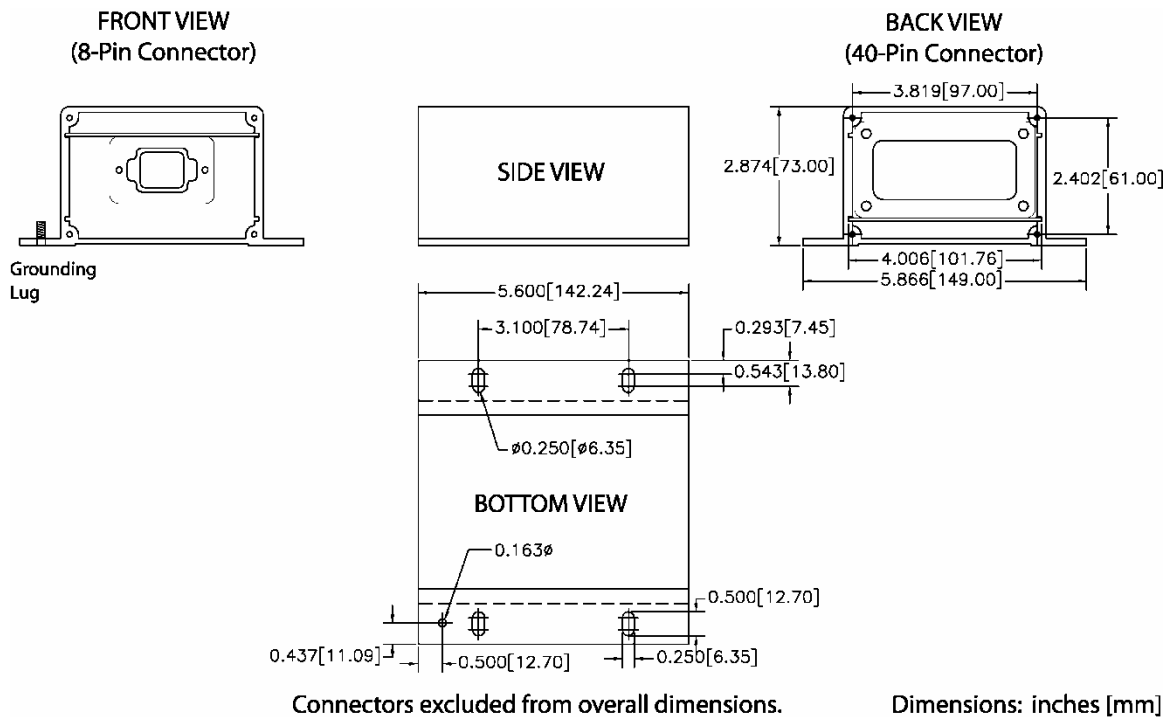


FIGURE 55: THERMOCOUPLE, RTD, AND DISCRETE I/O MODULE PHYSICAL LAYOUT

THERMOCOUPLE MODULE – CONFIGURATION

The Thermocouple module is field programmable using the Caterpillar® Service Tool. It is also flash programmable to update software using the Caterpillar® Service Tool.

The service tool software must be installed on a Windows PC. The Caterpillar communication adapter must be connected between the PC and the J1939 data link on which the target Thermocouple module is connected. When connecting the Thermocouple module, the user will first see the Module Summary screen shown in FIGURE 56.

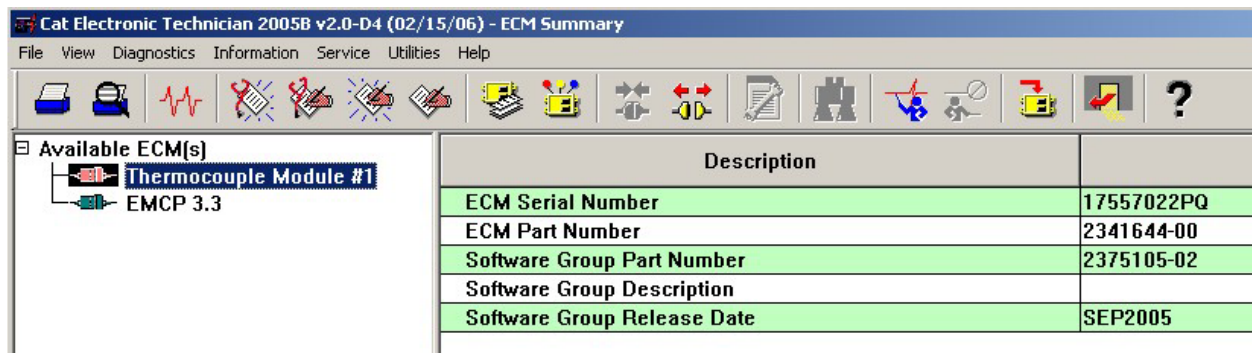


FIGURE 56: CATERPILLAR® SERVICE TOOL THERMOCOUPLE MODULE SUMMARY SCREEN

The service tool configuration tool contains setpoints for configuring the Thermocouple module identification, as well as the thermocouple inputs.

FIGURE 57 shows the ECM Identification Parameters list. This list shows the ECM serial number (read-only) of the module that is connected, and allows for configuration of the ECU instance. Each thermocouple module on the data link must have a unique ECU instance. If ECU instances are duplicated, one of the modules must be disconnected and the other reconfigured to a different ECU instance.

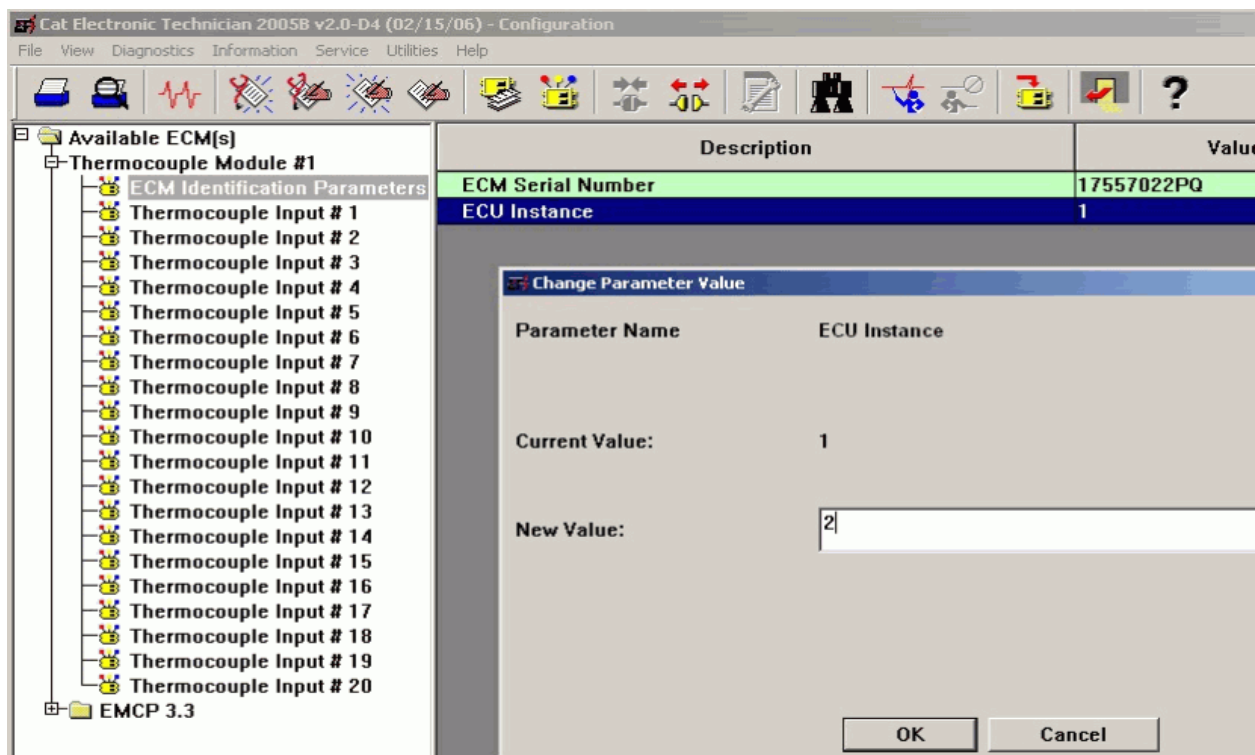


FIGURE 57: CATERPILLAR[®] SERVICE TOOL THERMOCOUPLE MODULE IDENTIFICATION PARAMETERS

Upon changing the ECU instance, the Caterpillar[®] Service Tool will automatically reconnect to the data link, and the Thermocouple module name should reflect the new ECU instance. In this example, as shown in FIGURE 58, the module was previously named Thermocouple Module #1, and after the ECU instance is changed to 2 and the service tool reconnects, the name reads Thermocouple Module #2.

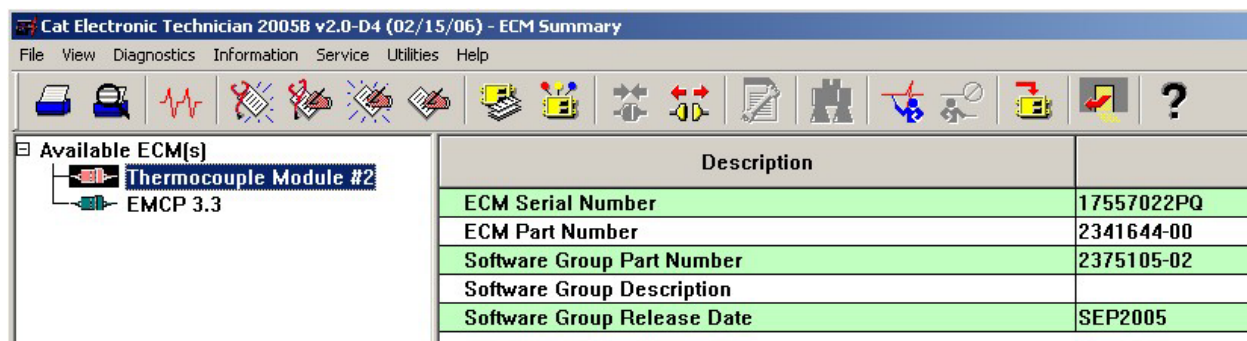
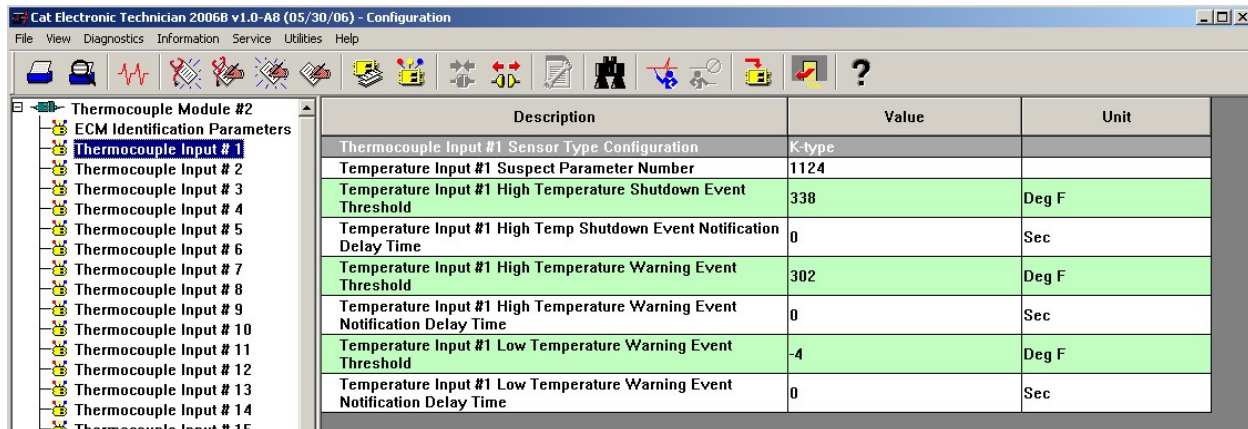


FIGURE 58: CATERPILLAR[®] SERVICE TOOL THERMOCOUPLE MODULE AFTER ECU INSTANCE CHANGE

CONFIGURING THERMOCOUPLE INPUTS

FIGURE 59 shows the **THERMOCOUPLE INPUT #1** Configuration list, when using the Caterpillar® Service Tool. All twenty thermocouple inputs have identical parameters and options.



Description	Value	Unit
Thermocouple Input #1 Sensor Type Configuration	K-type	
Temperature Input #1 Suspect Parameter Number	1124	
Temperature Input #1 High Temperature Shutdown Event Threshold	338	Deg F
Temperature Input #1 High Temp Shutdown Event Notification Delay Time	0	Sec
Temperature Input #1 High Temperature Warning Event Threshold	302	Deg F
Temperature Input #1 High Temperature Warning Event Notification Delay Time	0	Sec
Temperature Input #1 Low Temperature Warning Event Threshold	-4	Deg F
Temperature Input #1 Low Temperature Warning Event Notification Delay Time	0	Sec

FIGURE 59: CATERPILLAR® SERVICE TOOL THERMOCOUPLE INPUT CONFIGURATION

The **SENSOR TYPE CONFIGURATION** selects either a J or K type configuration. Select the appropriate configuration based on the type of thermocouple installed.

The **SUSPECT PARAMETER NUMBER (SPN)** is a numerical entry between a predetermined list of SPNs that are supported by the Thermocouple module. All of the thermocouple inputs support the same list of SPNs. To change the SPN, type in the number that corresponds with the desired parameter as shown in FIGURE 61. See RENR7902 for specific information on what possible SPN values can be used.

The **HIGH TEMPERATURE SHUTDOWN EVENT THRESHOLD** sets the high temperature at which a high shutdown event will occur.

The **HIGH TEMPERATURE WARNING EVENT THRESHOLD** sets the high temperature at which a high warning event will occur.

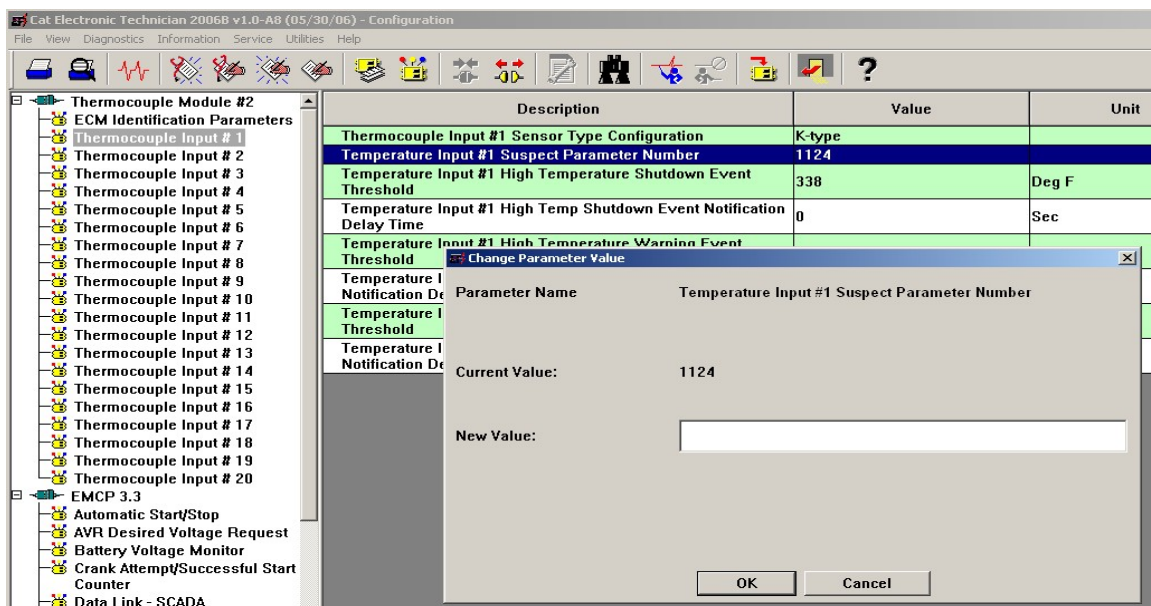


FIGURE 60: CATERPILLAR® SERVICE TOOL THERMOCOUPLE MODULE SUSPECT PARAMETER NUMBER

The **LOW TEMPERATURE WARNING EVENT THRESHOLD** sets the low temperature at which a low warning event will occur.

The **EVENT NOTIFICATION DELAY TIME** sets the amount of time the threshold must be exceeded until the Thermocouple module triggers that particular event on the data link. Each of the delay time options corresponds with a particular event type.

17.3 RTD MODULE (EMCP 3.3)

RTD FEATURES

Reads up to eight (8) Platinum RTD inputs with 2, 3, and 4 wire configurations

System throughput has all 8 channels scanned in 2 seconds (250 ms/channel).

Overall drift with temperature is 15mOhm/°C (maximum)

Module is fully functional during configuration and communications

Parameter values and diagnostic error codes are retained when the modules are de-energized

Suitable for moist, high shock and vibration environments

Compact size (see mechanical drawing, FIGURE 61)



RTD SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

Accept 5-32 V DC power (12 or 24 V DC nominal)

Over voltage capability is 32 V DC for 1 hour @ 85°C

Power supply inputs are protected against transient surges and short circuits and are isolated from I/O

Optical isolation is 500 V DC from input to ground. Three way isolation is provided for the CAN line, inputs and power supply.

Burden is limited to less than 200 mA; inrush not to exceed 800 mA

Isolation voltage is 1500 V AC (rms) or 2550V for 1 sec.

Designed to meet relevant European standards for EMI/RFI/Immunity without the use of external filtering (Third party testing is being pursued)

ENVIRONMENTAL SPECIFICATIONS

Encapsulated in a rugged aluminum housing with watertight Deutsch connectors (IP65 rating)

Operating temperature range -40 to 85°C (-40 to 185°F) (for ambient temperatures exceeding 85°C, the temperature scanner may deviate in accuracy an additional $\pm 1^\circ\text{C}$)

The ambient storage temperature range is -50°C to +120°C

It is protected against 95% humidity non-condensing, 30°C to 60°C

NETWORK COMMUNICATIONS INTERFACE

Incorporates an SAE J1939 communications port with variable slew rate on the transceiver to accommodate different CAN (SAE J1939) connections (capable of working on both the EMCP 3 GSC Primary and Accessory J1939 data links)

Node address is auto configurable as per J1939-81

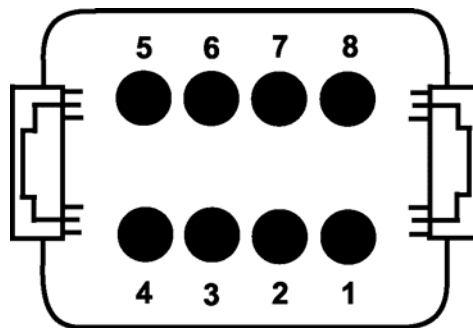
Optical isolation is provided for the CAN line

Retains current date and time relative to synchronization every 24 hours (or upon boot up) with equipment system time via an explicit command from the EMCP 3 GSC or Service Tool when the GSC is not available; synchronization time is accurate to within 1 sec

Includes a watchdog timer to automatically reboot should the microprocessor lock.

Module operates normally with loss of communication link, retaining configured values and error codes in non-volatile memory

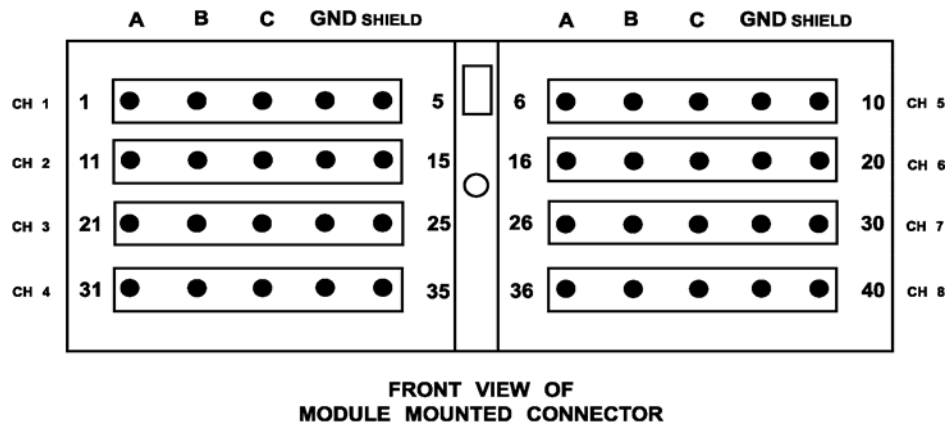
Configuration and firmware updates are accomplished with the Caterpillar[®] Service Tool over the J1939 network

RTD WIRING**POWER AND CAN BUS WIRING**

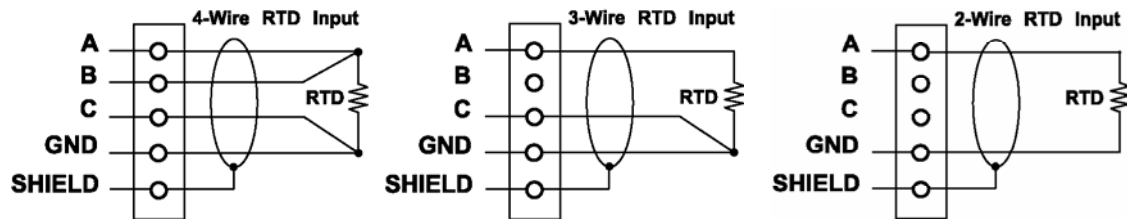
**FRONT VIEW
MODULE MOUNTED CONNECTOR
DEUTSCH P/N: DT13-08PA**

1 = PWR+	5 = SHIELD
2 = CAN-H	6,7,8 = NOT USED
3 = CAN-L	
4 = PWR-	

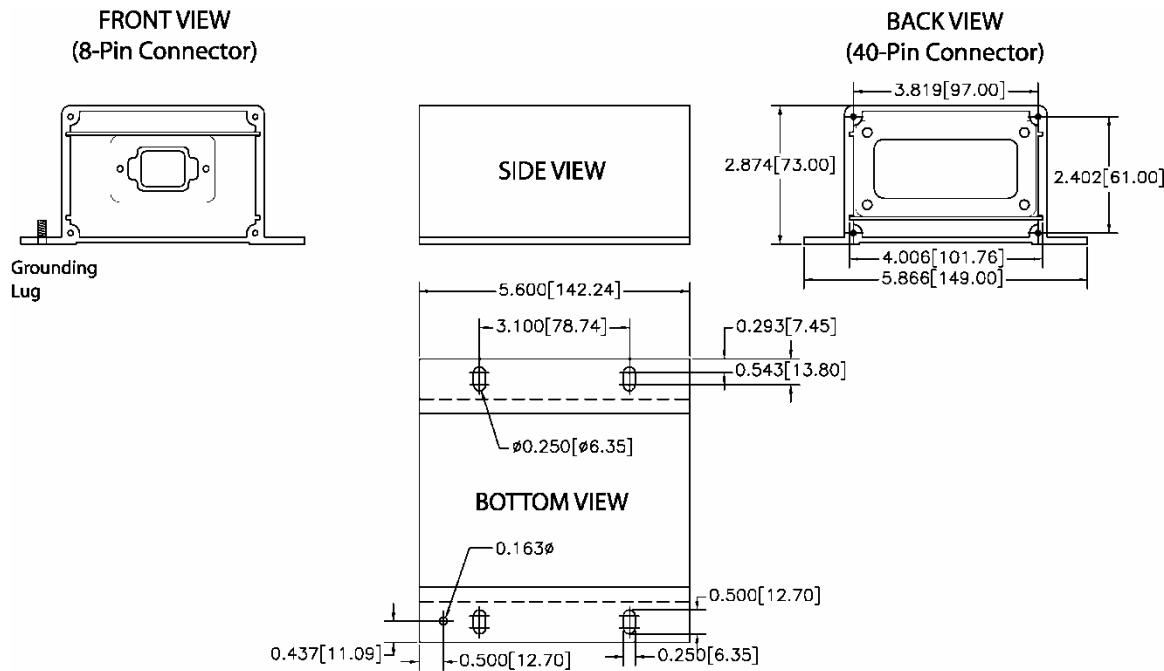
RTD SENSOR WIRING



RTD WIRING TYPICAL CONNECTIONS



RTD WIRING



Connectors excluded from overall dimensions. Dimensions: inches [mm]

FIGURE 61: THERMOCOUPLE, RTD, AND DISCRETE I/O MODULE PHYSICAL LAYOUT

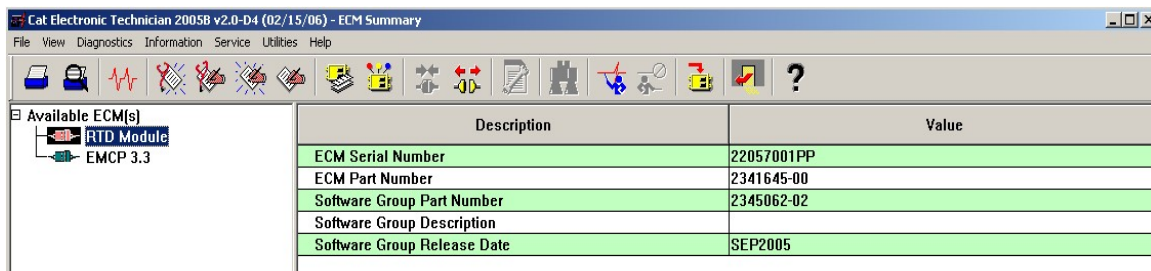
RTD MODULE – CONFIGURATION

The RTD (Resistance Temperature Detector) module is field programmable using the Caterpillar® Service Tool. It is also flash programmable to update software using the Caterpillar® Service Tool.

The service tool software must be installed on a Windows PC.

The Caterpillar communication adapter must be connected between the PC and the J1939 data link on which the target RTD module is connected.

When connecting to the RTD module, the user will first see the Module Summary screen shown in FIGURE 62.



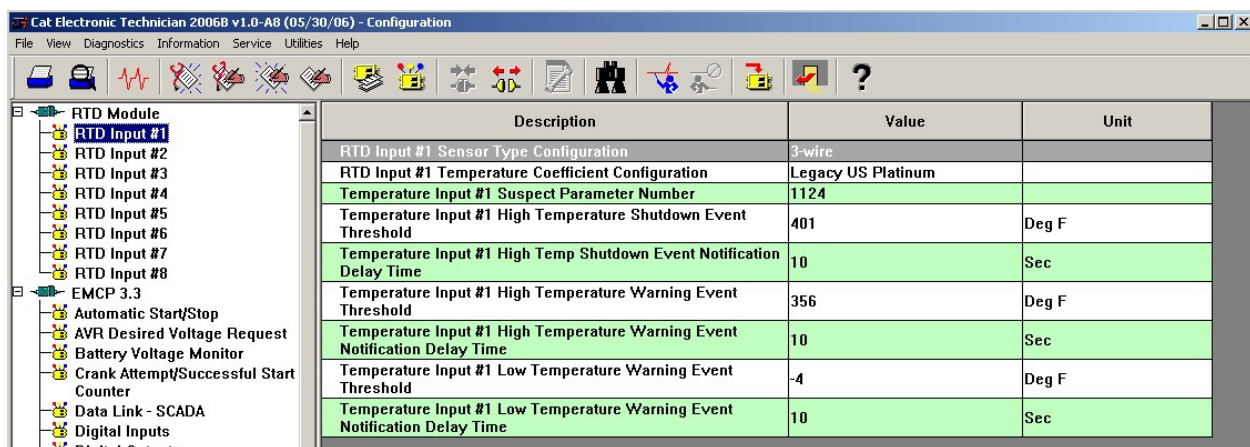
Description	Value
ECM Serial Number	22057001PP
ECM Part Number	2341645-00
Software Group Part Number	2345062-02
Software Group Description	
Software Group Release Date	SEP2005

FIGURE 62: CATERPILLAR® SERVICE TOOL RTD MODULE SUMMARY SCREEN

The service tool configuration tool, accessed by pressing F5 or clicking the configuration tool icon on the toolbar, contains setpoints for configuring the RTD module identification, as well as the RTD inputs.

CONFIGURING RTD INPUTS

The RTD Input #1 Configuration list of the service tool configuration tool is shown in FIGURE 63. All eight RTD inputs have identical parameters and options.



Description	Value	Unit
RTD Input #1 Sensor Type Configuration	3-wire	
RTD Input #1 Temperature Coefficient Configuration	Legacy US Platinum	
Temperature Input #1 Suspect Parameter Number	1124	
Temperature Input #1 High Temperature Shutdown Event Threshold	401	Deg F
Temperature Input #1 High Temp Shutdown Event Notification Delay Time	10	Sec
Temperature Input #1 High Temperature Warning Event Threshold	356	Deg F
Temperature Input #1 High Temperature Warning Event Notification Delay Time	10	Sec
Temperature Input #1 Low Temperature Warning Event Threshold	-4	Deg F
Temperature Input #1 Low Temperature Warning Event Notification Delay Time	10	Sec

FIGURE 63: CATERPILLAR® SERVICE TOOL RTD MODULE DIGITAL INPUT CONFIGURATION

The **SENSOR TYPE CONFIGURATION** selects between a 2, 3, or 4 wire configuration. Select the appropriate configuration based on the type of RTD sensor installed.

The **TEMPERATURE COEFFICIENT CONFIGURATION** selects between an IEC Platinum, JIS Platinum, Legacy US Platinum, SA MA Platinum or US Platinum type of RTD sensor. Select the appropriate configuration based on the type of RTD sensor installed.

The **SUSPECT PARAMETER NUMBER (SPN)** is a choice between a predetermined list of SPNs that are supported by the RTD module. All of the RTD inputs support the same list of SPNs. To change the SPN, type in the number that corresponds with the desired parameter as shown in FIGURE 64. See RENR7902 for specific information on what possible SPN values can be used.

The **HIGH TEMPERATURE SHUTDOWN EVENT THRESHOLD** sets the high temperature at which a shutdown event will occur.

The **HIGH TEMPERATURE WARNING EVENT THRESHOLD** sets the high temperature at which a high warning event will occur.

The **LOW TEMPERATURE WARNING EVENT THRESHOLD** sets the low temperature at which a low warning event will occur.

The **EVENT NOTIFICATION DELAY TIME** sets the amount of time the threshold must be reached until the RTD module triggers that particular event on the data link. Each of the delay time options corresponds with a particular event type.

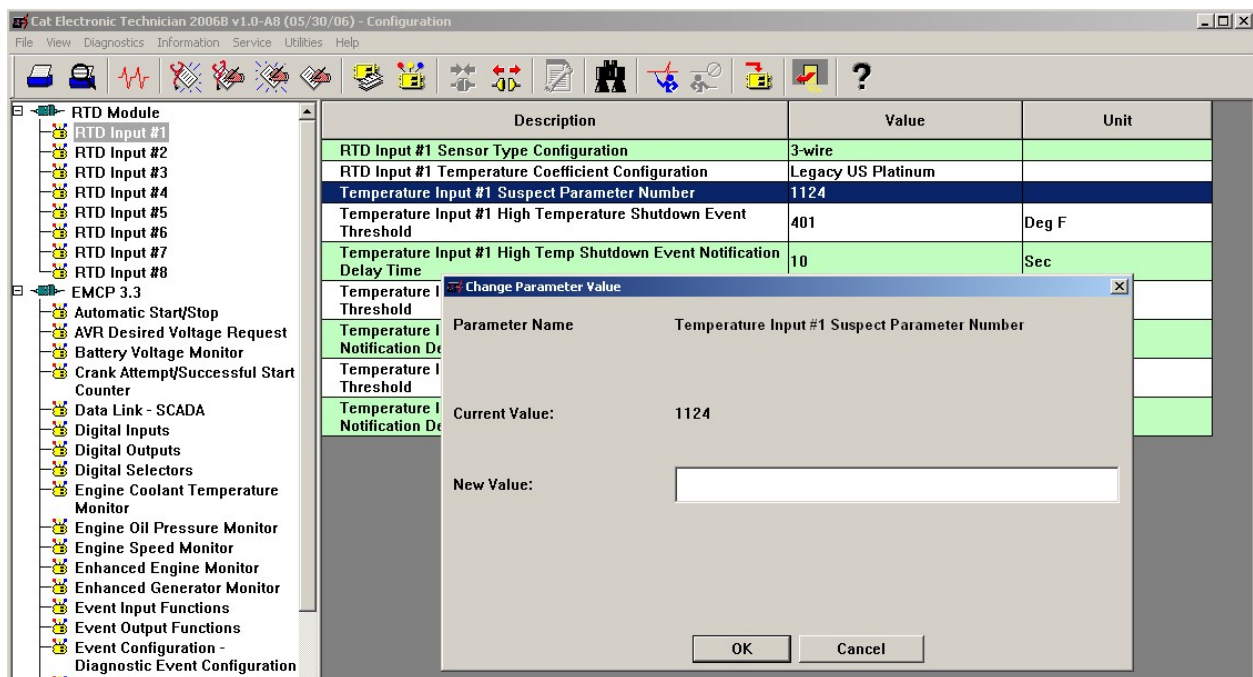


FIGURE 64: CATERPILLAR[®] SERVICE TOOL RTD MODULE SUSPECT PARAMETER NUMBER

17.4 DISCRETE I/O MODULE

The EMCP 3 GSC Discrete I/O (DIO) module is designed for mounting on generator sets or remotely, to provide auxiliary switch inputs or relay contact outputs. Up to 4 DIO modules can be used on the EMCP 3 GSC Accessory J1939 data link, given that they are programmed to unique ECU Instance numbers.

DISCRETE I/O FEATURES

Reads twelve (12) discrete inputs and sets eight (8) Form C relay outputs



Converts between physical I/O and CAN (J1939) data link commands

System throughput: All channels are scanned in 100 ms

Low-Level input voltage range: 0 to 0.8 V

High-Level input voltage range: 3.75 to 24V

Inputs have internal pull-up resistors

LED to indicate communication network status

Compact size (see mechanical drawing, FIGURE 65)

DISCRETE I/O SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

Accept 5-32 V DC power (12 or 24V DC nominal)

Over voltage capability is 32 V DC for 1 hour @ 85°C

Resistive Loads rated for 3A@30 V DC

Normally Closed (NC) relay contacts rated for 3A@125 V AC / 2A@277 V AC / 3A@30 V DC

Normally Open (NO) relay contacts rated for 5A@125 V AC / 2A@277 V AC / 5A@30 V DC

Inductive Loads rated for 0.5A@250 V AC $\cos\phi=0.4$

Maximum current draw of 400mA + 50mA per energized relay @ 12V DC

Power supply inputs are protected against transient surges and short circuits and are isolated from I/O

Isolation voltage: 4000 V AC (rms), 50/60 Hz for 1 min. between coil and contacts, 750 V AC, 50/60 Hz for 1 min. between contacts of the same polarity

ENVIRONMENTAL SPECIFICATIONS

Encapsulated in a rugged aluminum housing with watertight Deutsch connectors (IP65 rating)

Operating temperature range -40 to 85°C (-40 to 185°F)

The ambient storage temperature range is -50°C to +120°C.

It is protected against 95% humidity non-condensing, 30°C to 60°C.

Designed to meet relevant European standards for EMI/RFI/Immunity without the use of external filtering (Third party testing is being pursued).

NETWORK COMMUNICATIONS INTERFACE

Incorporates an SAE J1939 communications port with variable slew rate on the transceiver to accommodate different CAN (SAE J1939) connections (capable of working on both the EMCP 3 GSC Primary and Accessory J1939 data links)

Node address is auto configurable as per J1939-81

Optical isolation is provided for the CAN line

Retains current date and time relative to synchronization every 24 hours (or upon boot up) with equipment system time via an explicit command from the EMCP 3 GSC or Service Tool when the GSC is not available; synchronization time is accurate to within 1 sec

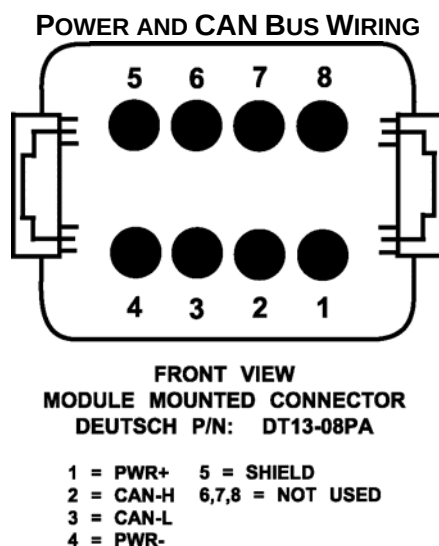
Includes a watchdog timer to atomically reboot should the microprocessor lock

Module operates normally with loss of communication link, retaining configured values and error codes in non-volatile memory

Configuration and firmware updates are accomplished with the Caterpillar[®] Service Tool over the J1939 network

Monitored parameters and alarms are read-only over the network

DISCRETE I/O WIRING



I/O WIRING TYPICAL CONNECTIONS

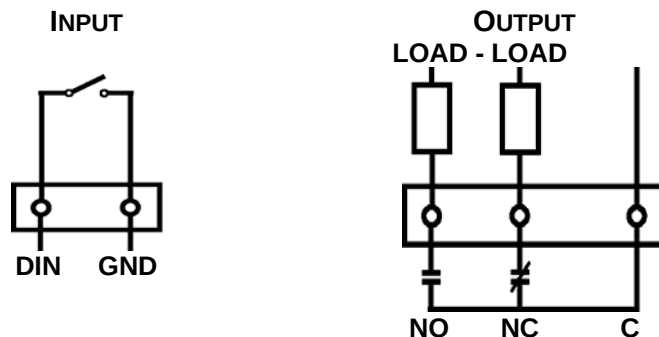


TABLE 11 DISCRETE I/O

INPUTS	PIN	OUTPUTS	PIN	OUTPUTS	PIN
DIN1	1	NC 1	5	C 6	19
DIN2	11	C 1	6	NO 6	20
DIN3	21	NO 1	7	NC 7	28
DIN4	31	NC 2	15	C 8	29
DIN5	2	C 2	16	NO 7	30
DIN6	12	NO 2	17	NC 8	38
DIN7	22	NC 3	25	C 8	39
DIN8	32	C 3	26	NO 8	40
DIN9	3	NO 3	27		
DIN10	13	NC 4	35	NO = Normally Open NC = Normally Closed C = Common	
DIN11	23	C 4	36		
DIN12	33	NO 4	37		
GND	4	NC 5	8		
GND	14	C 5	9		
GND	24	NO 5	10		
GND	34	NC 6	18		

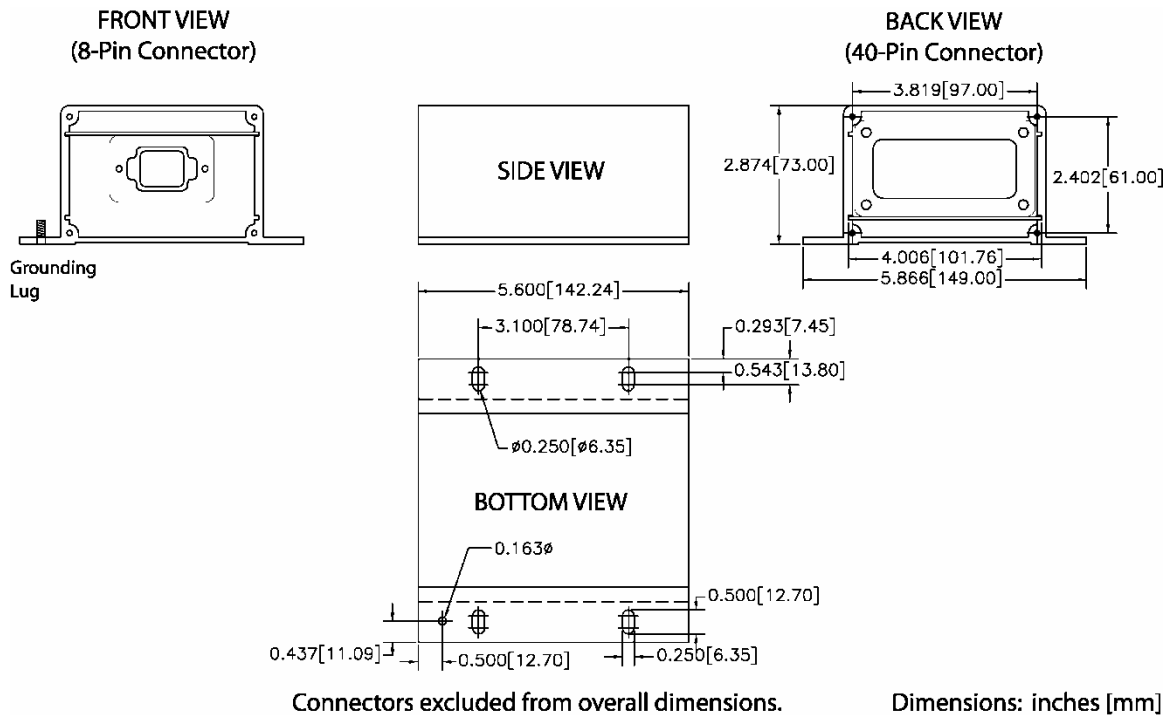


FIGURE 65: THERMOCOUPLE, RTD, AND DISCRETE I/O MODULE PHYSICAL LAYOUT

DISCRETE I/O SOFTWARE CONFIGURATION

The DIO module is field-programmable using the Caterpillar® Service Tool. It is also flash programmable to update software using the Caterpillar® Service Tool.

The service tool software must be installed on a Windows PC. The Caterpillar communication adapter must be connected between the PC and the J1939 data link on which the target DIO module is connected. (The service tool may be connected to the EMCP 3 GSC Accessory Data Link service connector).

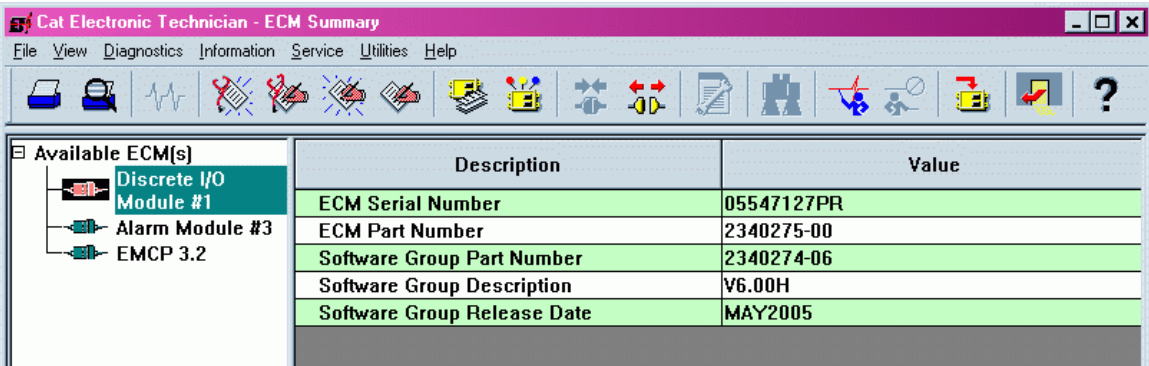


FIGURE 66: CATERPILLAR® SERVICE TOOL DIO SUMMARY SCREEN

When connecting to the DIO, the user will first see the Module Summary screen shown in **FIGURE 66**. The service tool configuration tool, accessed by pressing F5 or clicking the configuration tool icon on the toolbar, contains setpoints for configuring the DIO identification, as well as the inputs and outputs.

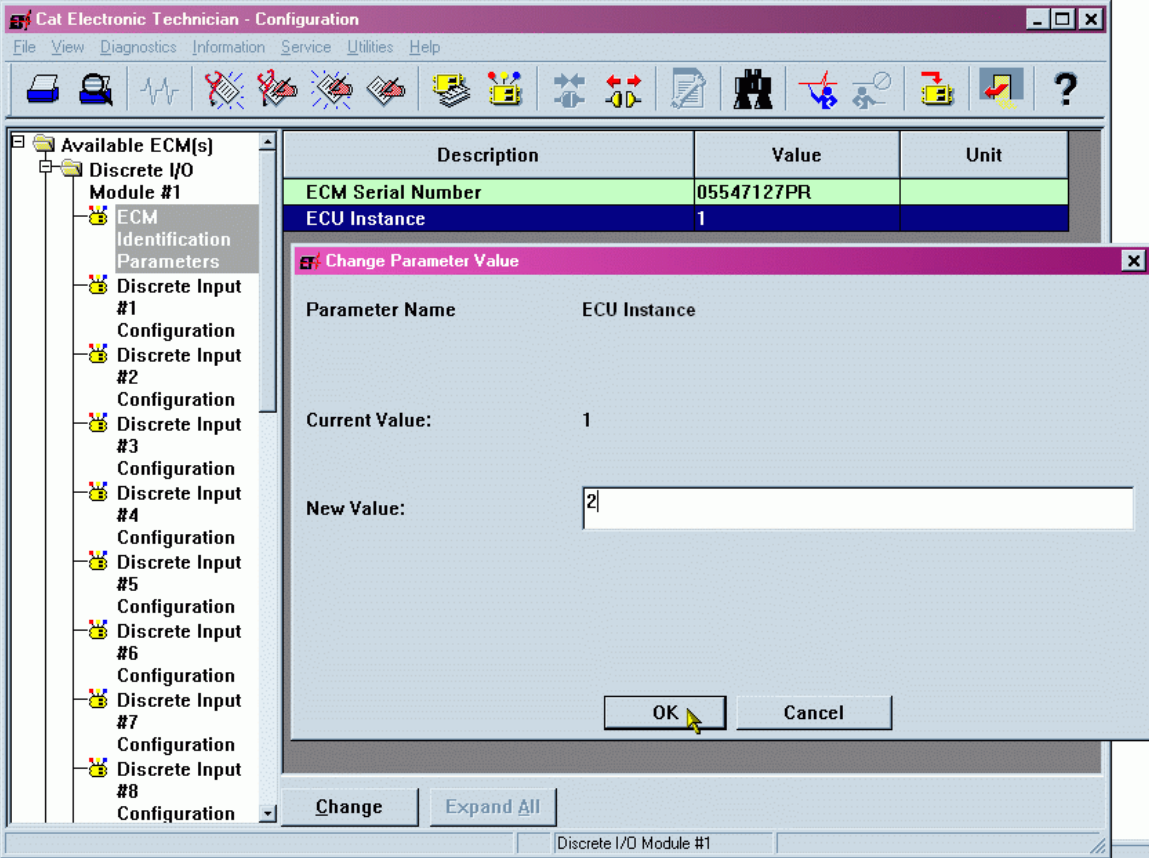
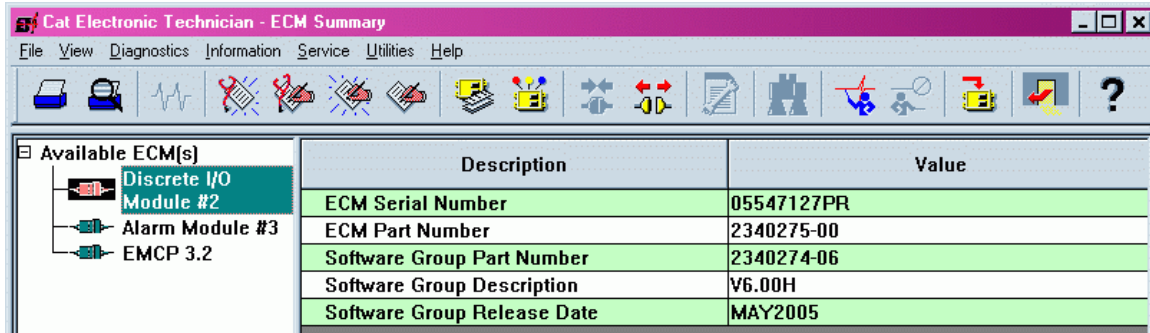


FIGURE 67: CATERPILLAR® SERVICE TOOL DIO IDENTIFICATION PARAMETERS

FIGURE 67 shows the ECM Identification Parameters list. This list shows the ECM serial number (read-only) of the module that is connected, and allows for configuration of the ECU instance. It is important to match a specific module to a certain ECU Instance. The system will not function properly if ECU instances are duplicated. Upon changing the ECU instance, the Caterpillar

service tool will automatically disconnect and reconnect to the data link, and the DIO module name should reflect the new ECU instance.

In the example shown in FIGURE 68, the module was previously named Discrete I/O Module #1, and after the ECU instance is changed to 2 and the service tool reconnects, the name reads Discrete I/O Module #2.

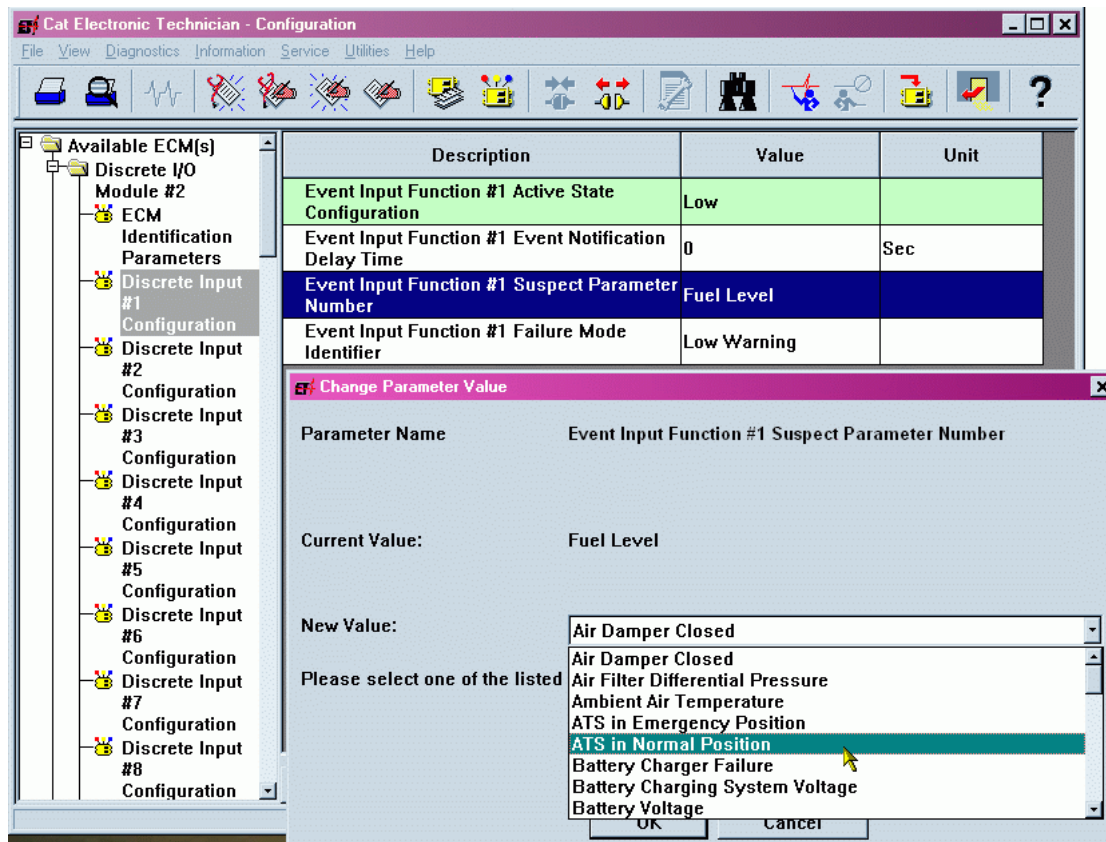


Available ECM(s)	Description	Value
Discrete I/O Module #2	ECM Serial Number	05547127PR
Alarm Module #3	ECM Part Number	2340275-00
EMCP 3.2	Software Group Part Number	2340274-06
	Software Group Description	V6.00H
	Software Group Release Date	MAY2005

FIGURE 68: CATERPILLAR® SERVICE TOOL DIO AFTER ECU INSTANCE CHANGE

CONFIGURING DIGITAL INPUTS

FIGURE 69 shows the Discrete Input #1 Configuration list using the service tool configuration tool. All twelve discrete inputs have identical parameters and options.



Available ECM(s)	Description	Value	Unit
Discrete I/O Module #2	Event Input Function #1 Active State Configuration	Low	
ECM Identification Parameters	Event Input Function #1 Event Notification Delay Time	0	Sec
Discrete Input #1 Configuration	Event Input Function #1 Suspect Parameter Number	Fuel Level	
Discrete Input #2 Configuration	Event Input Function #1 Failure Mode Identifier	Low Warning	

Parameter Name	Event Input Function #1 Suspect Parameter Number
Current Value:	Fuel Level
New Value:	Air Damper Closed Air Damper Closed Air Filter Differential Pressure Ambient Air Temperature ATS in Emergency Position ATS in Normal Position Battery Charger Failure Battery Charging System Voltage Battery Voltage

FIGURE 69: CATERPILLAR® SERVICE TOOL DIO DIGITAL INPUT CONFIGURATION

The *active state configuration* determines which state (high or low) triggers the event, and depends on the sensor/switch wiring configuration.

The *event notification delay time* sets the amount of time the input must remain active until the DIO module triggers an event on the data link.

SUSPECT PARAMETER NUMBER (SPN)

The *suspect parameter number* (SPN) is a choice between a predetermined list of SPNs that are supported by the DIO module. All of the discrete inputs support the same list of SPNs, except Custom Event.

Discrete Input #1, when set to Custom Event, will trigger an event for Custom Event #1. Discrete Input #2, when set to Custom Event, will trigger an event for Custom Event #2; likewise for all twelve discrete inputs.

FAILURE MODE IDENTIFIER (FMI)

The **FAILURE MODE IDENTIFIER** (FMI) configures what type of failure this event will represent. The technician is free to configure any FMI for any SPN, but discretion must be used. Certain combinations may not be meaningful (i.e. the EMCP 3 GSC may not be configurable to display or trigger a response for certain combinations of SPN and FMI).

For example, a Fuel Level SPN with a Condition Exists FMI is not meaningful; the EMCP 3 can be configured to display or react to only fuel level low or high warnings or shutdowns.

CONFIGURING RELAY OUTPUTS

The Relay Output #1 Configuration list of the service tool configuration tool is shown in FIGURE 70. All eight relay outputs have identical parameters and options.

The *suspect parameter number* (SPN) is a choice between a predetermined list of SPNs that are supported by the DIO module. If you wish to configure the DIO to trigger an output based on an event on the data link related to a specific SPN, the SPN must be selected here.

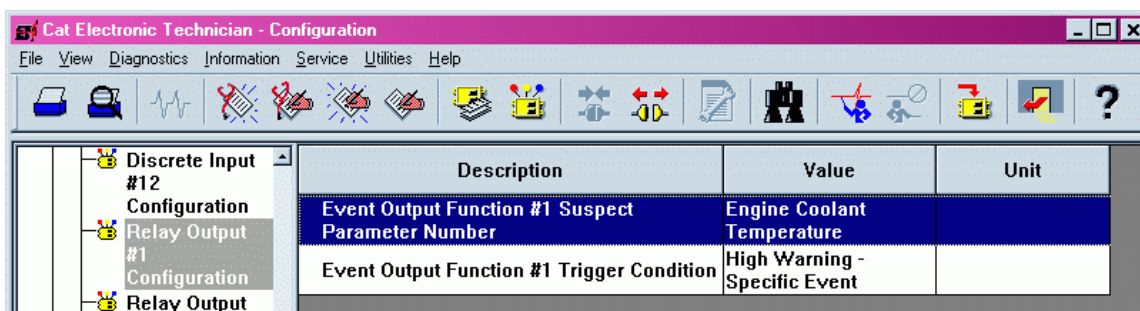


FIGURE 70: CATERPILLAR[®] SERVICE TOOL DIO RELAY OUTPUT CONFIGURATION

The *trigger condition* is a list of conditions that will trigger this output. For the conditions labeled specific event, the relay will be activated upon receiving a category of events (either a single FMI or a set of FMIs) for the SPN selected in the *suspect parameter number* parameter. For the conditions labeled general event, the relay will be activated upon receiving a category of events (either a single FMI or a set of FMIs) for *any* SPN. In this case, the DIO module will ignore the entry in the *suspect parameter number* parameter. If the disabled condition is chosen, the relay output will not activate on any condition.

18 SCADA (MODBUS) DATA LINK (EMCP 3.2 & 3.3)

The **SCADA DATA LINK** or **MODBUS** is supported by the EMCP 3.2 and EMCP 3.3.

The EMCP 3.2 and EMCP 3.3 have a **SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)** communications link between the controller and a host device using the **MODBUS** protocol. The host device is able to remotely monitor or control the genset package equipped with the EMCP 3 GSC in much the same way an operator does from the panel.

- The host device connects to the EMCP GSC through a half-duplex RS-485 serial link.
- The data is transmitted in a binary format over the serial connection.
- The host device acts as Modbus Master, and the EMCP 3 GSC acts as the Modbus Slave, also called a **REMOTE TRANSMITTER UNIT (RTU)**.
- The host device initiates all communication, sending commands or requests for information to the EMCP 3.2
- The EMCP 3 GSC then takes action based on the query and/or sends a response to the query over Modbus.

Baud rates can be configured on the EMCP 3 GSC. Various data rates between 2400 bits/second (baud) and 57,600 bits/second are available. See the SOFTWARE CONFIGURATION Chapter 0 below for instructions.

WIRING

SCADA COMMUNICATION wires are brought out of the EMCP 3 GSC as part of the 70-pin AMP connector. Table 12 shows the pins on the AMP connector.

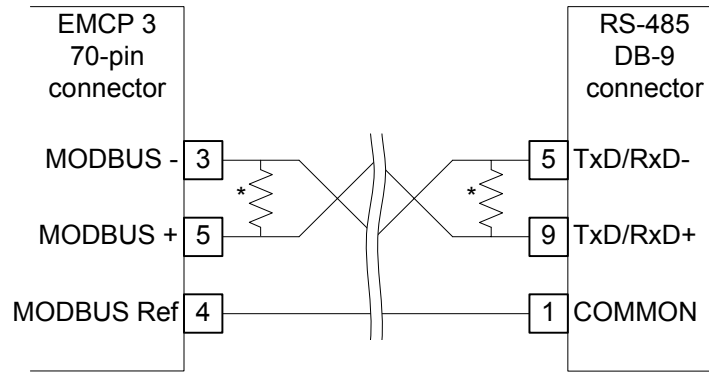
TABLE 12 SCADA PINS ON 70-PIN CONNECTOR

SCADA COMMUNICATION WIRES		
Pin #	Name	Description
3	MODBUS –	Optically isolated half-duplex differential (-) for Modbus
4	MODBUS Reference	Half-duplex RS-485 Reference for Modbus
5	MODBUS +	Optically isolated half-duplex differential (+) for Modbus

MODBUS DATA TRANSMISSION over RS-485 is accomplished over a single shielded twisted pair for differential signaling with transmit and receive alternating over the same wire pair (**MODBUS+** and **MODBUS-**). The Reference (**MODBUS REF**) should be connected to the shield, to prevent ground loop currents.

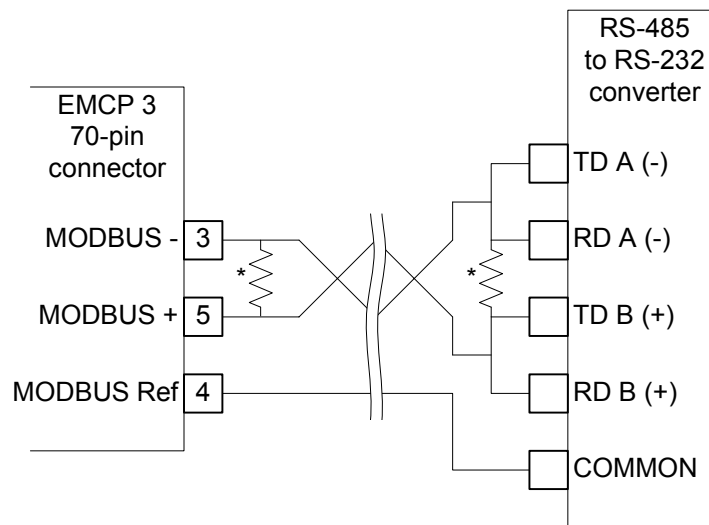
- FIGURE 71 shows a possible wiring configuration to a RS-485 device.
- FIGURE 72 shows a possible wiring configuration to a RS-485 to RS-232 converter.

NOTE: See documentation of connected device to verify wiring configuration.



* - For multipoint network, terminate with 120 ohm resistors at ends of network trunk

FIGURE 71: POSSIBLE WIRING CONFIGURATION TO AN RS-485 DEVICE



* - For multipoint network, terminate with 120 ohm resistors at ends of network trunk

FIGURE 72: POSSIBLE WIRING CONFIGURATION TO AN RS-485 TO RS-232 CONVERTER

LINE TERMINATION

Both ends of the Modbus lines (or the extreme ends of the trunk, for a multipoint network) should have termination between MODBUS+ and MODBUS-.

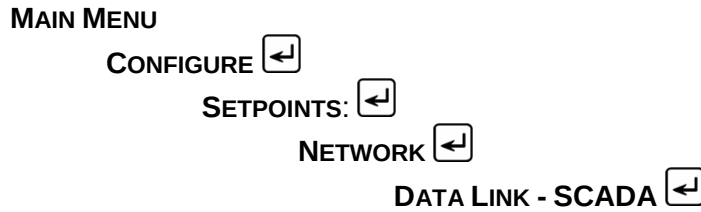
A 0.5W 150Ω resistor may be adequate.

If line polarization is implemented (see Software Configuration Chapter below), a better choice is a 10 μF capacitor (10V minimum) in series with a 0.25W 120Ω resistor.

NOTE: For more details on setting up a Modbus network over a serial line, please refer to RS-485 specifications or Modbus specifications. See the Software Configuration Chapter below for instructions on enabling line polarization.

SOFTWARE CONFIGURATION

The **SCADA DATA LINK** may require software configuration. The configuration parameters are accessible on the EMCP 3 GSC via the following menu options:



BAUD RATE options are the following: 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, and 115200 baud. (115200 baud is not currently supported).

PARITY can be set to None, Even, or Odd parity.

The **SLAVE ADDRESS** is a unique address for each slave on the Modbus data link. This address is referenced in the data messages, described in the Data Link Layer section below. The slave (EMCP 3 GSC) will only respond to messages addressed to its particular slave address, or to global requests. This address can be set to any integer from 1 to 247.

The **CONNECT TIMEOUT INTERVAL** is the amount of time the EMCP 3 GSC will wait between message transmissions before it resets the SCADA security level. If a **SCADA PASSWORD** has been set, this timeout will disallow any further SCADA reads/writes until the proper password is written.

The **RS-485 BIAS RESISTOR** provides line polarization. Line polarization helps prevent noise and external interference. The data terminals of the EMCP 3 GSC are internally opto-coupled, and therefore line polarization is not required for the EMCP 3 GSC. However, other devices may require line polarization. To polarize the line, the EMCP 3 GSC Modbus terminals have hardware-selectable passive pull-up / pull-down lines. Only a single device on a Modbus network should have line polarization.

In addition to these setpoints, SCADA access can be restricted by means of assigning a **SCADA PASSWORD** (register 724). For more information, see Chapter 21.1 DATA LINK SECURITY.

MESSAGE DATA STRUCTURE

Modbus registers are 2 bytes long. A register is the smallest block that can contain a single piece of data. Larger pieces of data occupy consecutive registers, with the most significant word (pair of bytes) in the lowest register, and the least significant word (pair of bytes) in the highest register.

NOTE: Modbus register addresses are referenced starting with register 1, whereas data link requests begin at 0. This results in an offset of 1 in the register address. For example, to request the parameter Generator Overall Power Factor, which resides in Modbus register number 103 (\$67), a register address of \$66 must be sent.

TABLE 13 MODBUS PACKET FORMAT

DATA STRUCTURE		
Byte Offset	Field	Field Description
0	Address	Slave address, for both query and response. Every control on the network has a unique slave address between 1 and 247. Use 0 to make a broadcast query, which is supported for Function Codes 6 and 16. The EMCP 3 GSC will always respond with it's own slave address.
1	Function Code	Function Code for both query and response. See Supported Function Codes for a list and syntax of supported function codes.
2	Data	Data or exception responses. See Supported Function Codes for the format of address, counts, and data. See Exception Responses for the format of exception responses.
...		
(n-3)		
(n-2)	CRC	Cyclic Redundancy Check to catch transmission errors. The low byte is transmitted first, then the high byte.
(n-1)		

COMMUNICATION

Modbus communication is comprised of data packets. A packet is a set of bytes transmitted consecutively and interpreted as one message, and can vary in length. A packet is sent with byte offset 0 first, and the data is sent with the most significant byte first. Every packet shares a common structure, which is shown in Table 13 Modbus Packet Format. Only the Data field has a variable length, depending on the function being performed and the amount of data being transmitted.

SUPPORTED FUNCTION CODES

Three normal function codes are supported by the EMCP 3.2. If the EMCP 3 GSC receives an erroneous request, it can also generate an error function code, called an exception response. See EXCEPTION RESPONSES Chapter 0 for descriptions of exception responses.

3 (\$03) – READ REGISTERS

Send this Function Code to read data, single or up to 123 consecutive registers, from the EMCP 3 GSC. Note that the query will contain the register count, while the response will contain the byte count (byte count = register count x 2). Note also that the query has a fixed length of 4 bytes, whereas the response has a variable length depending on the number of registers requested.

TABLE 14: DATA FIELDED OF READ REGISTERS QUERY

DATA Fielded of READ REGISTERS QUERY	
Address	slave address (recipient of this msg)
Function Code	\$03
Data field	register address (high byte)
	register address (low byte)
	register count (high byte)
	register count (low byte)
CRC	CRC (low byte)
	CRC (high byte)

TABLE 15: DATA FIELDED OF READ REGISTERS RESPONSE

DATA Fielded of READ REGISTERS RESPONSE	
Address	slave address (source of this msg)
Function Code	\$03
Data field	byte count
	data (Big Endian) (variable length)
CRC	CRC (low byte)
	CRC (high byte)

6 (\$06) – WRITE SINGLE REGISTER

Send this Function Code to write data to a single register on the EMCP 3 GSC. Note that the EMCP 3 GSC will attempt to write the data, and then respond with the new value in the register. If the query inadvertently attempted to write data to a read-register, the response data bytes will not match the query data bytes. This Function Code may be broadcast, in which case no response will be sent.

TABLE 16: DATA FIELDED OF WRITE SINGLE REGISTER QUERY

DATA Fielded of WRITE SINGLE REGISTER QUERY	
Address	slave address (recipient of this msg)
Function Code	\$06
Data field	data link register address (high byte)
	data link register address (low byte)
	data (high byte)
	data (low byte)
CRC	CRC (low byte)
	CRC (high byte)

TABLE 17: DATA FIELDED OF WRITE SINGLE REGISTER RESPONSE

DATA Fielded of WRITE SINGLE REGISTER RESPONSE DATA	
Address	slave address (source of this msg)
Function Code	\$06
Data field	data link register address (high byte)
	data link register address (low byte)
	data (high byte) (confirm written data)
	data (low byte) (confirm written data)
CRC	CRC (low byte)
	CRC (high byte)

16 (\$10) – WRITE MULTIPLE REGISTERS

Send this Function Code to write data to up to 123 contiguous registers on the EMCP 3 GSC. Note that the query will contain both the register count and the byte count (byte count = register count x 2).

Note, also, that the query has a variable length depending on the number of registers being written, whereas the response has a fixed length of 4 bytes.

The EMCP 3 GSC will not respond with any data, only the starting address and the register count as sent in the query. The entire Write will fail, and the slave will return an Exception Response, if any register in this span is a Read register.

This Function Code may be broadcast, in which case no response will be sent.

TABLE 18: DATA FIELDED OF WRITE MULTIPLE REGISTERS QUERY

DATA Fielded of WRITE MULTIPLE REGISTERS QUERY	
Address	slave address (recipient of this msg)
Function Code	\$10
Data field	data link register address (high byte)
	data link register address (low byte)
	register count (high byte)
	register count (low byte)
	byte count
	data (Big Endian) (variable length)
CRC	CRC (low byte)
	CRC (high byte)

TABLE 19: DATA FIELDED OF WRITE MULTIPLE REGISTERS RESPONSE

DATA Fielded of WRITE MULTIPLE REGISTERS RESPONSE	
Address	slave address (source of this msg)
Function Code	\$10
Data field	data link register address (high byte)
	data link register address (low byte)
	register count (high byte)
	register count (low byte)
CRC	CRC (low byte)
	CRC (high byte)

DATA LINK REGISTER ADDRESSES

Register addresses in the EMCP 3 GSC start with address 100 and go up. If using a PLC or other legacy Modbus system where the addresses are represented in five digits, the EMCP 3 GSC register addresses represent offsets from 40000 (holding registers). Therefore, the register address 100 would be represented as 40100, register address 1000 would be 41000, etc.

Detailed information about each EMCP 3 GSC Modbus register is given in Chapter 21, SCADA Parameter Information .

ERROR CHECKING

In EMCP 3 GSC SCADA communications, various levels of error-checking are performed.

The Modbus data link protocol allows for **BYTE-LEVEL ERROR CHECKING** and **PACKET-LEVEL ERROR CHECKING**.

- For **BYTE-LEVEL** error-checking, parity checking may be done.
- For **PACKET-LEVEL** error-checking, the Modbus protocol dictates that a Cyclic Redundancy Check be performed to catch transmission errors; that is, verify that the packet received is identical to the packet that was sent. These occur in the Modbus data link layer. More information on the CRC is given below.

Once the packet is verified, the addresses and function codes are checked. This is handled using simple logic, determining whether the function code is supported and determining whether or not the address range or count is within range. If not, an exception response is sent. This occurs in the Modbus application layer.

FAULT RESPONSE

Once the addresses and function codes are checked, the data is ready to be handled by the EMCP 3 GSC application software. There is error-checking, at this level, is to determine whether there are any application-specific errors.

For example: if you are attempting to write 101% into a register that is defined to hold 0-100%, then, even though the data may fit into the register (and therefore passes the previous error-checking), the application does not accept an input of 101%, and therefore a **FAULT RESPONSE** is sent.

This fault response is called a **FAULT IDENTIFIER**, or **FID**.

A fault response is data that is valid over the Modbus data link, but the EMCP 3 GSC and the Modbus Master device agree to reserve for use as an FID.

PARITY CHECK

Parity checking uses standard even or odd parity. The parity can be set in the EMCP 3 GSC to even, odd, or none. Parity checking occurs at the byte-level. Upon successful parity check, the checked byte is accepted as part of the transmitted message. If the parity check fails, the byte is discarded.

CYCLIC REDUNDANCY CHECK

The **CYCLIC REDUNDANCY CHECK (CRC)** algorithm checks the contents of the entire message. The CRC field consists of a 16-bit value, and is appended to the end of the message. When this is done, the low-order byte of the field is appended first, followed by the high-order byte. The CRC high-order byte is the last byte to be sent in the message.

The CRC value is calculated by the sending device, which appends the CRC to the message. The receiving device recalculates a CRC using the same algorithm during receipt of the message, and as it receives the CRC field, compares the calculated value to the received value. If the two values are not equal, the message is discarded.

A detailed description as well as sample code and a calculation example are given in the Modbus Serial Line Implementation Guide version 1.0 or the most current version, available at www.modbus.org.

EXCEPTION RESPONSES

Upon a parity or CRC error, the byte or message (respectively) is discarded. If neither of these errors occurs, the read/write status is checked. An **EXCEPTION RESPONSE** will be sent if there is a read/write error.

If the register cannot be read from or written to at a particular time due to some application software state, it will not generate an Exception Response. Instead, the application layer will respond with data that is in the Fault Identifiers (FID) range.

An Exception Response contains a function code that is related to the function code the EMCP 3 GSC is responding to; it's value is [128 + Function Code for Query]. Any function code 128 (\$80) or higher is an Exception Response.

128+ (\$80 AND ABOVE) – EXCEPTION RESPONSE TO UNSUPPORTED QUERIES

The EMCP 3 GSC does not support any function codes not listed above in the Supported Function Codes Chapter. Such queries will return an exception response with this exception code.

EXCEPTION CODE	REASON
01	Unsupported function code

131 (\$83) – EXCEPTION RESPONSE TO READ REGISTERS QUERY

The exception response contains only 1 byte of data, which is comprised of the exception code.

EXCEPTION CODE	REASON
02	Starting or ending (starting + count) register address invalid
03	Register Count was less than 1 or greater than 123
04	Read error possibly due to some register(s) in the span not being Read registers

134 (\$86) – EXCEPTION RESPONSE TO WRITE SINGLE REGISTER QUERY

The exception response contains only 1 byte of data, which is comprised of the exception code.

EXCEPTION CODE	REASON
02	Register address invalid
03	Register value out of range perhaps because longer than 2 bytes
04	Write error possibly due to not being a Write register

144 (\$90) – EXCEPTION RESPONSE TO WRITE MULTIPLE REGISTERS QUERY

The exception response contains only 1 byte of data, which is comprised of the exception code.

EXCEPTION CODE	REASON
02	Starting or ending (starting + count) register address invalid
03	Register Count was less than 1 or greater than 123, or byte count was not (Register Count x 2)
04	Write error possibly due to some register(s) in the span not being Write registers

FAULT IDENTIFIERS (FID)

FAULT IDENTIFIERS (FIDs) are based on the concept that the entire data space within the register(s) is partitioned in a predefined manner, irrespective of the specific type of data in the register(s). The range of data in the EMCP 3 GSC response allows the master device to interpret the data as valid or as an indication of a fault.

The following chart shows the transmitted signal ranges, including the ranges that comprise Fault Identifiers (FIDs).

TABLE 20: TRANSMITTED SIGNAL RANGES

TRANSMITTED SIGNAL RANGES				
Range Name	Boolean Data [†]	1-Register Data	2-Register Data	Notes
Valid Data	0, 1	0 – 64,255	0 – 4,211,081,215	See individual Parameter Descriptions for units, offset, and scaling to convert to physical units
	\$0000 or \$0001	\$0000 – \$FAFF	\$00000000 – \$FAFFFFFF	
Not Used	2-65532	65,256 – 65,023	4,211,081,214	These data ranges are not used.
	\$0010 - \$FFFC	\$FB00 – \$FDFF	\$FB000000 – \$FDFFFFFF	
Error	65533	65,024 – 65,279	4,261,412,864h – 4,278,190,079h	FID: Signal saturated, out of range, or error from source transmitter
	\$FFFD	\$FE00 – \$FEFF	\$FE000000 – \$FEFFFFFF	
Not Available / Not Requested	65535	65280 – 65535	4,278,190,080 – 4,294,967,294	FID: Parameter is not applicable in the current state, not available from the controller, or not requested
	\$FFFF	\$FF00 – \$FFFF	\$FF000000 – \$FFFFFFF	
† Note that 2-bit data is not transmitted individually, but rather within a register.				

19 MONITORING SOFTWARE (EMCP 3.2 & 3.3)

The EMCP 3 Monitoring Software can be used to control and monitor a generator set over the SCADA data link. This functionality is available on the EMCP 3.2 and EMCP 3.3.

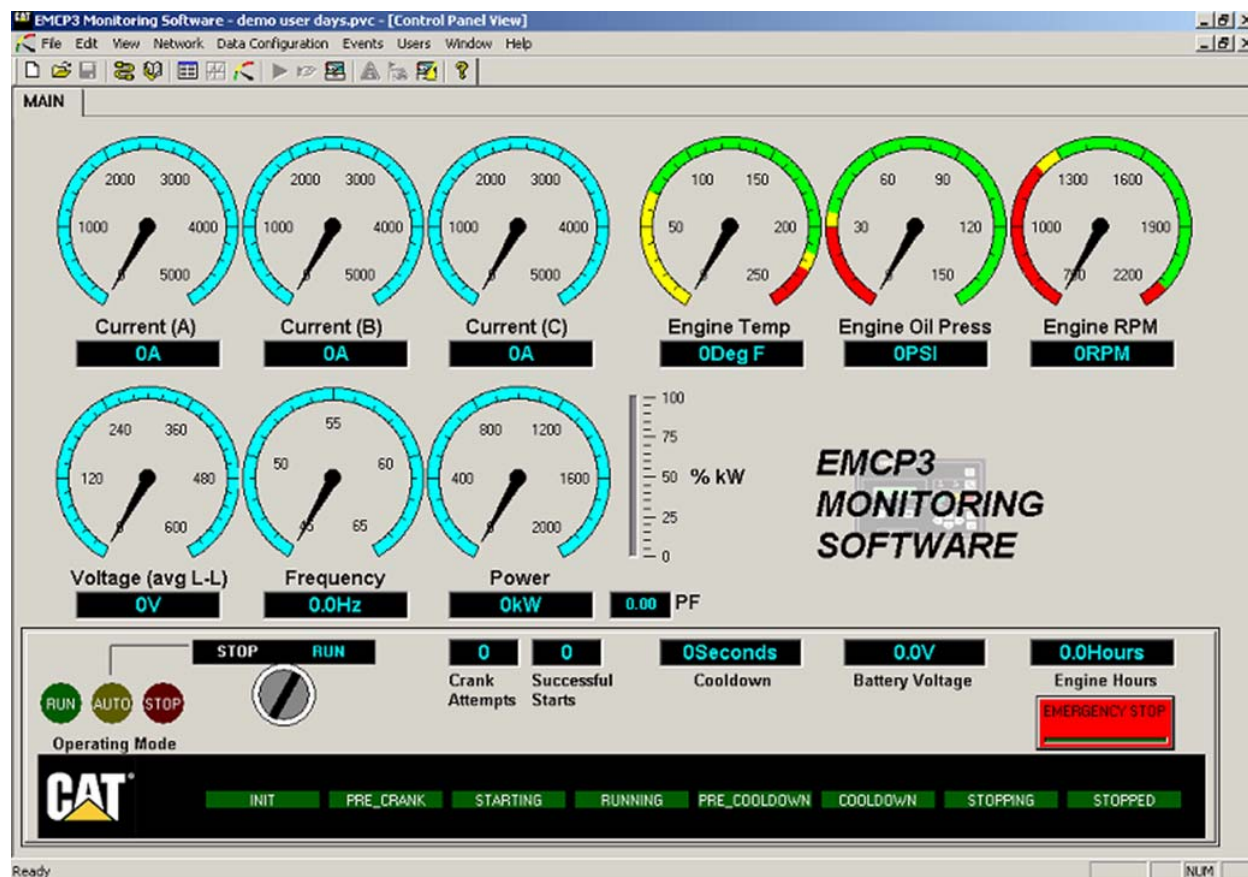


FIGURE 73: EMCP 3 MONITORING SOFTWARE SCREEN

FIGURE 73 shows the default control panel, provided with the EMCP 3 Monitoring Software. Control Panels can be edited or created, as shown in Chapter 19.3, Creating A Control Panel View.

19.1 SOFTWARE SETUP

The computer must first be connected to the EMCP 3 GSC over the SCADA Data Link following the instructions located in the EMCP 3 Monitoring Software Quick Start Guide Chapter 19.2.

After launching the program, it will ask for a login name and a password. You may use the default username of administrator and enter admin for the password as shown in FIGURE 74.

To add the device to the network, select Network > Add Device or right-click on the cable symbol in the top left corner (where it says Offline) and select Add Device.

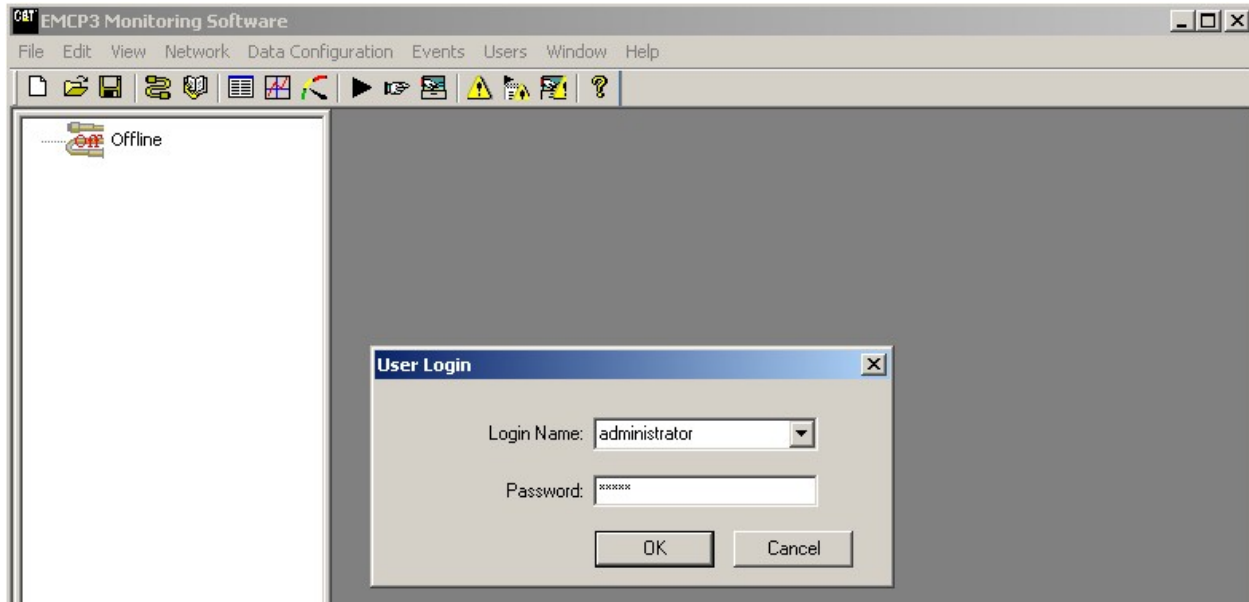


FIGURE 74: LOGIN SCREEN

For Device Name, enter a name of your choosing for the device and then select the device type and the node address as shown in FIGURE 75. Make sure that the node address matches the SCADA Data Link Slave Address setpoint on the EMCP 3 GSC.

The setpoint can be found from the main menu by making the following selections: Configure > Setpoints > Network > Data Link – SCADA.

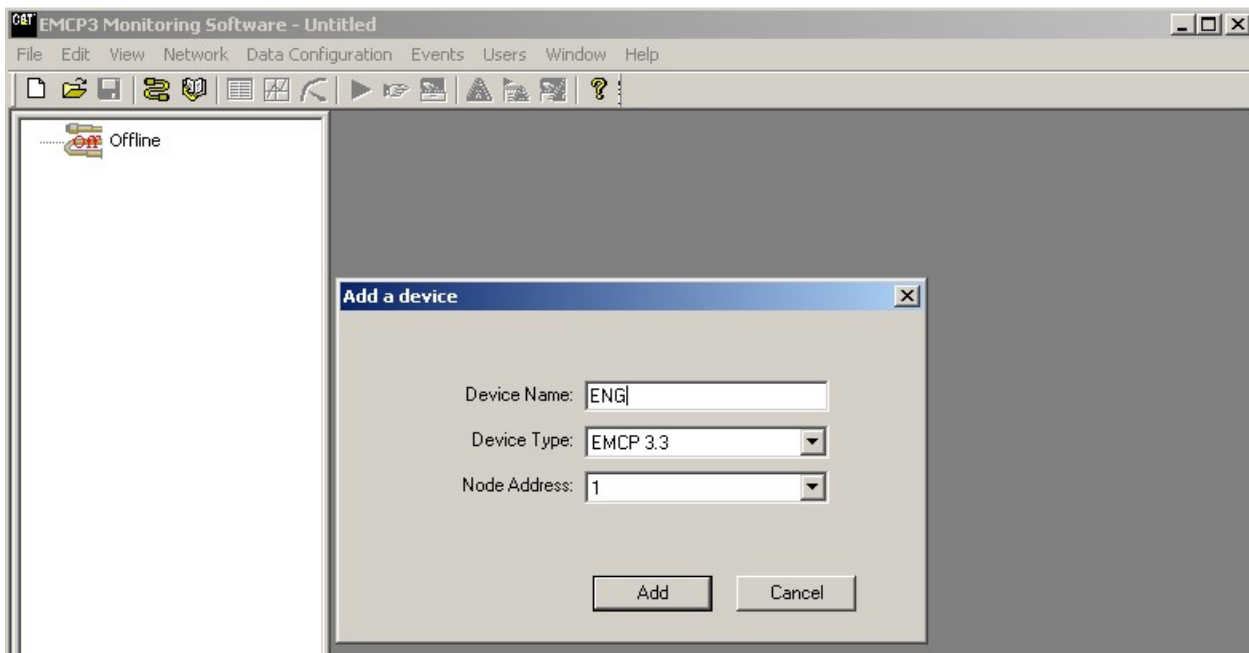


FIGURE 75: ADDING THE DEVICE

Check the online configuration settings by selecting Network > Online Configuration or again by right clicking on the cable symbol and selecting Online Configuration. Verify that the connection interface is correct and that the baud rate and parity match the settings on the EMCP 3 GSC as shown in FIGURE 76. On the EMCP 3 GSC, these settings can be found from the main menu by making the following selections: Configure > Setpoints > Network > Data Link – SCADA.

To create a simple test, select Edit > Control Panel Configuration. In this control panel, a digital display showing battery voltage will be added to verify that a connection between the EMCP 3 GSC and the software has been established. (Simply telling the software to Go Online does not verify a connection. This is because the software will appear to successfully go online whether or not a connection is present).

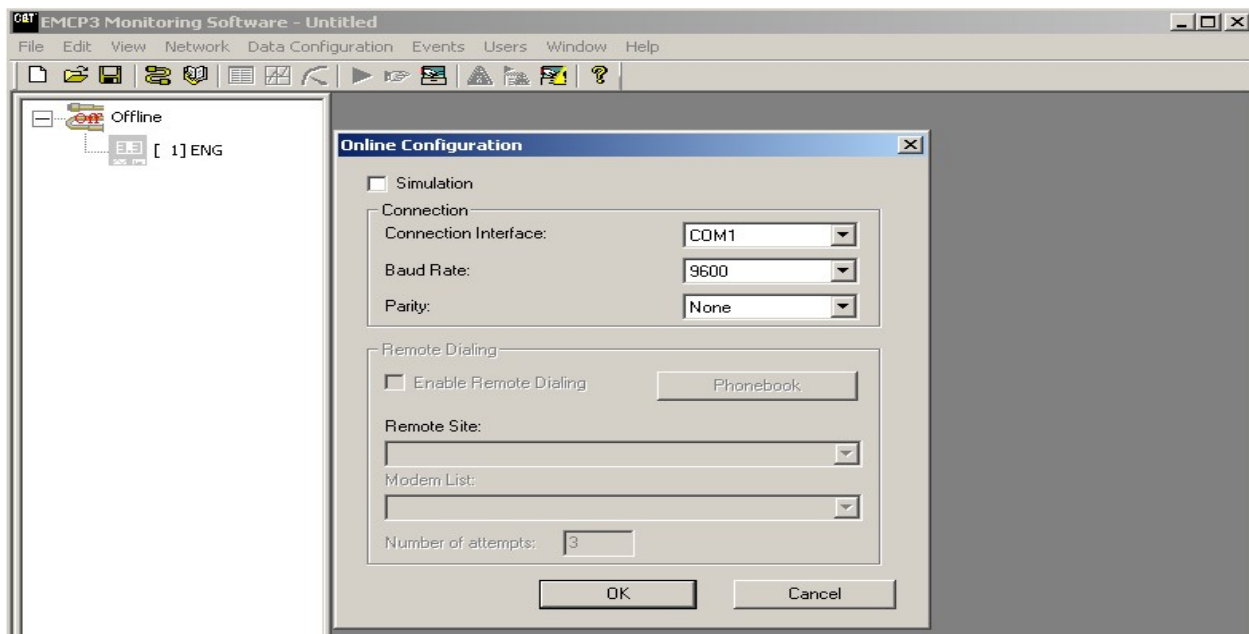


FIGURE 76: ONLINE CONFIGURATION SETTINGS

Select Edit > Add Control > Digital Display or click the Digital Display button on the toolbar. To add the control, double click on the desired location within the control panel. This will add the digital display as shown in FIGURE 77.

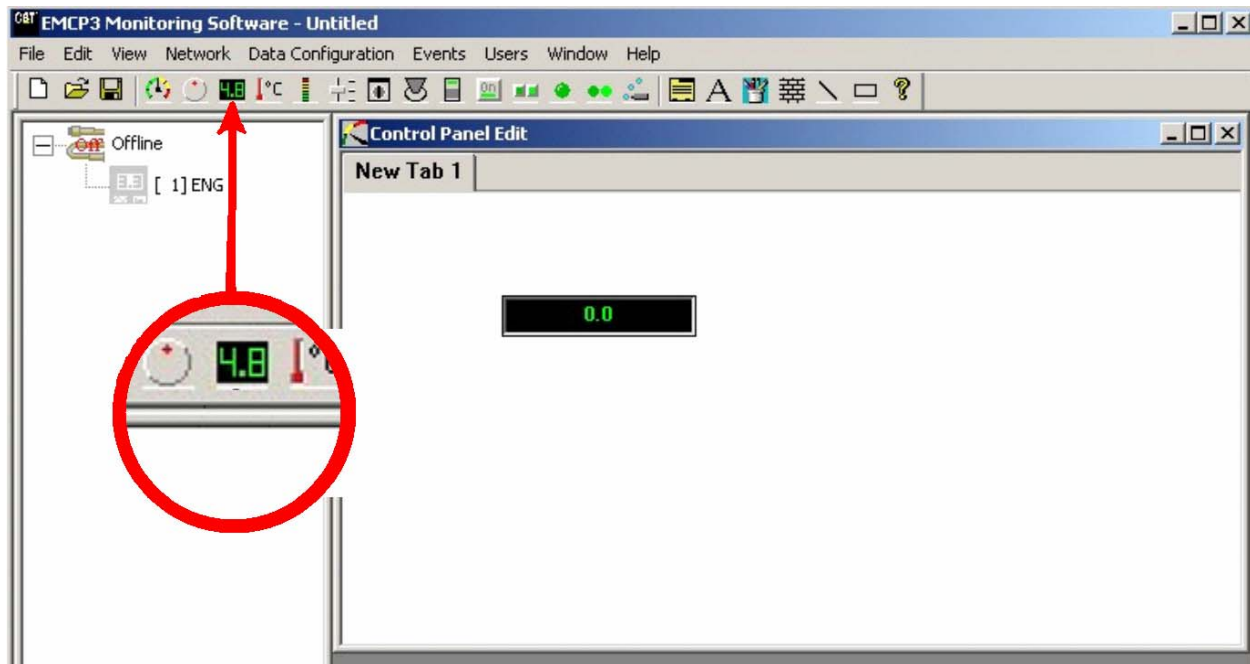


FIGURE 77: ADDING THE DIGITAL DISPLAY

After adding the display, it needs to be set to display battery voltage. Right click on the display and select Set Parameter Association. This will bring up a Control Configuration window as shown in FIGURE 78.

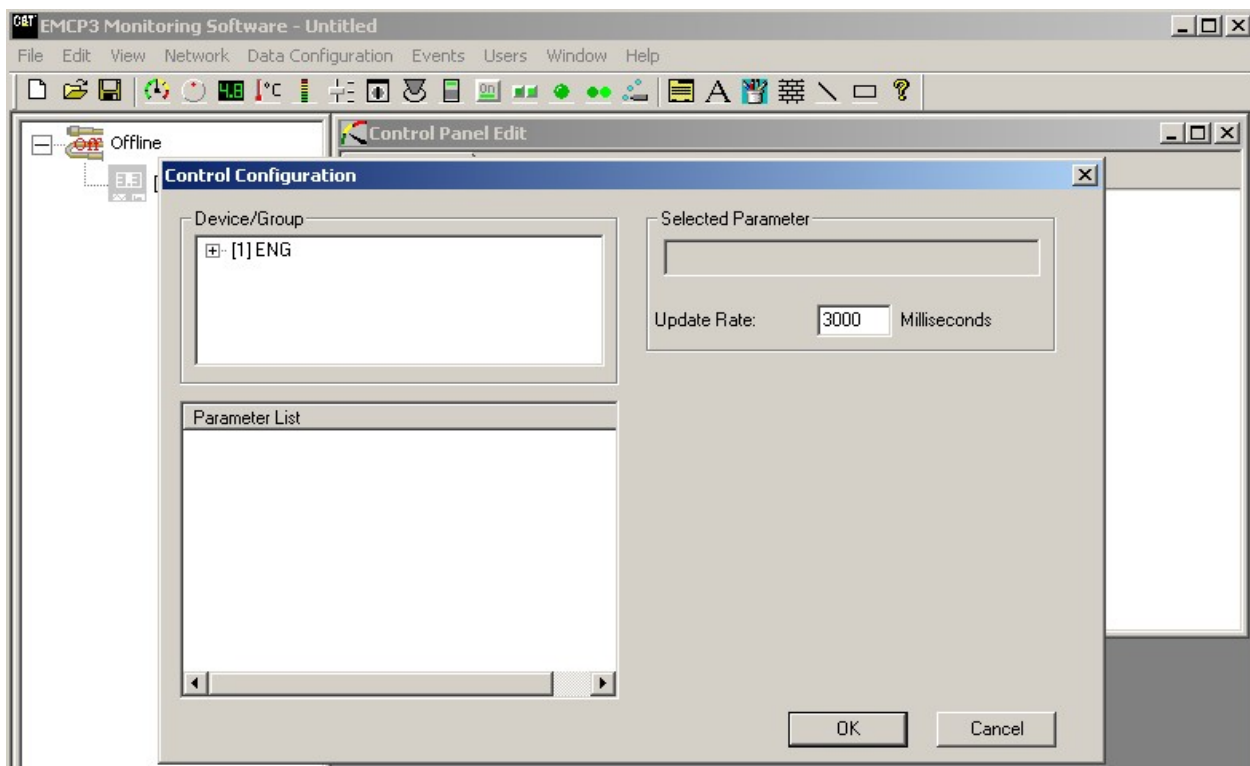


FIGURE 78: CONTROL CONFIGURATION WINDOW

Under Device/Group, select the previously named device (ENG in this example) and all of the possible parameters for the digital display will be shown in the Parameter List. Double click on Battery Voltage to select it. This can be seen in FIGURE 79.

Make sure to double click the parameter or it will not be selected. Also, it shows up under Selected Parameter after it has been selected.

Click ok and the parameter will be set.

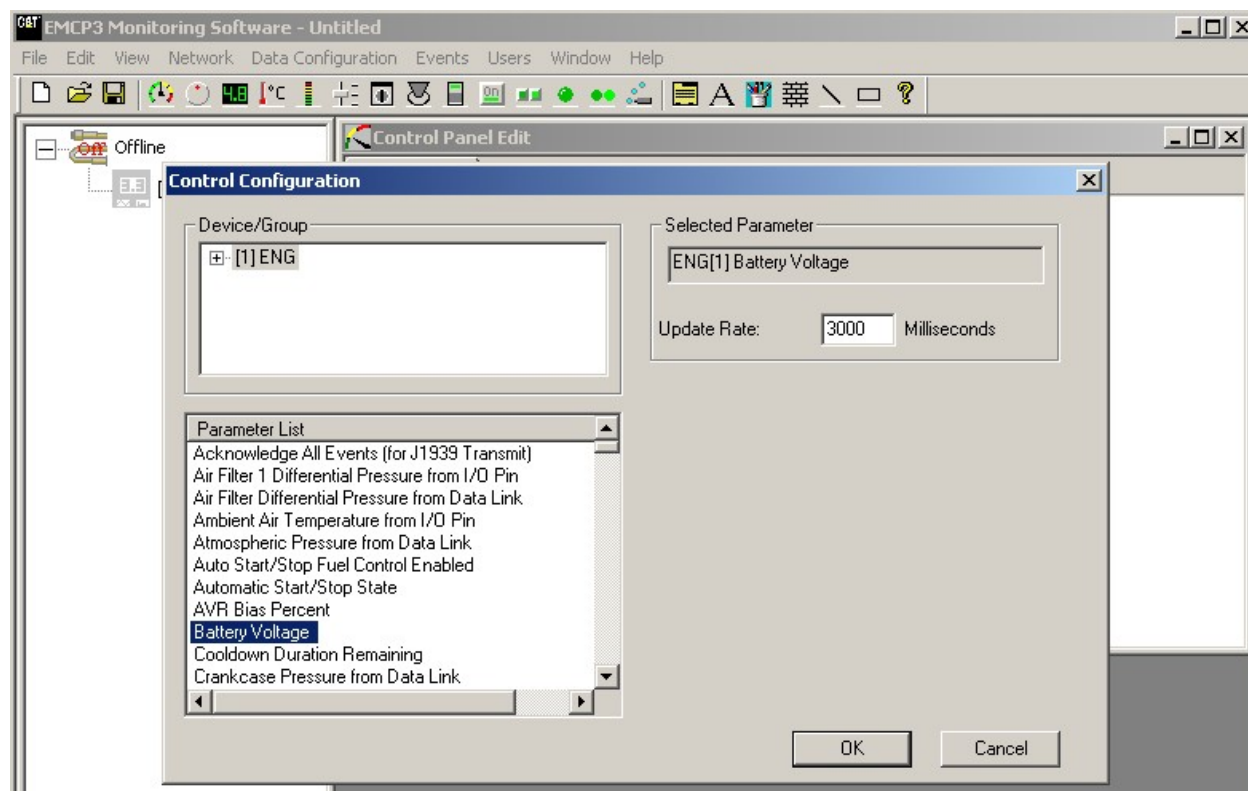


FIGURE 79: SELECTING A PARAMETER

Now that the parameter is set, save the document by selecting File > Save or click the Save button on the toolbar.

Select a location and name for the file and click save. The control panel should now look similar to FIGURE 80.

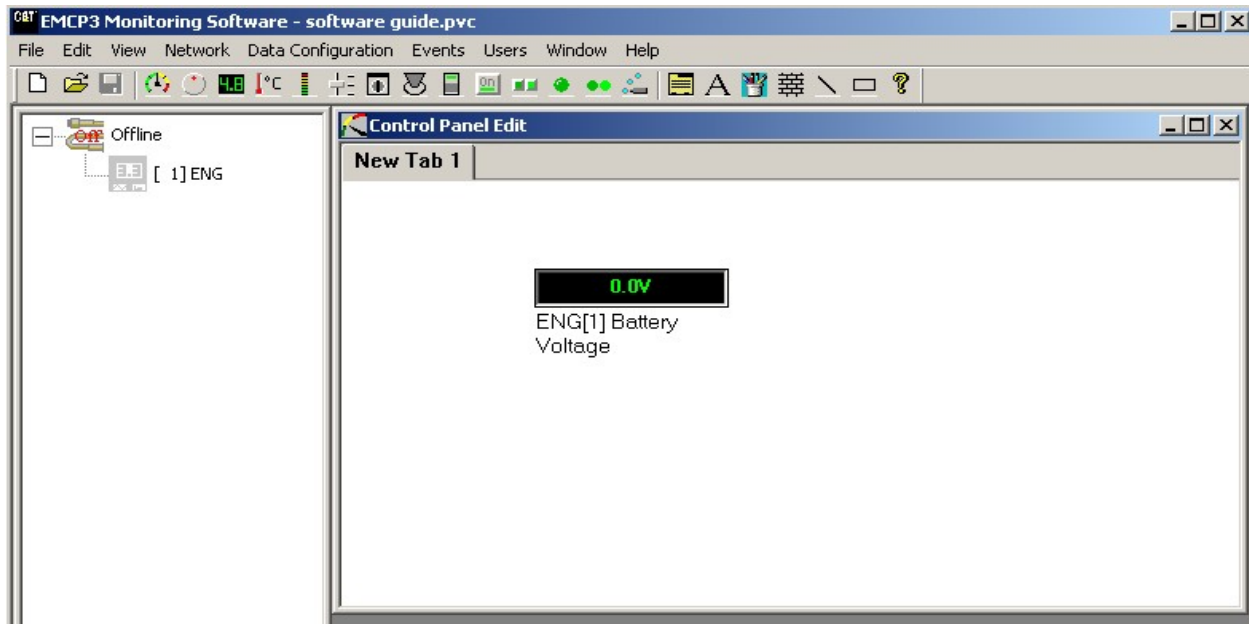


FIGURE 80: CONTROL PANEL THAT DISPLAYS BATTERY VOLTAGE

Close the Control Panel Edit window by selecting the X in the top right corner of the window. Make sure to close only the control panel window and not the program. Select View > Control Panel Data to bring up the Control Panel View window. This is shown in FIGURE 81.

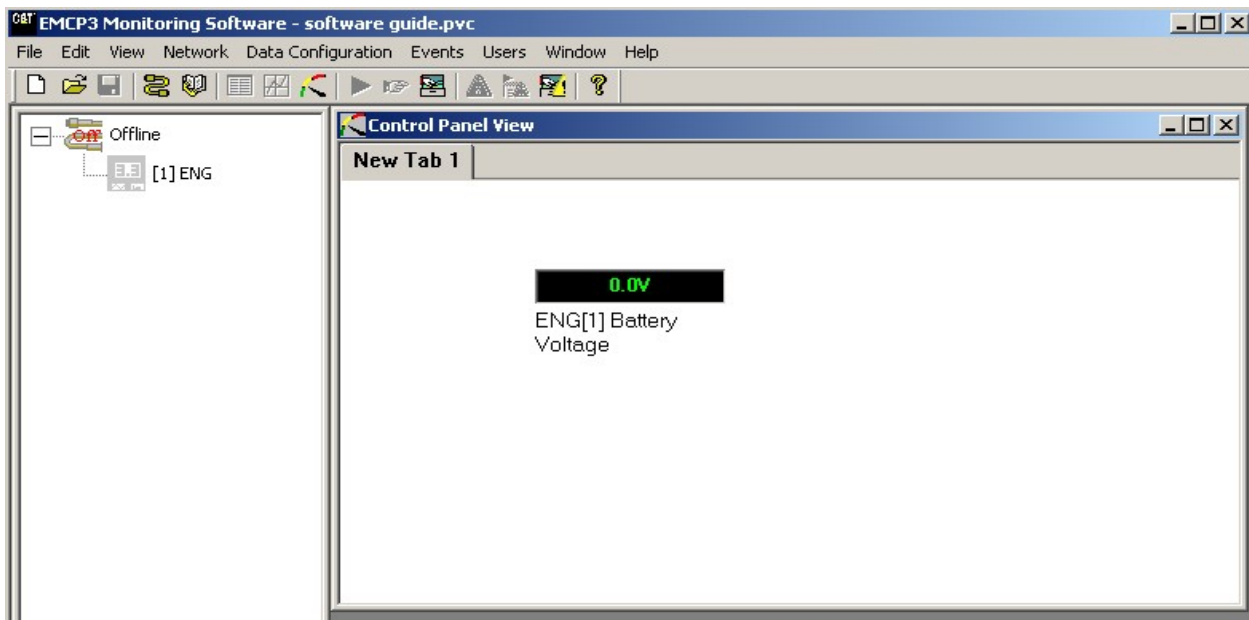


FIGURE 81: CONTROL PANEL DISPLAY

To test the connection, select Network > Go Online or right click on the cable symbol in the top left corner (where it says Offline) and select Go Online. This tells the computer to begin the connection and within a few seconds the battery voltage should be displayed. It should look similar to FIGURE 82.

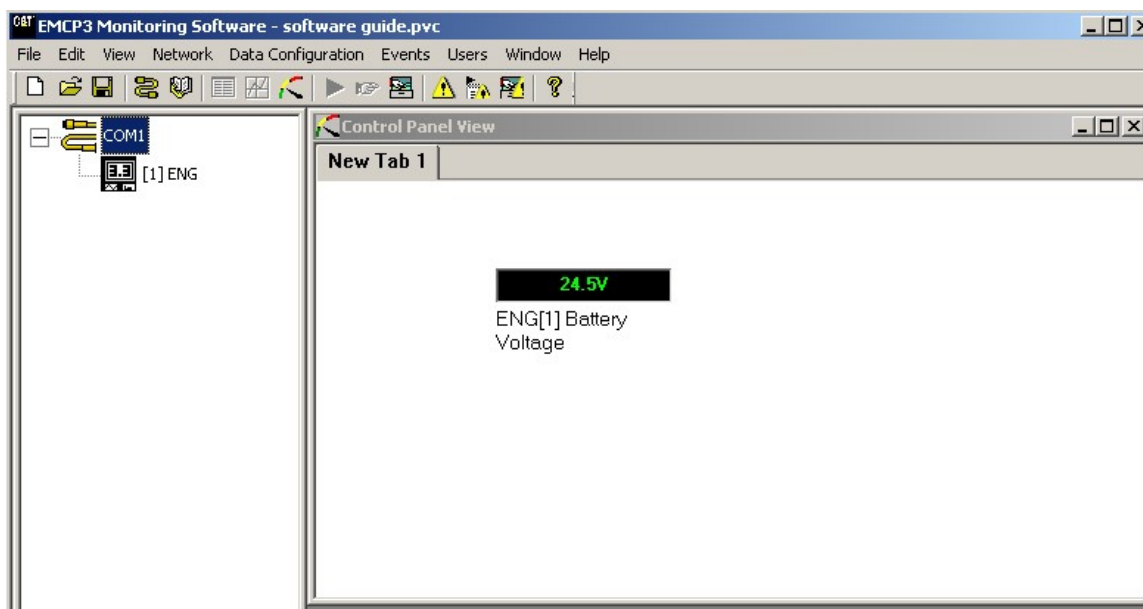


FIGURE 82: CONTROL PANEL DISPLAY AFTER GOING ONLINE

If the battery voltage is reading correctly, then the connection is working properly and it is time to begin designing the control panel view. If not, first make sure that the window being displayed is the Control Panel View window and not the Control Panel Edit window.

Also, recheck all settings mentioned at the beginning of this setup chapter. Finally, check the wiring for any possible problems.

Another simple test is to select the View Current Events button from the toolbar and it should display all events currently listed on the EMCP 3 GSC.

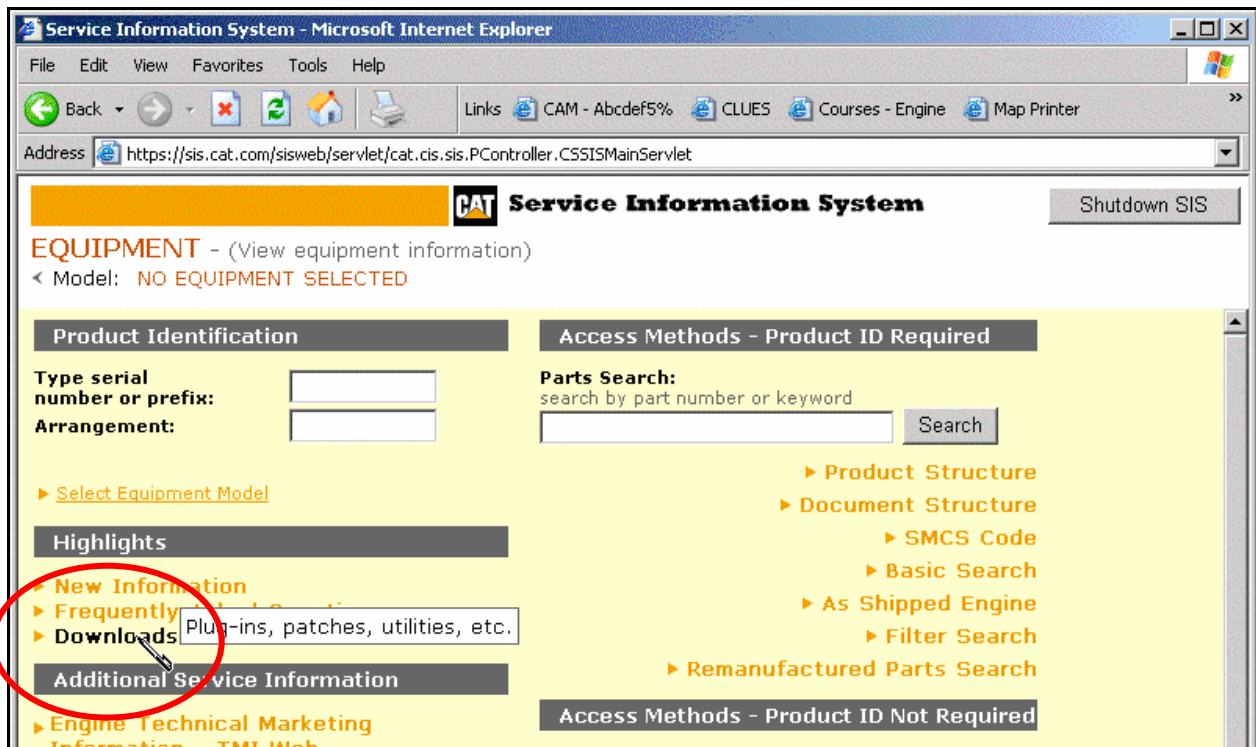
19.2 QUICK START GUIDE

The EMCP 3 Monitoring Software Quick Start Guide is located on the SIS website (<https://sis.cat.com>).

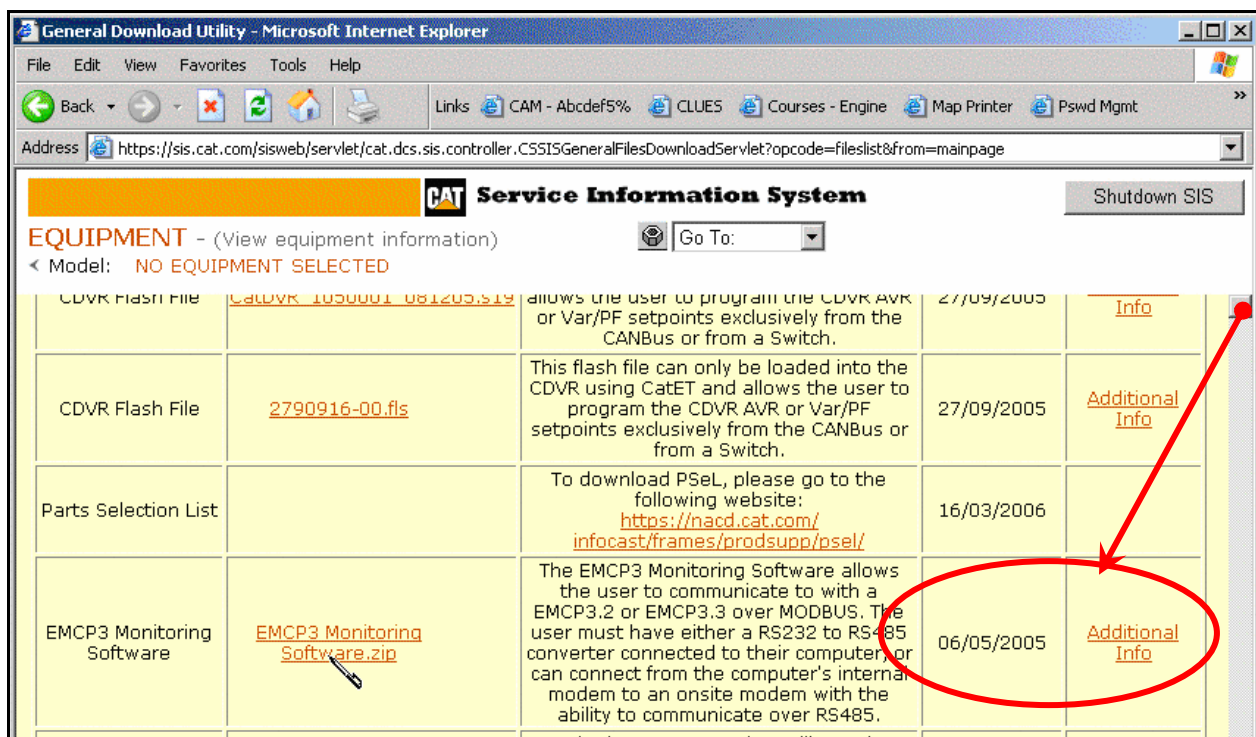
Log into the Caterpillar network with the correct CWS ID and password.

Click on to the link to the SIS web site above or copy and paste it into you browser.

Under Highlights, on the left, select Downloads.

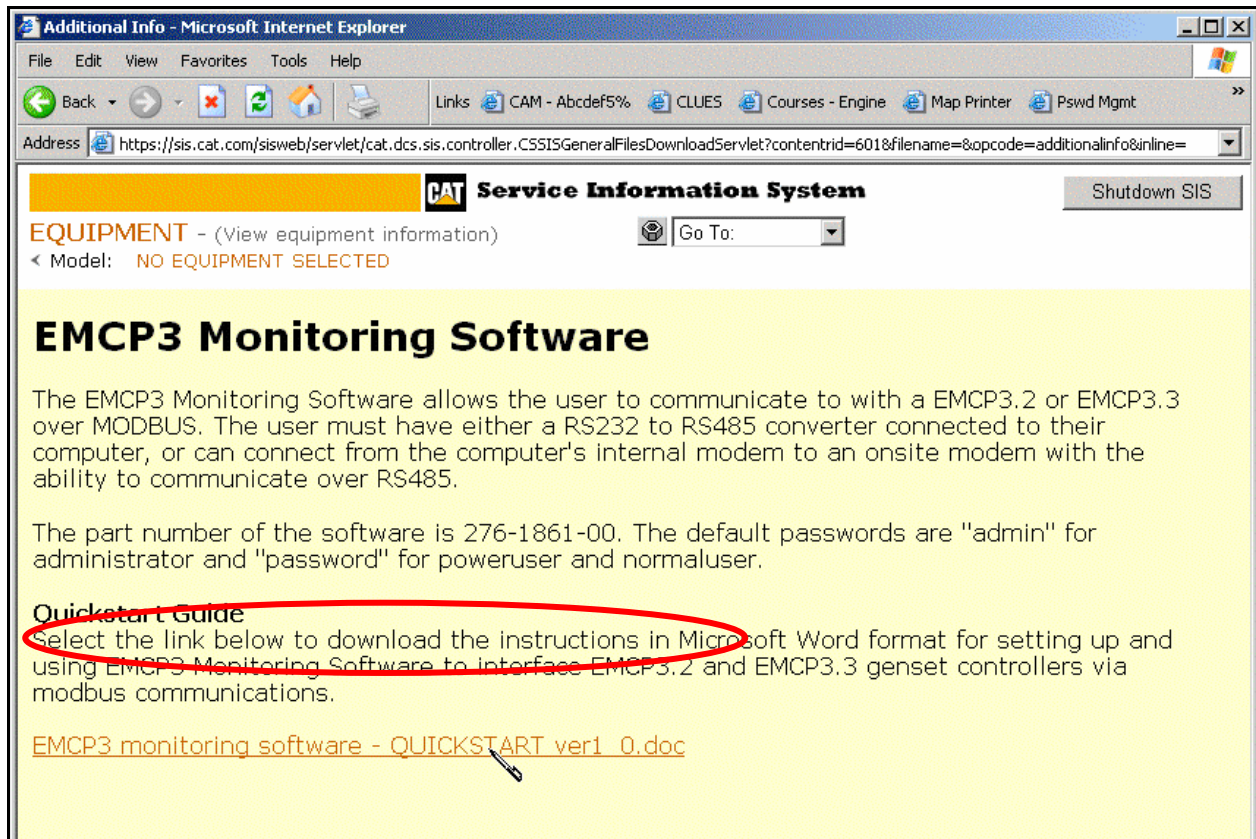


The next screen will display a list of available downloads.



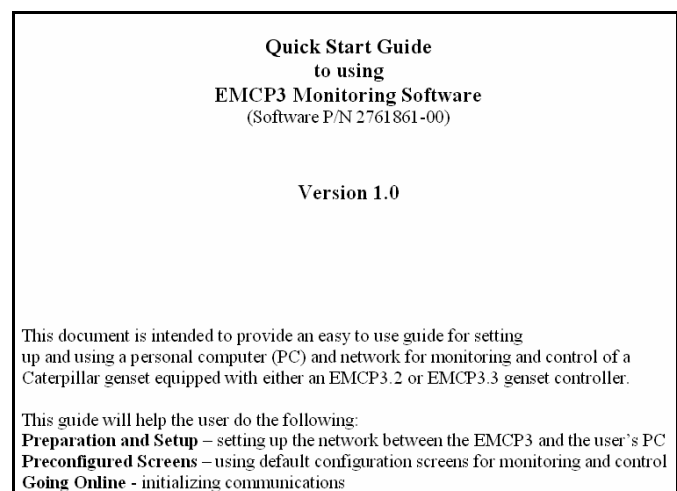
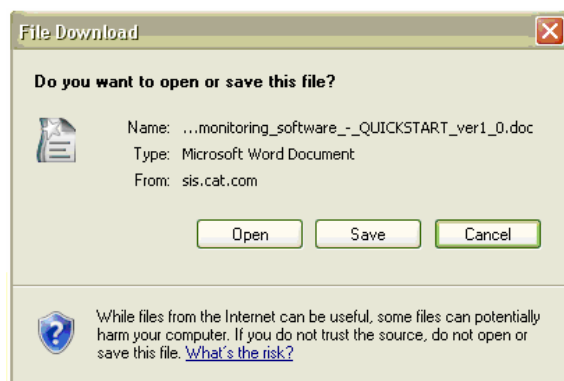
Using the scroll bar on the right, scroll down until you see EMCP Monitoring Software in the left column. The next column is title EMCP Monitoring Software.zip and to the far right is the link Additional Info. Click on it for the Quick Start Guide.

The next screen will display EMCP3 Monitoring Software.



At the bottom of the text, select: ECMP monitoring software – QUICKSTART ver1_0.doc to start the download.

The File Download box will open.



Select OPEN to start a document editor and display the Quick Start Guide or SAVE to a folder.

19.3 CREATING A CONTROL PANEL VIEW

In the software setup Chapter, a control panel view was created to display battery voltage. A control panel view, however, can be created to do many more things. This Chapter will provide an overview of the steps necessary to design a control panel view.

To begin, select Edit > Control Panel Configuration to bring up the editing window. The entire control panel can be created from within this window. This window is shown in FIGURE 83. If this option is unavailable, close out of the Control Panel View window. Both windows cannot be open at the same time. Also, it is recommended to go offline before editing the control panel view. This can be done by selecting Network > Go Offline or by right clicking on the cable symbol and selecting Go Offline.

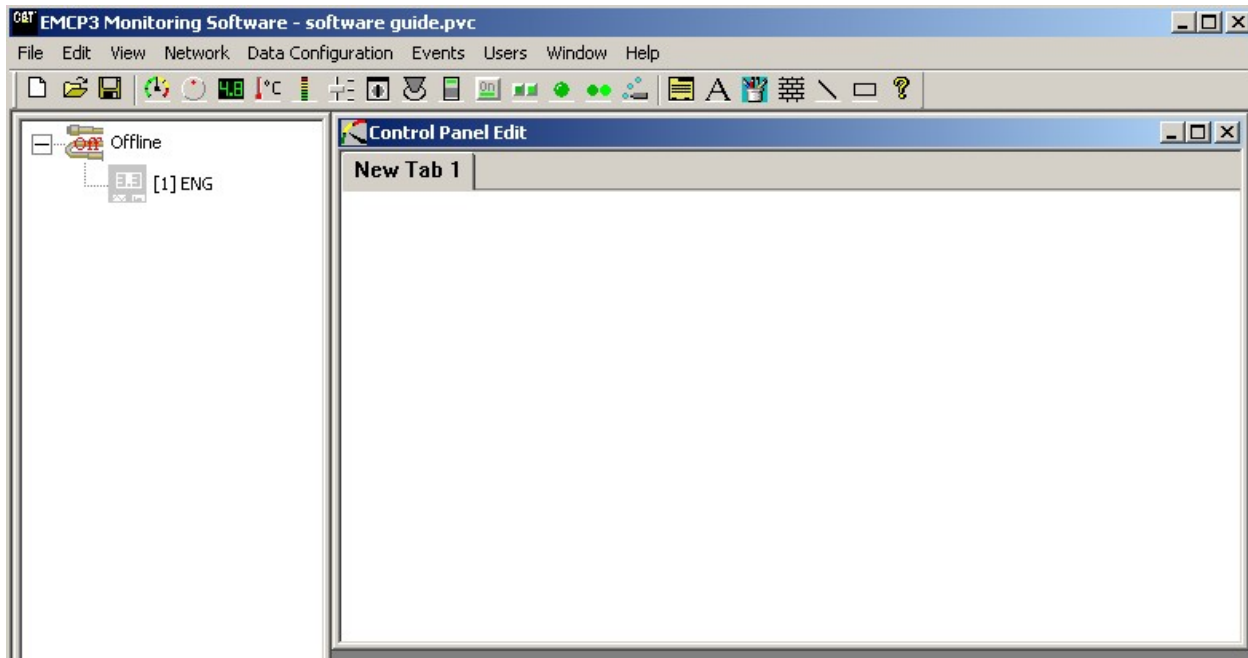


FIGURE 83: CONTROL PANEL EDIT WINDOW

NOTE: The monitoring software allows the use to create new control panel views by selecting which parameters to display and in what format (circular gauge, numeric display, etc). then save the configuration to a file. A Default configuration file is supplied is supplied with the monitoring software and the file name **default.pvc** contains basic screens with standard parameters already built in . The user can modify the file and save as a new file if desired

To add new controls and displays simply click the proper button on the toolbar and then double click within the control panel. Controls can also be chosen by selecting Edit > Add Control and choosing a control from the list.

There are three types of controls available – displays, switches and LEDs. The display controls consist of the circular gauge, digital display, thermometer and linear gauge. These displays can be used to display information about the generator set. Some examples include engine coolant temperature, generator total real power, engine RPM and battery voltage. This can be seen in FIGURE 84.

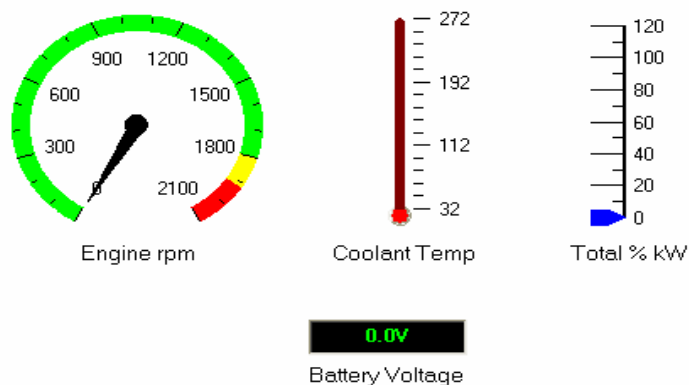


FIGURE 84: DISPLAY CONTROLS

The switches consist of the sliding switch, panel switch, lever switch, rocker switch, single button and rotary switch. The rotary knob and the multiple button switch also fall into this category. These switches can be used to control something that is either off or on. Some examples include emergency stop, remote initiate command and digital selectors. The multiple button switch can also control the engine operating mode command as in FIGURE 85.

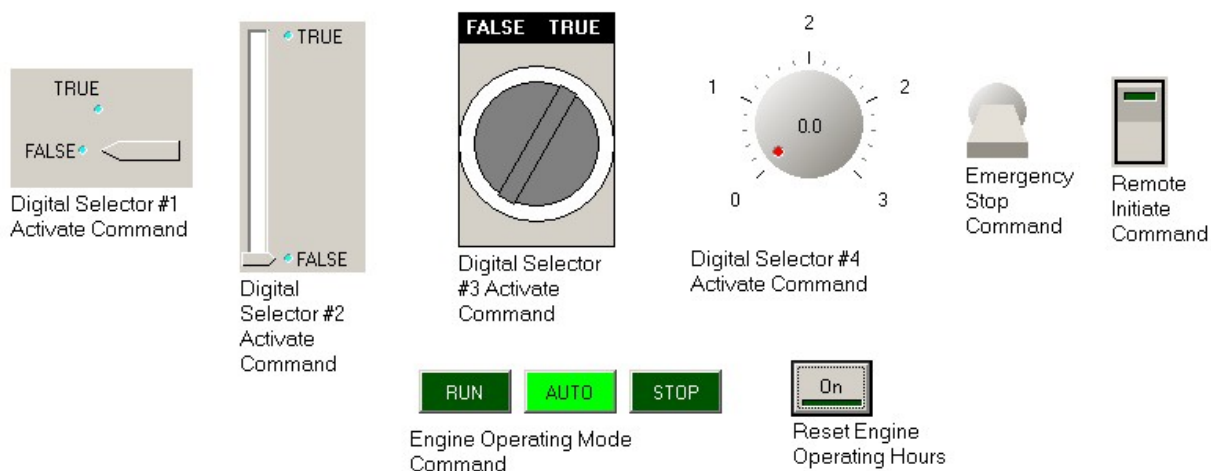


FIGURE 85: SWITCH CONTROLS

The LEDs consist of the single LED and the multiple LED control. These LEDs are used to display outputs from the genset. Some examples include digital input active state and engine operating mode (see FIGURE 86).



FIGURE 86: LED CONTROLS

After adding controls to the control panel, they can be moved and resized. To move a control, simply click and drag it to its desired location. To resize it, select the control by clicking on it and then move the mouse to the edge of the control until the pointer becomes an arrow. Then, just simply click and drag it to its desired size as shown in FIGURE 87.

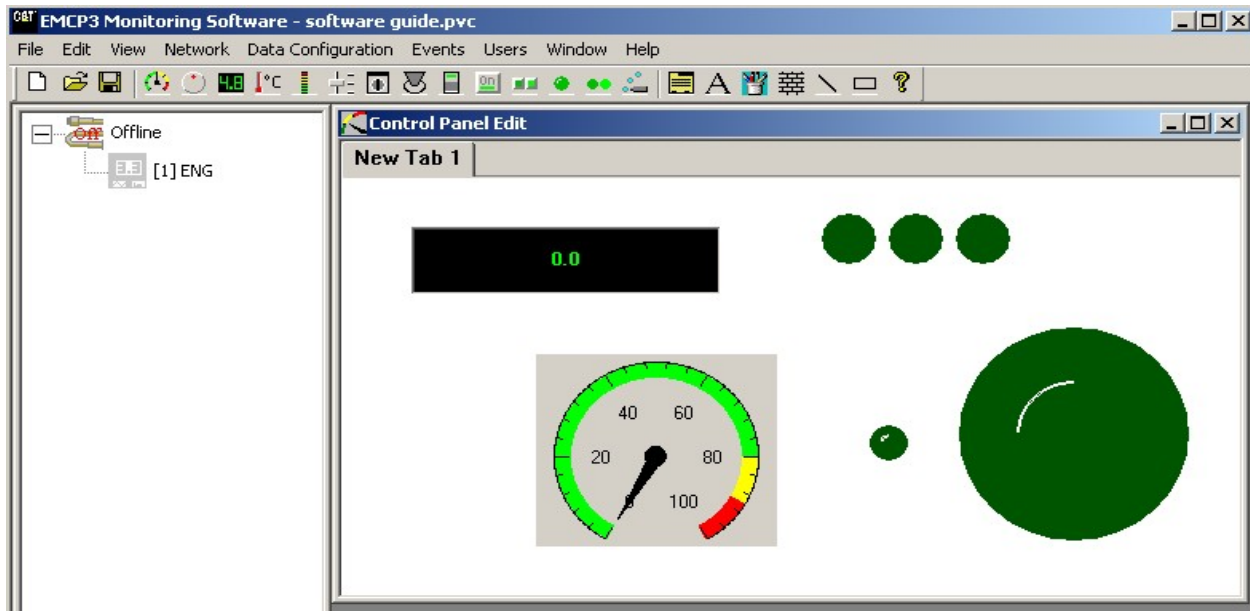


FIGURE 87: MOVING AND RESIZING CONTROLS

Other display properties can be changed for any of the controls by right clicking on the control and selecting Set Display Properties. For example, the font size and color for the digital display can be changed as shown in FIGURE 88.

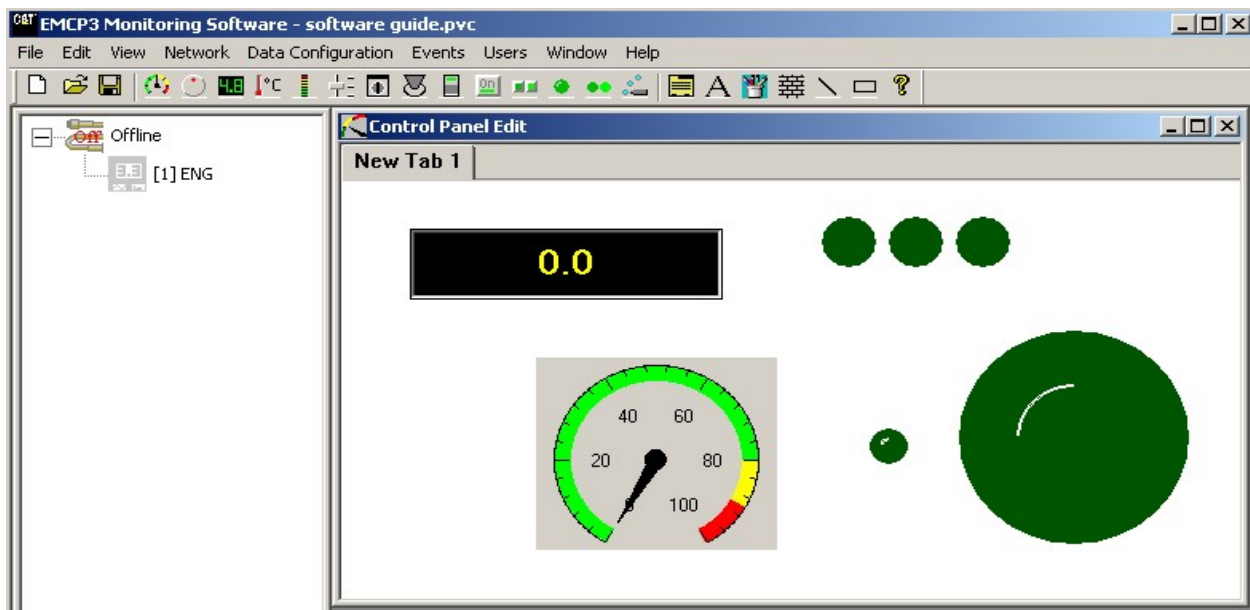


FIGURE 88: CHANGING DISPLAY PROPERTIES OF THE DIGITAL DISPLAY

Each control has different parameters that can be associated with it. To change the parameters follow the instructions in the setup Chapter. This time, however, select any desired parameter. The possible parameters can also be viewed under the following categories: block types, control, engine, generator, I/O and status.

To do this, click the + next to the device name in the Device/Group window and select the desired category as shown in FIGURE 89.

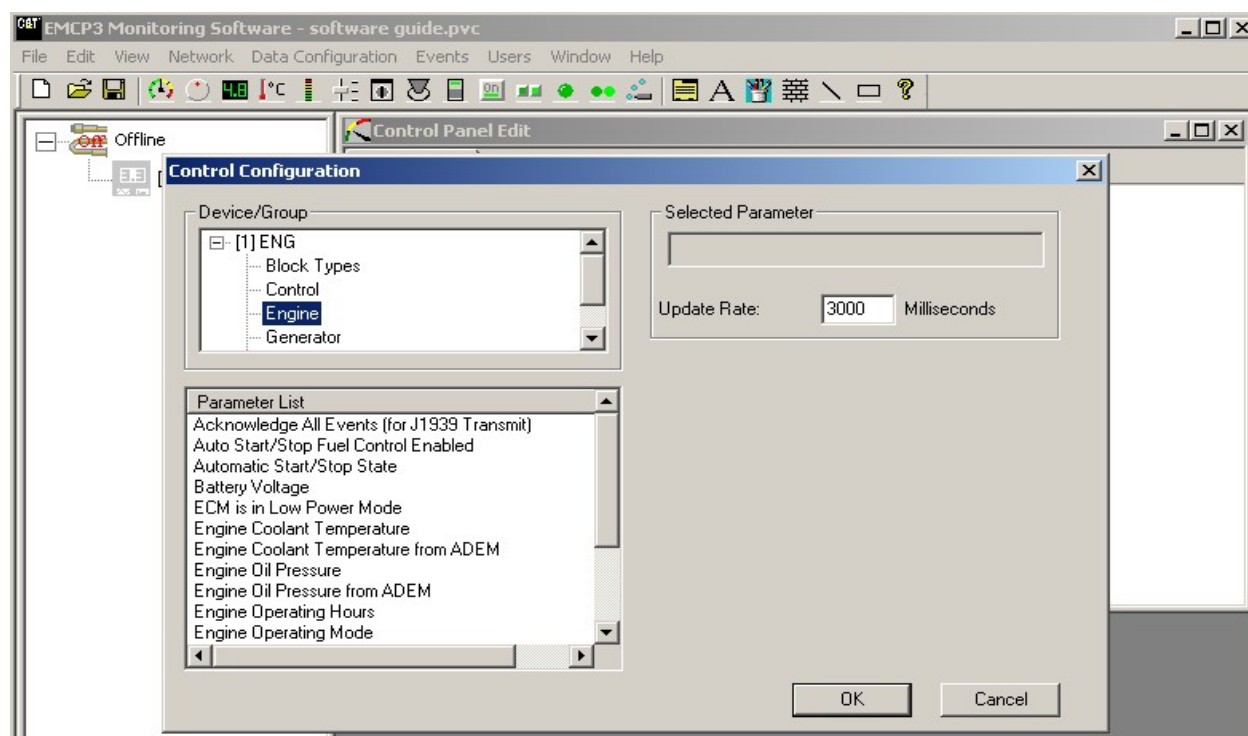


FIGURE 89: VIEWING PARAMETERS BY CATEGORY

Remember to double click the desired parameter to select it. Click **ok** and the parameter will be set. This can be seen in FIGURE 90.

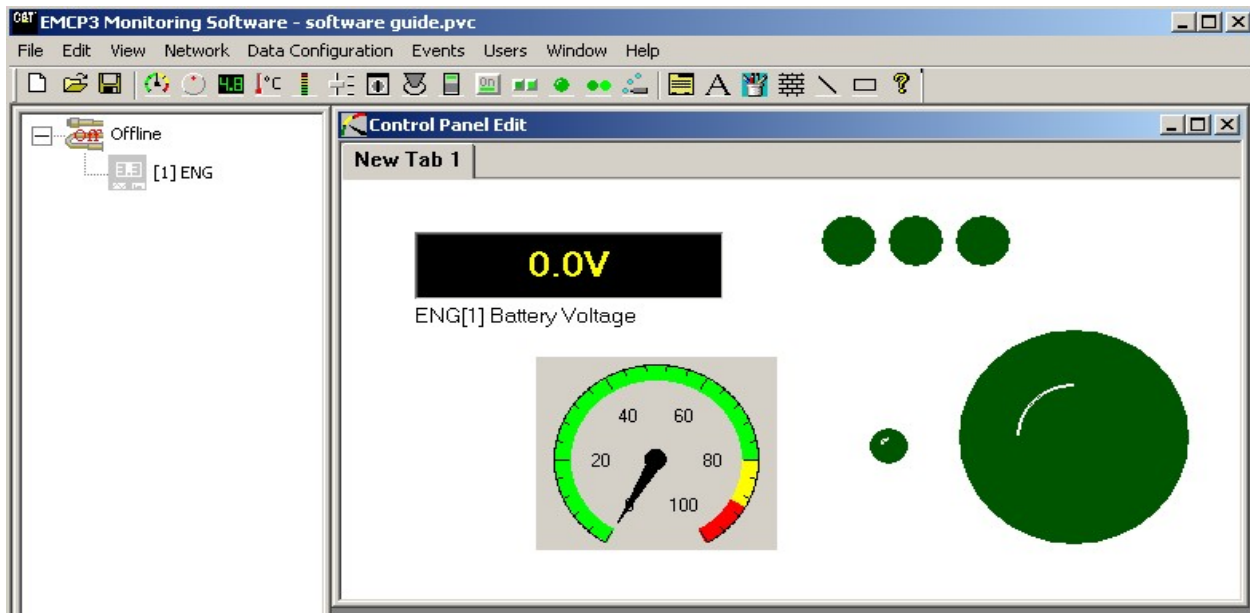


FIGURE 90: SETTING THE PARAMETER FOR THE DIGITAL DISPLAY

After selecting a desired parameter, the displayed text can be changed by right clicking on the text box and selecting Set Text or simply by double clicking on the text. This change can be seen in FIGURE 91.

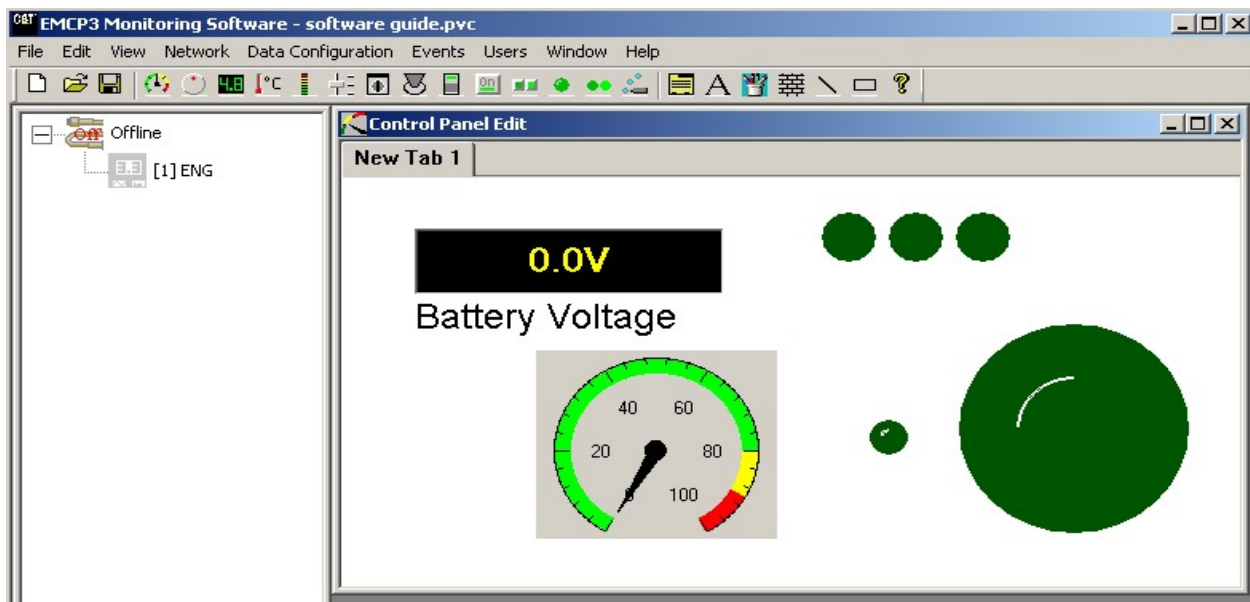


FIGURE 91: EDITING THE TEXT AND FONT SETTINGS

The background of the control panel can also be changed. Right click on an empty space in the control panel and select Set Background Image or select Edit > Set Background Image. To change the background to a simple color, open Paint and create a screen of the desired color. Then save it and open it as the background image.

The controls and text can also be set to transparent. This is done by right clicking on the desired item and selecting Display Transparent. These changes can be seen in FIGURE 92.

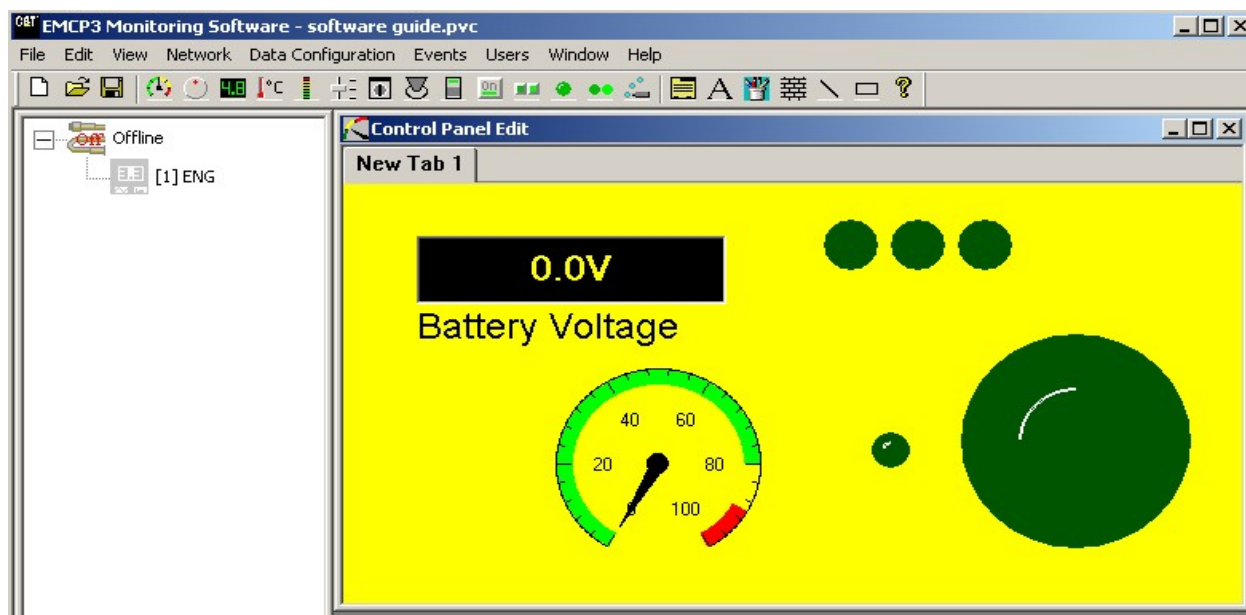


FIGURE 92: CHANGING BACKGROUND IMAGE AND SETTING CONTROLS TO TRANSPARENT

Tabs can also be used on the control panel. To rename the current tab select Edit > Rename Selected Tab. To add another tab select Edit > Add Tab. To edit the new tab, simply click that tab and the new sheet will open. This can be seen in FIGURE 93.

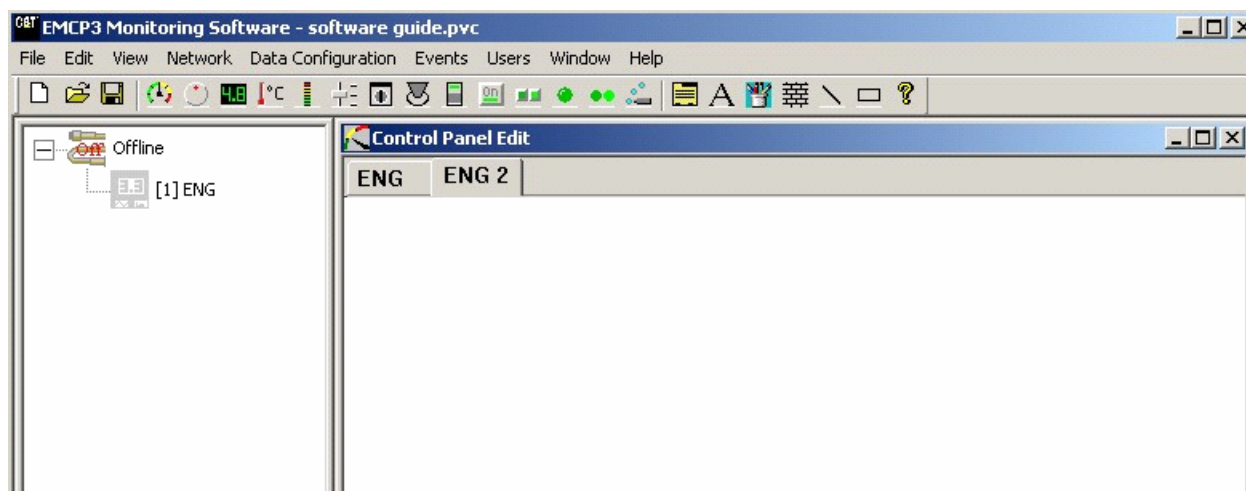


FIGURE 93: ADDING AND RENAMING TABS

NOTE: When using multiple tabs, the parameters for each control should be set after moving and resizing them. If this is not done, the control may go back to its original position when the parameter was first set and possibly corrupt the entire tab. This is not necessary for the first tab, only the following ones.

If moving or resizing a control after setting the parameter is necessary, move it to the desired location and then **RESET** the parameter again. This will **RESET** its standard position and prevent the control from moving. Be sure to **RESET** the parameter for any control that has been moved. Again, this is not necessary for the first tab.

19.4 LOGGING DATA TO A FILE

The EMCP 3 GSC Monitoring Software can also view data in text format and can log this data to a file. To pick the data to be logged, select Edit > Data Log Configuration.

To choose the logging data, select the desired parameter under the parameter list and click add or simply double click the desired parameter. This should add the parameter to the right of the screen where all selected parameters are located. Multiple parameters can be chosen if desired. This can be seen in FIGURE 94.

The parameters can also be viewed under the following groups: block types, control, engine, generator, I/O, and status. To select a certain group type, click on the desired choice under the Device/Group heading. This will change the parameter list to show only the parameters that fall under the selected group.

After selecting the data, click ok to close the configuration screen.

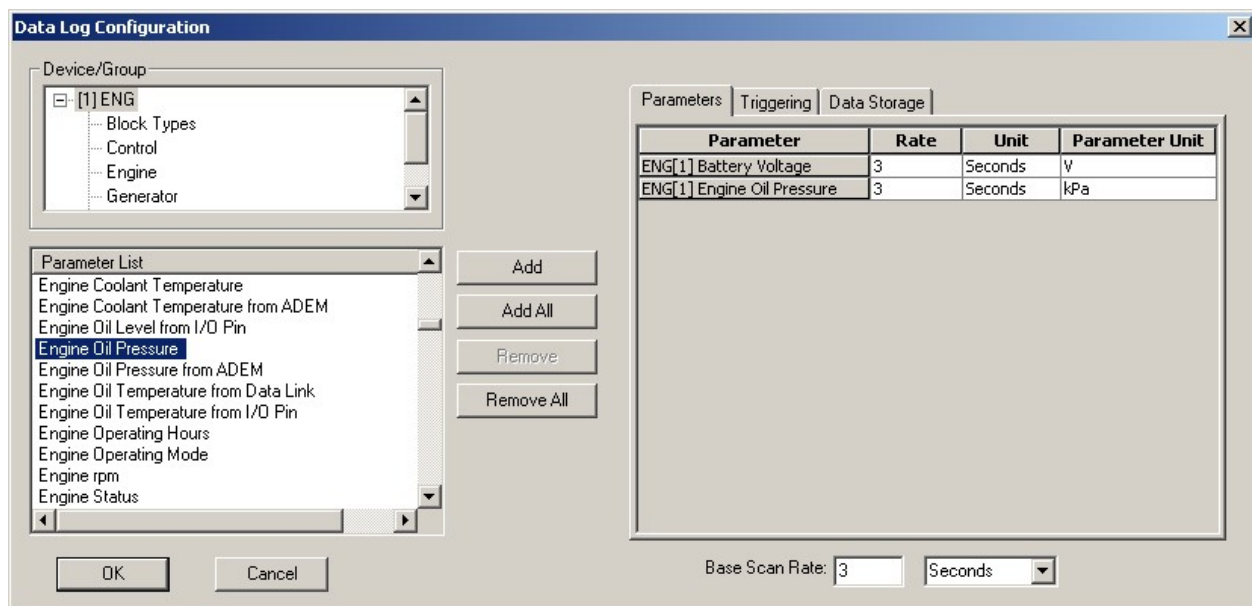


FIGURE 94: DATA LOG CONFIGURATION WINDOW

To view this data select View > Data Log Data. This will bring up a new screen as shown in FIGURE 95. If the data value says Offline, be sure to go online as described in the software setup Chapter. Once online, select Data Configuration > Arm or press the play button on the toolbar to begin receiving the data.

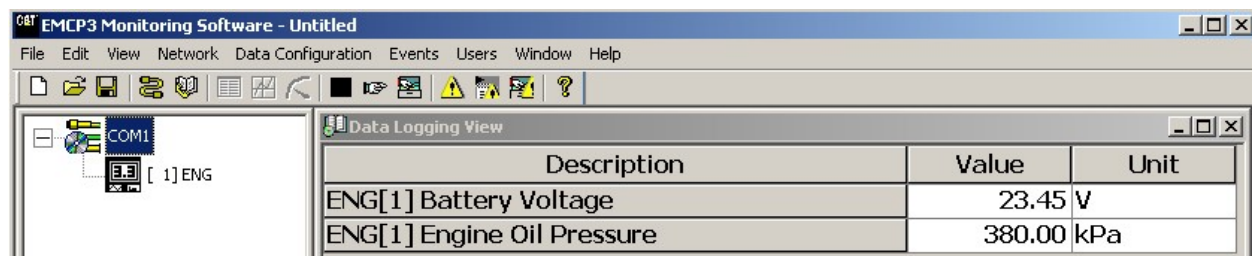


FIGURE 95: VIEWING DATA LOG VALUES

This data can also be logged to a file. First, go back to the Data Log Configuration window by selecting Edit > Data Log Configuration. On the right side of the screen where the parameters are located, select the Data Storage tab. Write the desired name and location of the file into the box next to Log File or click browse to select the name and location. This can be seen in FIGURE 96.

Select the Triggering tab to choose the start and stop events. For the start event, select either On Arm, Manual Trigger, or Absolute Time. On Arm will start the data collection immediately after selecting Arm or after clicking the play button. Manual Trigger will begin the data collection once the manual trigger button on the toolbar has been pushed or by selecting Data Configuration > Start Trigger. Absolute Time will begin the data collection at the specific data and time specified. The stop event can be configured for Manual Trigger, Duration, or Absolute Time. Manual Trigger will stop the data collection once the manual trigger button is clicked or by selecting Data Configuration > Stop Trigger. Duration will stop collecting data as soon as the specified amount of time has passed.

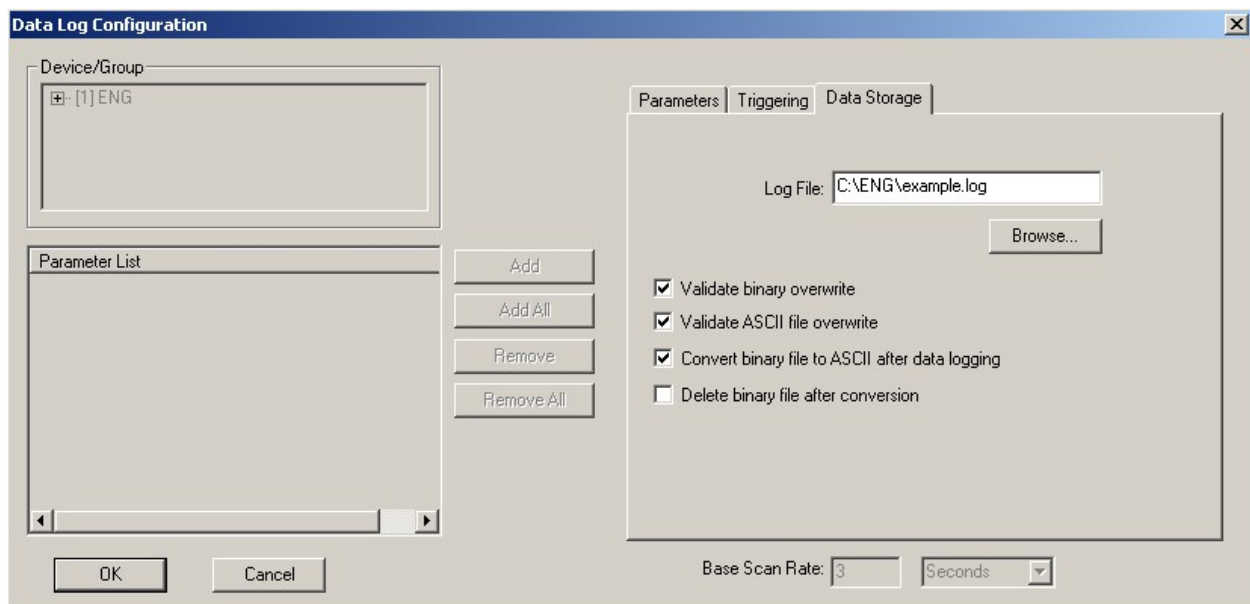


FIGURE 96: SETTING THE LOG FILE

Absolute Time will stop the data collection once the specified date and time is met.

After the data has been collected, the text file can be opened. Find the saved file and open it in a text editor such as notepad. The file will contain a timestamp from the start of data logging as well as data captured according to the Base Scan Rate setting in the Data Log Configuration window shown in FIGURE 96. The file should look similar to the one shown in FIGURE 97.

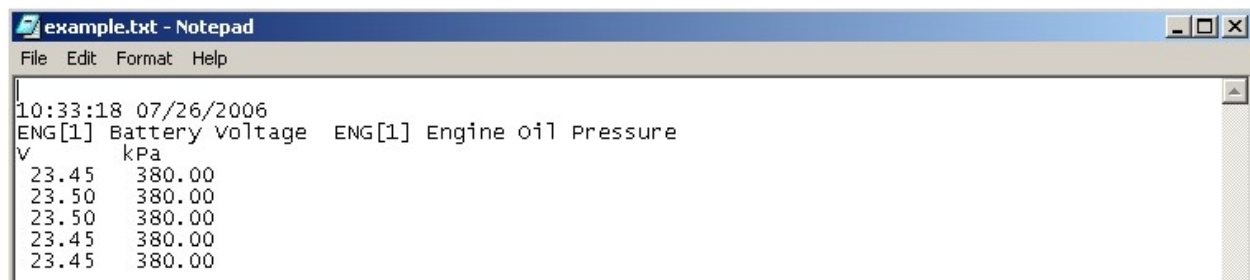


FIGURE 97: LOG FILE

20 INSTALLING & UPGRADING SOFTWARE

The EMCP 3 supports field-programming (called flashing) of software for all of the modules. This is done by using the Caterpillar® Service Tool software and a Caterpillar Communication Adapter connected to one of the J1939 data link service connectors.

The flashing feature is only supported on the J1939 Primary data link even though the EMCP 3 GSC is connected to both data links. Refer to your generator set package documentation for the location of the service connectors.

To flash the EMCP 3 requires the following hardware and software:

SOFTWARE AND HARDWARE REQUIRED

- ☑ The Caterpillar® Service Tool software installed and licensed on a PC
- ☑ A Caterpillar Communication Adapter
- ☑ A 9-pin Deutsch service connection to the appropriate J1939 data link
- ☑ The new application software flash file for the target module
- ☑ The J1939 Primary data link service connector must be used for modules connected to the J1939 Primary Data Link.
- ☑ The J1939 Accessory data link service connector must be used for modules connected to the J1939 Accessory Data Link.

20.1 UPGRADING SOFTWARE

CAUTION: To UPGRADE software, steps 1, 2, and 3 must be completed first before flashing the software upgrade (steps 4 – 9).

To install **NEW** software into a **BLANK MODULE**, skip to steps 4 - 9.

NOTE: To **UPGRADE** use the following Steps 1 – 9.

1. Stop the generator set

The EMCP 3 modules cannot be flashed while the generator set is running. The engine must be stopped (the Engine Overview screen should show 0 rpm and STOPPED).

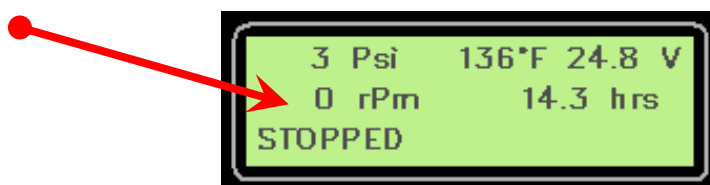


FIGURE 98: ENGINE OVERVIEW SCREEN - STOPPED

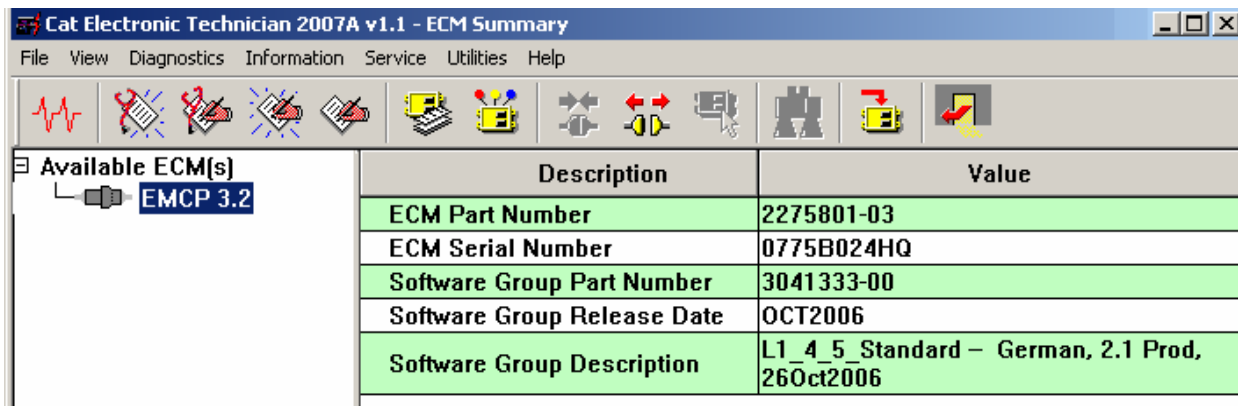
2. Back up your current configuration (all of the setpoint values)

See Chapter 12.1 SAVING EMCP 3 CONFIGURATION DATA for instructions. The procedure given there is for the EMCP 3 GSC; the process is similar for each of the EMCP 3 modules.

NOTE: Flashing application software does not affect the setpoints. However, should a problem occur during flashing, this backup can be used to quickly configure a replacement module and minimize downtime.

3. Record your current software version information

This is done by connecting to the appropriate J1939 data link, and connecting with the Caterpillar® Service Tool, and viewing the ECM Summary information (see example screenshot below, FIGURE 99).



Description	Value
ECM Part Number	2275801-03
ECM Serial Number	0775B024HQ
Software Group Part Number	3041333-00
Software Group Release Date	OCT2006
Software Group Description	L1_4_5_Standard – German, 2.1 Prod, 26Oct2006

FIGURE 99: ECM SUMMARY INFORMATION

NOTE: This is useful in case the customer wishes to roll back to the previous version, this information can be used to obtain the correct flash file.

20.2 INSTALLING SOFTWARE INTO A BLANK MODULE

NOTE: For BLANK MODULE software installation use steps 4 – 9.

4. Connect to the module using WinFlash

After connecting to the target module with the Caterpillar® Service Tool, enter the WinFlash component by selecting Utilities > WinFlash as shown in FIGURE 100.

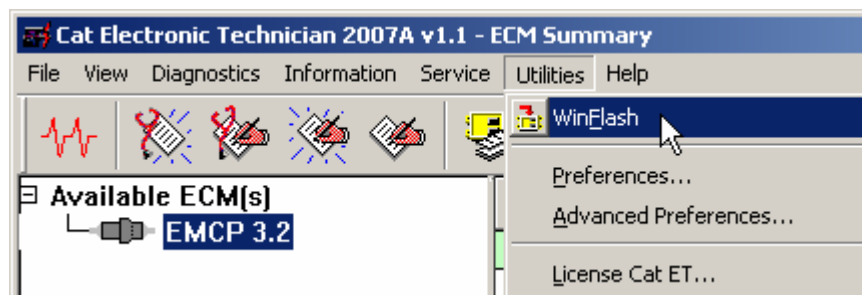


FIGURE 100: WINFLASH

5. Select the target module

After the module(s) have been found and listed, click on the target module and click on the Select ECM button below the list (if the EMCP 3 is the only detected ECM, then the Select ECM button will be grayed out) as shown in FIGURE 101.

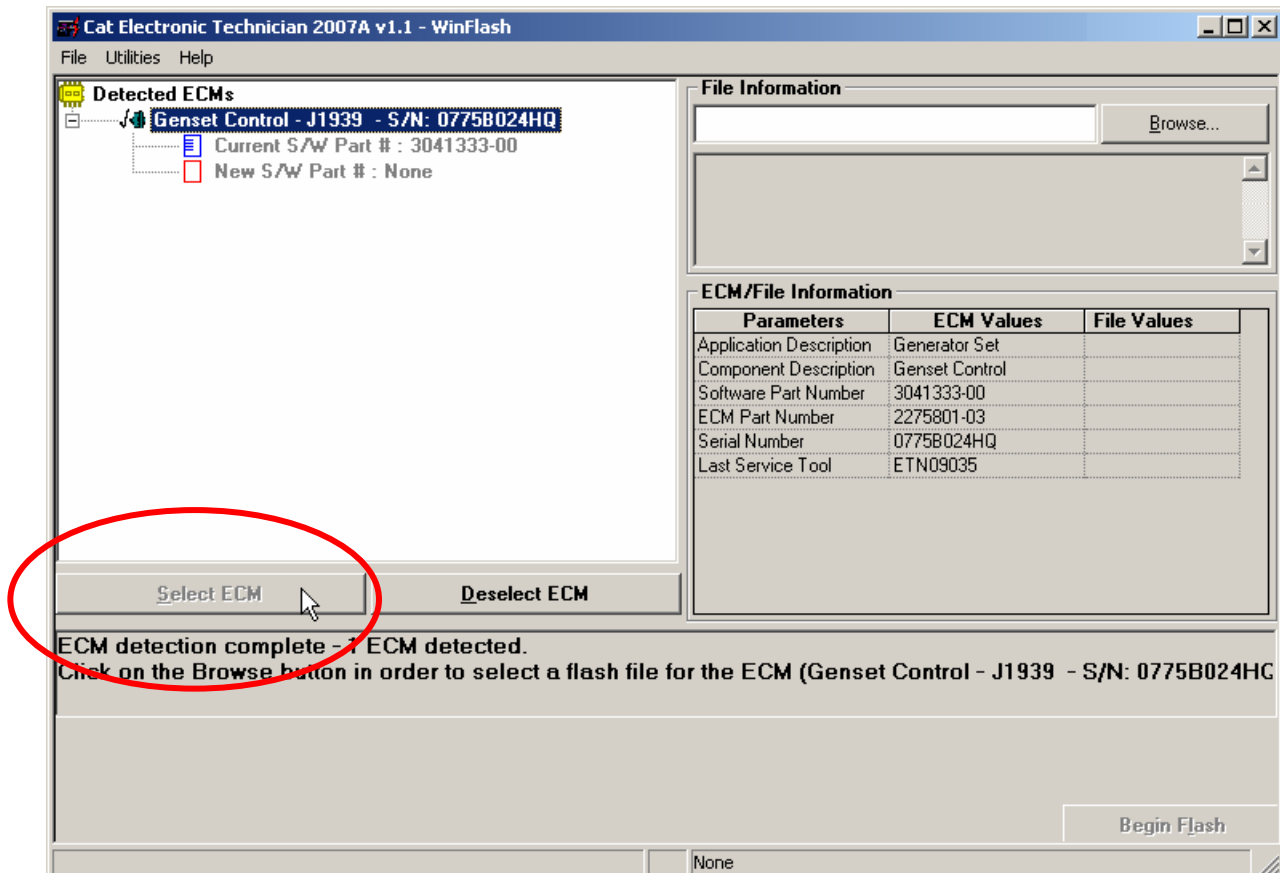


FIGURE 101: TARGET MODULE

NOTE: Occasionally, WinFlash will not find all of the modules on the J1939 data link to which it is connected. If you are certain that the target module is connected to the same J1939 data link, you may attempt to re-scan the data link by pressing F8 (or selecting File > Uppdate ECM List).

6. Select the flash file

On the right side of the window, click on Browse... and navigate to the folder where the new application software flash file is located (FIGURE 102).

7. Click to select the file, and click on open

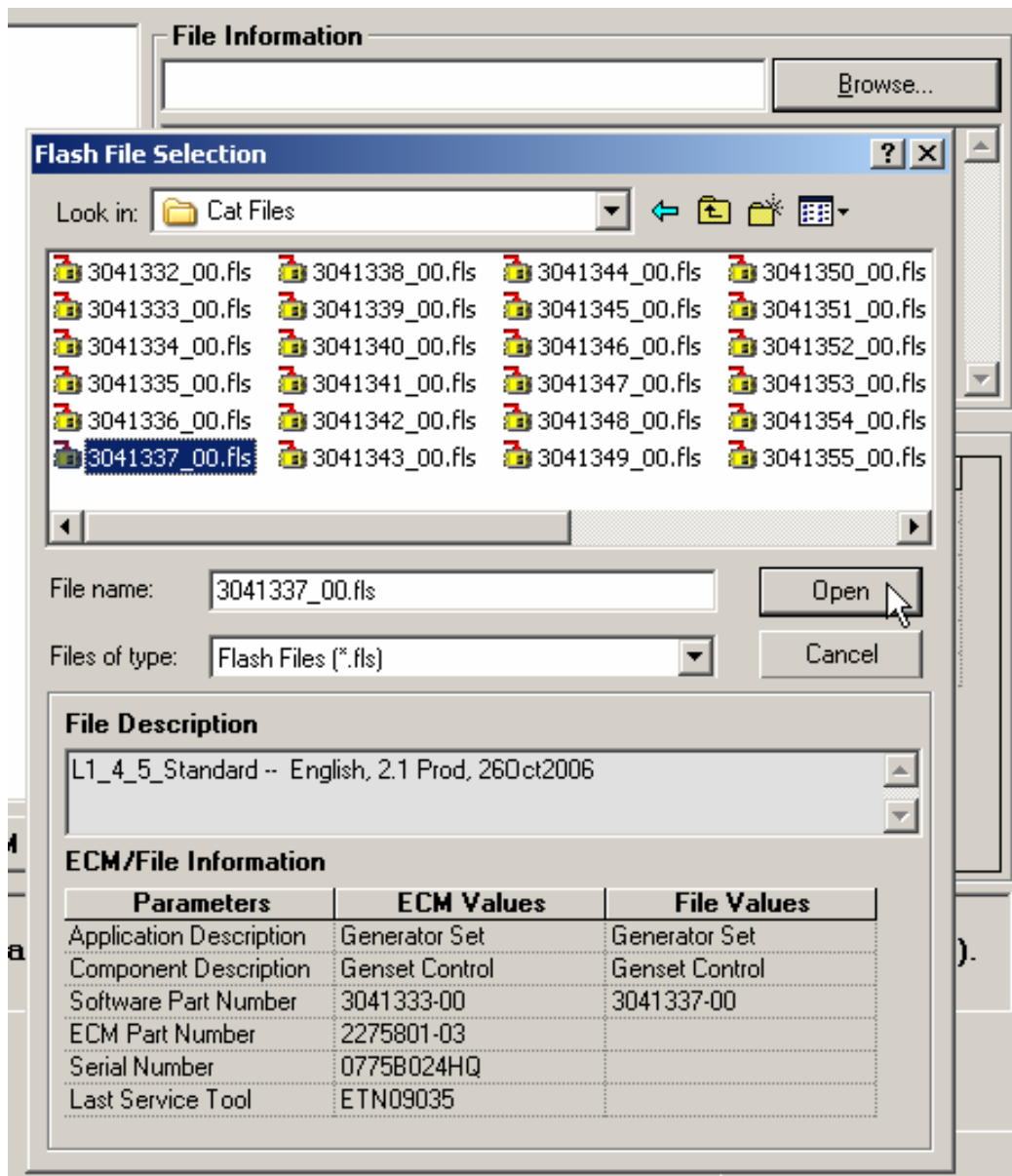


FIGURE 102: FLASH FILE SELECTION

8. Begin flashing

Click on Begin Flash at the bottom of the window.

This process may take up to 10 minutes, depending on the file size and connection speed. Typically, the EMCP 3 GSC application flash file will take 5-10 minutes, and the other modules will take less time.

NOTE: The flashing process will **abort** at this step if the EMCP 3 is not STOPPED, or if an incorrect version of software was selected. This includes EMCP 3.1 versus 3.2 versus 3.3 software.

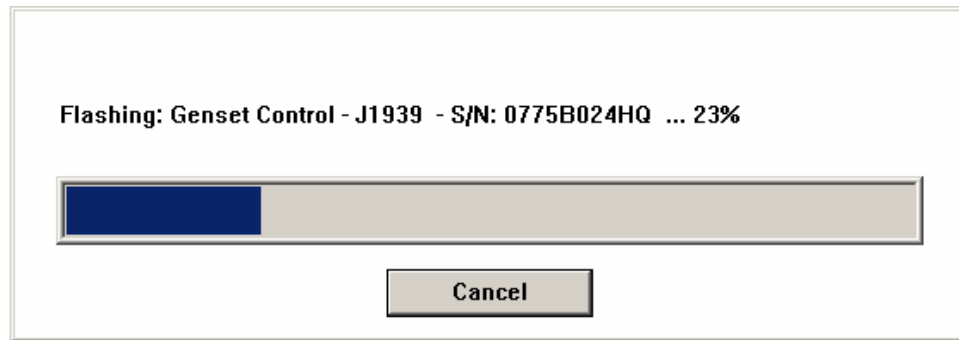


FIGURE 103: LOADING FLASH FILE

9. Complete

When the flashing process is complete, the ECM that was flashed will reboot. Also, WinFlash will bring up a window giving options for what to do next (see FIGURE 104 below). This indicates that the software has finished flashing, and is ready to use.



FIGURE 104: FLASHING PROCESS COMPLETE

The EMCP 3 GSC will automatically reboot if it was the module that was flashed with new application software.

On startup, the EMCP 3 shows the software part number.

Verify the software part number matches the new application software that was flashed (FIGURE 105).

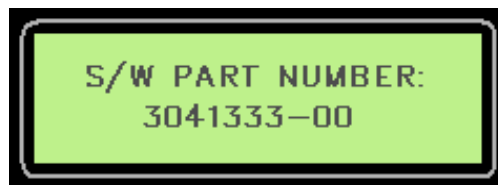


FIGURE 105: SOFTWARE PART NUMBER

21 SCADA PARAMETER INFORMATION (EMCP 3.2 & 3.3)

This Chapter provides information on Parameters by function. For an alphabetical list of parameters, see APPENDIX B: Alphabetic Reference Of Modbus Registers.

21.1 DATA LINK SECURITY

Data link security uses a different set of passwords than the EMCP 3 GSC local security. The passwords grant access to the same levels of functionality and setpoints, however. FIGURE 106 below illustrates the different security levels.

NOTE: The display and SCADA can be at different access levels at the same time.

	Display	SCADA	Service Tool
Svc Tool Access Warranty-related or specialized functions			Perform all operations. Write all (except read-only) setpoints.
Level 3 Access Specialized functions	Perform most operations. Write Level 0-3 setpoints.	Read/Write all Modbus registers. Write Level 0-3 setpoints.	
Level 2 Access Safety or system reconfig functions	Perform most operations. Write Level 0-2 setpoints.	Read/Write most Modbus registers. Write Level 0-2 setpoints.	
Level 1 Access Technician functions	Perform some operations. Write Level 0-1 setpoints.	Read/Write most Modbus registers. Write Level 0-1 setpoints.	
Level 0 Access Operator functions	Perform few operations. Write Level 0 setpoints.	Read/write most Modbus registers. Write Level 0 setpoints.	
No Access Prevents external access		Only poll security level and write access password.	

FIGURE 106: ILLUSTRATION OF EMCP 3 GSC SECURITY LEVELS

The EMCP 3 GSC supports five levels of SCADA access, with increasing permissions:

NO ACCESS

This level only allows access to two registers: Current Security Level (732), and Write Access Password (700). Any other read queries will return unavailable data (\$FF's), and write queries will fail with an exception response.

LEVEL 0 ACCESS

This level allows access to all Modbus registers. However, none of the setpoints can be written with this access level. See Chapter 7 for information about programming EMCP 3 GSC setpoints via Modbus.

LEVEL 1 ACCESS

This level allows access to all Modbus registers. It also allows the changing of setpoints that have a security level of Level 1. See APPENDIX D for information about setpoints and their associated security levels.

LEVEL 2 ACCESS

This level allows access to all Modbus registers. It also allows the changing of setpoints that have a security level of Level 1 or 2. See APPENDIX D for information about setpoints and their associated security levels.

LEVEL 3 ACCESS

This level allows access to all Modbus registers. It also allows the changing of setpoints that have a security level of Level 1, 2 or 3. See APPENDIX D for information about setpoints and their associated security levels. The Caterpillar Dealer TC must be contacted to acquire a Level 3 Password.

NOTE: If a password for a certain security level is not configured, or set to a single zero, that password is disabled. If access to the level below that is acquired, the EMCP 3 GSC will automatically grant access to the higher (password-disabled) level. For example, if there is a password configured for Level 1, but not for Level 2, then the EMCP 3 GSC will initialize to Level 0. Then if the correct Level 1 password is entered, the EMCP 3 GSC will automatically grant Level 2 Access.

The SCADA, Level 1, or Level 2 passwords can be changed by writing the new password to the SCADA Password, Level 1 Password, or Level 2 Password register, as long as the SCADA data link is at a sufficient access level.

- To change the Level 1 password, Level 1 access must be obtained.
- To change the SCADA or Level 2 passwords, Level 2 access must be obtained.
- A higher level of access can be requested by writing the password of the desired level to the Write Access Password register.
- A lower level of access can be requested simply by entering the desired security level number into the Write Current Security Level register.

All of the passwords, as well as the phone-in prompt, use the 1-byte ASCII format and character set. Each string is variable in length, so in order to enter a shorter password, the rest of the field may be padded with the space character (\$20).

All other characters are considered invalid data, and will result in a FID response.

Two of the built in timeout features will reset the security level after a period of inactivity:

The first is the Level 0 Timeout, which resets the SCADA access level to level 0 (or the lowest unprotected level above level 0) after 10 minutes without any successful write commands over the SCADA data link. To prevent this fixed timer from expiring without risking affecting functions of the EMCP 3 GSC, writing to the Key Press register (310) will reset this timer.

The second is the SCADA Timeout, which resets SCADA access completely below the SCADA security level (or the lowest unprotected level). The timeout for this is configurable from 0.1 seconds to 1 hour – it is the SCADA Data Link Connection Timeout Interval setpoint, and will only expire after a period without ANY activity on the SCADA data link.

WRITE ACCESS PASSWORD

\$02BC (700) - 8 REGISTERS (16 BYTES) LONG - WRITE

Modbus register to which the password for the desired Access Level (0, 1, 2, or 3) is written.

ASCII data, numbers (characters \$30 through \$39) valid. If the password is less than 16 characters long, pad the end with space characters (\$20).

(Example: 12345678 = \$ 31 32 33 34 35 36 37 38 20 20 20 20 20 20 20. See APPENDIX A for a full programming example).

LEVEL 1 PASSWORD

\$02C4 (708) - 8 REGISTERS (16 BYTES) LONG - WRITE

Modbus register to which a new Level 1 password is written, to change the password.

This is allowed only if current security level is 1 or higher.

ASCII data, numbers (characters \$30 through \$39) valid. To disable this password, enter a single zero. If a password is less than 16 characters long, pad the end with space characters (\$20). See APPENDIX A for a programming example.

Level 2 Password

\$02CC (716) - 8 REGISTERS (16 BYTES) LONG - WRITE

Modbus register to which a new Level 2 password is written, to change the password.

This is allowed only if current security level is 2 or higher.

ASCII data, numbers (characters \$30 through \$39) valid. To disable this password, enter a password of a single zero. If a password is less than 16 characters long, pad the end with space characters (\$20).

SCADA PASSWORD

\$02D4 (724) - 8 REGISTERS (16 BYTES) LONG - WRITE

Modbus register to which a new SCADA password is written, to change the password.

This is allowed only if the current security level is 2 or higher. The SCADA password allows the user to obtain Level 0 Access to the EMCP 3 GSC. See APPENDIX A for a programming example.

ASCII data, numbers (characters \$30 through \$39) valid. The SCADA password may be a maximum of 8 characters long. The last 8 characters should be set to NULL (\$00) or space (\$20). To disable this password, enter a password of a single zero.

Pad the end of a password with space characters (\$20).

This password is stored as a numerical data. Therefore, any leading zeros will be removed.

CURRENT SECURITY LEVEL

\$02DC (732) - 1 REGISTER (2 BYTES) LONG - READ

Current security level of the SCADA Data Link. See APPENDIX A for a programming example.

RESOLUTION	OFFSET	DATA RANGE
1 / bit	0	0 to 3

WRITE CURRENT SECURITY LEVEL

\$02DD (733) - 1 REGISTER (2 BYTES) LONG - WRITE

Write a security level value into this register to drop to a lower security level. In order to change to a higher security level, write a password to the Write Access Password register instead. See APPENDIX A for a programming example.

RESOLUTION	OFFSET	DATA RANGE
1 / bit	0	0 to 3

LEVEL 3 PASSWORD PHONE IN PROMPT

\$02DE (734) - 8 REGISTERS (16 BYTES) LONG - READ

Numerical key that needs to be communicated to the factory support operator who can provide a Level 3 password. Once the password is received, write it to the Write Access Password register (700). This is the same prompt as on the EMCP 3 GSC in the Configure – Security – Enter Level 3 menu.

ASCII data, characters \$30 through \$39 valid.

KEY PRESS

\$0136 (310) - 1 REGISTER (2 BYTES) LONG - WRITE

Triggers a key press event on the control.

The key press event is useful to reset the SCADA security level reset timer, which resets the SCADA access to level 0 after 10 minutes of inactivity. Reading from Modbus registers will not reset the above timers, but writing to any Modbus register will do so. This is a safe register to write, since it does not affect other functions of the EMCP 3.2

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

21.2 SPARE ANALOG INPUT

The EMCP 3.2 and higher have a **SPARE ANALOG INPUT**. It is factory-configured as one of three types of input:

- Level

- Temperature
- Pressure

Based on the type configuration, it can be assigned to a particular **SUSPECT PARAMETER NUMBER (SPN)**, and the **PERCENTAGE** (level), **TEMPERATURE**, or **PRESSURE** can be read over SCADA with the appropriate units.

If the configuration is set to a specific sensor type and SPN but, a request is made over SCADA for a different type or SPN, then **\$FFFF** will be sent in the response.

For example:

If Type Configuration is set to **TEMPERATURE**, and **SPARE ANALOG INPUT PRESSURE** is queried, the response will be **\$FFFF**

If Suspect Parameter Number is set to **OIL FILTER DIFFERENTIAL PRESSURE**, and **AIR FILTER 1 DIFFERENTIAL PRESSURE FROM I/O PIN** is queried, **\$FFFF** will be returned.

SPARE ANALOG INPUT PERCENTAGE

\$00CF (207) - 1 REGISTER (2 BYTES) LONG - READ

Percentage of full scale measured by auxiliary level sensor #1.

This is applicable only when the Spare Analog Input Enable Status is Enabled, and the Type Configuration is set to Level.

RESOLUTION	OFFSET	DATA RANGE
0.0078125 % / bit	-251%	-251 to 250.99 %

FUEL LEVEL FROM I/O PIN

\$0324 (804) - 1 REGISTER (2 BYTES) LONG - READ

Ratio of volume of fuel to the total volume of fuel storage container, as measured by the auxiliary analog input.

This is applicable only when the Spare Analog Input Enable Status is Enabled, the Type Configuration is set to Level, and the SPN is set to Fuel Level.

RESOLUTION	OFFSET	DATA RANGE
0.0078125 % / bit	-251%	-251 to 250.99 %

EXTERNAL TANK FUEL LEVEL FROM I/O PIN

\$0325 (805) - 1 REGISTER (2 BYTES) LONG - READ

Ratio of volume of fuel to the total volume of fuel storage container, as measured by the auxiliary analog input.

This is applicable only when the Spare Analog Input Enable Status is Enabled, the Type Configuration is set to Level, and the SPN is set to External Tank Fuel Level.

RESOLUTION	OFFSET	DATA RANGE
0.0078125 % / bit	-251%	-251 to 250.99 %

ENGINE OIL LEVEL FROM I/O PIN**\$0326 (806) - 1 REGISTER (2 BYTES) LONG - READ**

Ratio of current volume of engine sump oil to maximum required volume, as measured by the auxiliary analog input.

This is applicable only when the Spare Analog Input Enable Status is Enabled, the Type Configuration is set to Level, and the SPN is set to Engine Oil Level.

RESOLUTION	OFFSET	DATA RANGE
0.0078125 % / bit	-251%	-251 to 250.99 %

ENGINE COOLANT LEVEL FROM I/O PIN**\$0327 (807) - 1 REGISTER (2 BYTES) LONG - READ**

Ratio of volume of liquid found in engine cooling system to total cooling system volume, as measured by the auxiliary analog input.

This is applicable only when the Spare Analog Input Enable Status is Enabled, the Type Configuration is set to Level, and the SPN is set to Engine Coolant Level.

RESOLUTION	OFFSET	DATA RANGE
0.0078125 % / bit	-251%	-251 to 250.99 %

SPARE ANALOG INPUT TEMPERATURE**\$00D0 (208) - 1 REGISTER (2 BYTES) LONG - READ**

Temperature measured by auxiliary temperature sensor #1.

This is applicable only when the Spare Analog Input Enable Status is Enabled, and the Type Configuration is set to Temperature.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

GENERATOR REAR BEARING TEMPERATURE FROM I/O PIN**\$00A2 (162) - 1 REGISTER (2 BYTES) LONG - READ**

Temperature of the bearing inside the alternator, as measured by the auxiliary analog input. Bearing 1 is the left or rear bearing.

This is applicable only when the Spare Analog Input Enable Status is Enabled, the Type Configuration is set to Temperature, and the SPN is set to Generator Rear Bearing Temperature.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

ENGINE OIL TEMPERATURE FROM I/O PIN**\$0320 (800) - 1 REGISTER (2 BYTES) LONG - READ**

Temperature of the engine lubricant, as measured by the auxiliary analog input.

This is applicable only when the Spare Analog Input Enable Status is Enabled, the Type Configuration is set to Temperature, and the SPN is set to Engine Oil Temperature.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

EXHAUST TEMPERATURE FROM I/O PIN

\$0321 (801) - 1 REGISTER (2 BYTES) LONG - READ

Temperature of combustion byproducts leaving the engine, as measured by the auxiliary analog input.

This is applicable only when the Spare Analog Input Enable Status is Enabled, the Type Configuration is set to Temperature, and the SPN is set to Exhaust Temperature.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

LEFT MANIFOLD EXHAUST TEMPERATURE FROM I/O PIN

\$0322 (802) - 1 REGISTER (2 BYTES) LONG - READ

Temperature of combustion byproducts within the left engine exhaust manifold, as measured by the auxiliary analog input.

This is applicable only when the Spare Analog Input Enable Status is Enabled, the Type Configuration is set to Temperature, and the SPN is set to Left Exhaust Temperature.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

RIGHT MANIFOLD EXHAUST TEMPERATURE FROM I/O PIN

\$0323 (803) - 1 REGISTER (2 BYTES) LONG - READ

Temperature of combustion byproducts within the right engine exhaust manifold, as measured by the auxiliary analog input.

This is applicable only when the Spare Analog Input Enable Status is Enabled, the Type Configuration is set to Temperature, and the SPN is set to Right Exhaust Temperature.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

AMBIENT AIR TEMPERATURE FROM I/O PIN

\$032E (814) - 1 REGISTER (2 BYTES) LONG - READ

Temperature of the air surrounding the genset, as measured by the auxiliary analog input.

This is applicable only when the Spare Analog Input Enable Status is Enabled, the Type Configuration is set to Temperature, and the SPN is set to Ambient Air Temperature.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

SPARE ANALOG INPUT PRESSURE

\$00D1 (209) - 1 REGISTER (2 BYTES) LONG - READ

Pressure measured by auxiliary pressure sensor #1.

This is applicable only when the Spare Analog Input Enable Status is Enabled, and the Type Configuration is set to Pressure.

RESOLUTION	OFFSET	DATA RANGE
0.125 kPa / bit	0 kPa	0 to 8031.875 kPa

FIRE EXTINGUISHER PRESSURE FROM I/O PIN

\$0328 (808) - 1 REGISTER (2 BYTES) LONG - READ

Pressure of fire extinguisher contents, as measured by the auxiliary analog input.

This is applicable only when the Spare Analog Input Enable Status is Enabled, the Type Configuration is set to Pressure, and the SPN is set to Fire Extinguisher Pressure.

RESOLUTION	OFFSET	DATA RANGE
0.125 kPa / bit	0 kPa	0 to 8031.875 kPa

OIL FILTER DIFFERENTIAL PRESSURE FROM I/O PIN

\$0329 (809) - 1 REGISTER (2 BYTES) LONG - READ

Change in engine oil pressure, measured across the filter, due to the filter and any accumulation of solid or semisolid material on or in the filter, as measured by the auxiliary analog input.

This is applicable only when the Spare Analog Input Enable Status is Enabled, the Type Configuration is set to Pressure, and the SPN is set to Oil Filter Differential Pressure.

RESOLUTION	OFFSET	DATA RANGE
0.125 kPa / bit	0 kPa	0 to 8031.875 kPa

AIR FILTER 1 DIFFERENTIAL PRESSURE FROM I/O PIN

\$032A (810) - 1 REGISTER (2 BYTES) LONG - READ

Change in engine air system pressure, measured across the filter, due to the filter and any accumulation of solid foreign matter on or in the filter, as measured by the auxiliary analog input to the control.

This is applicable only when the Spare Analog Input Enable Status is Enabled, the Type Configuration is set to Pressure, and if the Suspect Parameter Number configured for the Spare Analog Input is set to Air Filter Differential Pressure.

RESOLUTION	OFFSET	DATA RANGE
1 / 128 kPa / bit	-250 kPa	-250 to 251.99 kPa

FUEL FILTER DIFFERENTIAL PRESSURE FROM I/O PIN**\$032B (811) - 1 REGISTER (2 BYTES) LONG - READ**

Change in fuel delivery pressure, measured across the filter, due to accumulation of solid or semisolid matter on the filter element, as measured by the auxiliary analog input.

This is applicable only when the Spare Analog Input Enable Status is Enabled, the Type Configuration is set to Pressure, and the Suspect Parameter Number configured for the Spare Analog Input is set to Fuel Filter Differential Pressure.

RESOLUTION	OFFSET	DATA RANGE
0.125 kPa / bit	0 kPa	0 to 8031.875 kPa

STARTING AIR PRESSURE FROM I/O PIN**\$032D (813) - 1 REGISTER (2 BYTES) LONG - READ**

Gage pressure of air in an engine starting system that utilizes compressed air to provide the force required to rotate the crankshaft, as measured by the auxiliary analog input.

This is applicable only when the Spare Analog Input Enable Status is Enabled, the Type Configuration is set to Pressure, and the Suspect Parameter Number configured for the Spare Analog Input is set to Starting Air Pressure.

RESOLUTION	OFFSET	DATA RANGE
0.125 kPa / bit	0 kPa	0 to 8031.875 kPa

21.3 DISCRETE INPUTS AND OUTPUTS

EMCP 3 GSC digital inputs, digital outputs, and relay outputs can be monitored over the SCADA data link. Table 21: shows the number of each available on each level of control. If an input is queried that is not available on a particular control, then an FID or an exception response will be sent in the response.

TABLE 21: DISCRETE I/O FOR EACH LEVEL OF EMCP 3 GSC

	EMCP 3.1 [†]	EMCP 3.2	EMCP 3.3
Number of Digital Inputs	6	8	8
Number of Digital Outputs	0	1	2
Number of Relay Outputs	6	8	8
Number of Digital Selectors	4	7	8
[†] Note that although discrete I/O counts are given for the EMCP 3.1 for completeness, the EMCP 3.1 does not have SCADA functionality, and therefore is not within the scope of this Chapter.			

On the EMCP 3 GSC, the Source Configuration for each digital selector can be configured to input 1 through 10, or Data Link. Each Digital Selector has one Modbus register to read the Digital Selector #n Commanded Value, and one to write a Digital Selector #n Activate Command.

These queries will only affect or reflect the outputs if the Digital Selector #n Source Configuration setpoint is set to Data Link.

Otherwise, these queries will set or read the SCADA command, but the EMCP 3 GSC will not use that command, and therefore the values will be meaningless.

DIGITAL INPUT #1 ACTIVE STATE (THROUGH) DIGITAL INPUT #8 ACTIVE STATE**\$0258 (600) THROUGH \$025F (607) - 1 REGISTER (2 BYTES) LONG - READ**

Indicates that Digital Input #n is ACTIVE.

DIGITAL INPUT	REGISTER ADDRESS (HEX)	REGISTER ADDRESS (DECIMAL)
1	\$0258	600
2	\$0259	601
3	\$025A	602
4	\$025B	603
5	\$025C	604
6	\$025D	605
7	\$025E	606
8	\$025F	607

All of these registers have the same data structure and bit definitions.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

RELAY OUTPUT #1 ACTIVE STATE (THROUGH) RELAY OUTPUT #8 ACTIVE STATE**\$0268 (616) THROUGH \$026F (623) - 1 REGISTER (2 BYTES) LONG - READ**

Relay Output #n is ACTIVE.

RELAY OUTPUT	REGISTER ADDRESS (HEX)	REGISTER ADDRESS (DECIMAL)
1	\$0268	616
2	\$0269	617
3	\$026A	618
4	\$026B	619
5	\$026C	620
6	\$026D	621
7	\$026E	622
8	\$026F	623

All of these registers have the same data structure and bit definitions.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

DIGITAL OUTPUT #1 ACTIVE STATE**\$0270 (624) - 1 REGISTER (2 BYTES) LONG - READ**

Digital Output #1 is ACTIVE.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

DIGITAL OUTPUT #2 ACTIVE STATE

\$0271 (625) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Digital Output #2 is **ACTIVE**.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

DIGITAL SELECTOR #1 ACTIVATE COMMAND (THROUGH) DIGITAL SELECTOR #10 ACTIVATE COMMAND

\$0274 (628) THROUGH \$027D (637) - 1 REGISTER (2 BYTES) LONG - WRITE

SCADA command to activate Digital Selector #n.

This will affect an output only if the **SOURCE CONFIGURATION** of the desired digital selector is set to **DATA LINK**.

DIGITAL SELECTOR	REGISTER ADDRESS (HEX)	REGISTER ADDRESS (DECIMAL)
1	\$0274	628
2	\$0275	629
3	\$0276	630
4	\$0277	631
5	\$0278	632
6	\$0279	633
7	\$027A	634
8	\$027B	635
9	\$027C	636
10	\$027D	637

All of these registers have the same data structure and bit definitions.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

DIGITAL SELECTOR #1 COMMANDED VALUE (THROUGH) DIGITAL SELECTOR #10 COMMANDED VALUE

\$027E (638) THROUGH \$0287 (647) - 1 REGISTER (2 BYTES) LONG - READ

Value of current Activate Command being applied to Digital Selector #n.

This will reflect the active state of an output only if the Source Configuration of the corresponding digital selector is set to Data Link.

DIGITAL SELECTOR	REGISTER ADDRESS (HEX)	REGISTER ADDRESS (DECIMAL)
1	\$027E	638
2	\$027F	639
3	\$0280	640
4	\$0281	641
5	\$0282	642
6	\$0283	643
7	\$0284	644
8	\$0285	645
9	\$0286	646
10	\$0287	647

All of these registers have the same data structure and bit definitions.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

21.4 GENERATOR AC PARAMETERS

The SCADA data link allows remote monitoring of various generator AC quantities. These include per-phase as well as average or overall parameters; voltages, currents, powers, and power factors; real, reactive, and apparent powers.

Some AC quantities are not valid for every setting of the Generator Connection Configuration setpoint. If a parameter is queried while it is invalid, an FID will be sent in the response. Table 22: shows which parameters are invalid under which wiring configurations.

TABLE 22: AC QUANTITIES DEPENDENT ON WIRING CONFIGURATION

	STAR	3-WIRE DELTA	4-WIRE DELTA	2-WIRE 1-PHASE	3-WIRE 1-PHASE
Gen Freq (0066h)	OK	OK	OK	OK	OK
V _{L-L} AVG (0064h)	OK	OK	OK	OK	OK
V _{A-B} (006Ch)	OK	OK	OK	OK	OK
V _{B-C} (006Dh)	OK	OK	OK	Invalid	Invalid
V _{C-A} (006Eh)	OK	OK	OK	Invalid	Invalid
V _{L-N} AVG (0094h)	OK	Invalid	OK	Invalid	OK
V _A (0072h)	OK	Invalid	OK	Invalid	OK
V _B (0073h)	OK	Invalid	OK	Invalid	OK
V _C (0074h)	OK	Invalid	OK	Invalid	Invalid
I _{AVG} (0065h)	OK	OK	OK	OK	OK
I _A (006Fh)	OK	OK	OK	OK	OK
I _B (0070h)	OK	OK	OK	OK	OK
I _C (0071h)	OK	OK	OK	Invalid	Invalid

GENERATOR AVERAGE AC RMS FREQUENCY

\$0066 (102) - 1 REGISTER (2 BYTES) LONG - READ

Average AC frequency measured at the generator output.

RESOLUTION	OFFSET	DATA RANGE
1/128 Hz / bit	0 Hz	0 to 501.9922 Hz

GENERATOR AVERAGE LINE-LINE AC RMS VOLTAGE

\$0064 (100) - 1 REGISTER (2 BYTES) LONG - READ

Average Line to Line RMS voltage measured at the generator output.

RESOLUTION	OFFSET	DATA RANGE
1 V / bit	0 V	0 to 64255 V

GENERATOR AVERAGE LINE-LINE AC RMS VOLTAGE PERCENT

\$00A3 (163) - 1 REGISTER (2 BYTES) LONG - READ

Average Line to Line RMS voltage at the generator, as a percentage of nominal generator voltage.

RESOLUTION	OFFSET	DATA RANGE
0.0078125 % / bit	-251%	-251 to 250.99%

GENERATOR PHASE A LINE-LINE AC RMS VOLTAGE

\$006C (108) - 1 REGISTER (2 BYTES) LONG - READ

Line to Line RMS voltage measured at the generator phase AB output.

RESOLUTION	OFFSET	DATA RANGE
1 V / bit	0 V	0 to 64255 V

GENERATOR PHASE B LINE-LINE AC RMS VOLTAGE

\$006D (109) - 1 REGISTER (2 BYTES) LONG - READ

Line to Line RMS voltage measured at the generator phase BC output.

RESOLUTION	OFFSET	DATA RANGE
1 V / bit	0 V	0 to 64255 V

GENERATOR PHASE C LINE-LINE AC RMS VOLTAGE

\$006E (110) - 1 REGISTER (2 BYTES) LONG - READ

Line to Line RMS voltage measured at the generator phase CA output.

RESOLUTION	OFFSET	DATA RANGE
1 V / bit	0 V	0 to 64255 V

GENERATOR AVERAGE LINE-NEUTRAL AC RMS VOLTAGE**\$0094 (148) - 1 REGISTER (2 BYTES) LONG - READ**

The average Line to Neutral AC RMS voltage measured at the generator output.

RESOLUTION	OFFSET	DATA RANGE
1 V / bit	0 V	0 to 64255 V

GENERATOR PHASE A LINE-NEUTRAL AC RMS VOLTAGE**\$0072 (114) - 1 REGISTER (2 BYTES) LONG - READ**

Line to Neutral RMS voltage measured at the generator phase A output.

RESOLUTION	OFFSET	DATA RANGE
1 V / bit	0 V	0 to 64255 V

GENERATOR PHASE B LINE-NEUTRAL AC RMS VOLTAGE**\$0073 (115) - 1 REGISTER (2 BYTES) LONG - READ**

Line to Neutral RMS voltage measured at the generator phase B output.

RESOLUTION	OFFSET	DATA RANGE
1 V / bit	0 V	0 to 64255 V

GENERATOR PHASE C LINE-NEUTRAL AC RMS VOLTAGE**\$0074 (116) - 1 REGISTER (2 BYTES) LONG - READ**

Line to Neutral RMS voltage measured at the generator phase C output.

RESOLUTION	OFFSET	DATA RANGE
1 V / bit	0 V	0 to 64255 V

GENERATOR AVERAGE AC RMS CURRENT**\$0065 (101) - 1 REGISTER (2 BYTES) LONG - READ**

Average RMS current measured at the generator output.

RESOLUTION	OFFSET	DATA RANGE
1 A / bit	0 A	0 to 64255 A

GENERATOR PHASE A AC RMS CURRENT**\$006F (111) - 1 REGISTER (2 BYTES) LONG - READ**

RMS current measured at the generator phase A output.

RESOLUTION	OFFSET	DATA RANGE
1 A / bit	0 A	0 to 64255 A

GENERATOR PHASE B AC RMS CURRENT**\$0070 (112) - 1 REGISTER (2 BYTES) LONG - READ**

RMS current measured at the generator phase B output.

RESOLUTION	OFFSET	DATA RANGE
1 A / bit	0 A	0 to 64255 A

GENERATOR PHASE C AC RMS CURRENT**\$0071 (113) - 1 REGISTER (2 BYTES) LONG - READ**

RMS current measured at the generator phase C output.

RESOLUTION	OFFSET	DATA RANGE
1 A / bit	0 A	0 to 64255 A

GENERATOR OVERALL POWER FACTOR**\$0067 (103) - 1 REGISTER (2 BYTES) LONG - READ**

The average power factor of the generator. See APPENDIX A for a programming example.

RESOLUTION	OFFSET	DATA RANGE
1/16384 / bit	-1.0	-1.0 to 1.0

GENERATOR OVERALL POWER FACTOR LAGGING**\$0068 (104) - 1 REGISTER (2 BYTES) LONG - READ**

Lead/lag status for generator average power factor.

BIT DEFINITIONS:

00 = Power factor leading

01 = Power factor lagging

10 = Error

11 = Not available

GENERATOR TOTAL PERCENT KW**\$0069 (105) - 1 REGISTER (2 BYTES) LONG - READ**

Total real power delivered by the generator, as a percentage of generator rated power.

RESOLUTION	OFFSET	DATA RANGE
0.0078125 % / bit	-251 %	-251 to 250.99 %

GENERATOR TOTAL REAL POWER**\$006A (106) - 2 REGISTERS (4 BYTES) LONG - READ**

Total real power delivered by the generator.

RESOLUTION	OFFSET	DATA RANGE
1 W / bit	-2000000000 W	-2000000000 to +2211081215 W

GENERATOR PHASE A REAL POWER

\$0075 (117) - 2 REGISTERS (4 BYTES) LONG - READ

The real power delivered by phase A of the generator.

RESOLUTION	OFFSET	DATA RANGE
1 W / bit	-2000000000 W	-2000000000 to +2211081215 W

GENERATOR PHASE B REAL POWER

\$0077 (119) - 2 REGISTERS (4 BYTES) LONG - READ

The real power delivered by phase B of the generator.

RESOLUTION	OFFSET	DATA RANGE
1 W / bit	-2000000000 W	-2000000000 to +2211081215 W

GENERATOR PHASE C REAL POWER

\$0079 (121) - 2 REGISTERS (4 BYTES) LONG - READ

The real power delivered by phase C of the generator.

RESOLUTION	OFFSET	DATA RANGE
1 W / bit	-2000000000 W	-2000000000 to +2211081215 W

GENERATOR PHASE A APPARENT POWER

\$007B (123) - 2 REGISTERS (4 BYTES) LONG - READ

The apparent power delivered by phase A of the generator.

RESOLUTION	OFFSET	DATA RANGE
1 VA / bit	-2000000000 VA	-2000000000 to +2211081215 VA

GENERATOR PHASE B APPARENT POWER

\$007D (125) - 2 REGISTERS (4 BYTES) LONG - READ

The apparent power delivered by phase B of the generator.

RESOLUTION	OFFSET	DATA RANGE
1 VA / bit	-2000000000 VA	-2000000000 to +2211081215 VA

GENERATOR PHASE C APPARENT POWER

\$007F (127) - 2 REGISTERS (4 BYTES) LONG - READ

The apparent power delivered by phase C of the generator.

RESOLUTION	OFFSET	DATA RANGE
1 VA / bit	-2000000000 VA	-2000000000 to +2211081215 VA

GENERATOR PHASE A REACTIVE POWER

\$0081 (129) - 2 REGISTERS (4 BYTES) LONG - READ

The reactive power delivered by phase A of the generator.

RESOLUTION	OFFSET	DATA RANGE
1 VAr / bit	-2000000000 VAr	-2000000000 to +2211081215 VAr

GENERATOR PHASE B REACTIVE POWER

\$0083 (131) - 2 REGISTERS (4 BYTES) LONG - READ

The reactive power delivered by phase B of the generator.

RESOLUTION	OFFSET	DATA RANGE
1 VAr / bit	-2000000000 VAr	-2000000000 to +2211081215 VAr

GENERATOR PHASE C REACTIVE POWER

\$0085 (133) - 2 REGISTERS (4 BYTES) LONG - READ

The reactive power delivered by phase C of the generator.

RESOLUTION	OFFSET	DATA RANGE
1 VAr / bit	-2000000000 VAr	-2000000000 to +2211081215 VAr

GENERATOR PHASE A POWER FACTOR

\$0087 (135) - 1 REGISTER (2 BYTES) LONG - READ

The power factor of phase A of the generator.

RESOLUTION	OFFSET	DATA RANGE
1/16384 / bit	-1.0	-1.0 to 1.0

GENERATOR PHASE B POWER FACTOR

\$0088 (136) - 1 REGISTER (2 BYTES) LONG - READ

The power factor of phase B of the generator.

RESOLUTION	OFFSET	DATA RANGE
1/16384 / bit	-1.0	-1.0 to 1.0

GENERATOR PHASE C POWER FACTOR

\$0089 (137) - 1 REGISTER (2 BYTES) LONG - READ

The power factor of phase C of the generator.

RESOLUTION	OFFSET	DATA RANGE
1/16384 / bit	-1.0	-1.0 to 1.0

GENERATOR TOTAL APPARENT POWER

\$008A (138) - 2 REGISTERS (4 BYTES) LONG - READ

The total apparent power delivered by the generator.

RESOLUTION	OFFSET	DATA RANGE
1 VA / bit	-2000000000 VA	-2000000000 to +2211081215 VA

GENERATOR TOTAL PERCENT KVA

\$008C (140) - 1 REGISTER (2 BYTES) LONG - READ

The total apparent power delivered by the generator, as a percentage of generator rated apparent power.

RESOLUTION	OFFSET	DATA RANGE
0.0078125 % / bit	-251 %	-251 to 250.99 %

GENERATOR TOTAL REACTIVE POWER

\$008D (141) - 2 REGISTERS (4 BYTES) LONG - READ

The total reactive power delivered by the generator.

RESOLUTION	OFFSET	DATA RANGE
1 VAR / bit	-2000000000 VAR	-2000000000 to +2211081215 VAR

GENERATOR TOTAL PERCENT KVAR

\$008F (143) - 1 REGISTER (2 BYTES) LONG - READ

The total reactive power delivered by the generator, as a percentage of generator rated reactive power.

RESOLUTION	OFFSET	DATA RANGE
0.0078125 % / bit	-251 %	-251 to 250.99 %

GENERATOR TOTAL KW HOURS EXPORT

\$0090 (144) - 2 REGISTERS (4 BYTES) LONG - READ

The total kilowatt-hours that have been exported by the generator.

RESOLUTION	OFFSET	DATA RANGE
1 kWh / bit	0 kWh	0 to 4211081215 kWh

GENERATOR TOTAL KVAR HOURS EXPORT**\$0092 (146) - 2 REGISTERS (4 BYTES) LONG - READ**

The total kilovar-hours that have been exported by the generator.

RESOLUTION	OFFSET	DATA RANGE
1 kVArh / bit	0 kVArh	0 to 4211081215 kVArh

GENERATOR PHASE A POWER FACTOR LAGGING**\$009F (159) - 1 REGISTER (2 BYTES) LONG - READ**

Lead/lag status for generator phase A power factor.

BIT DEFINITIONS:

00 = Power factor leading

01 = Power factor lagging

10 = Error

11 = Not available

GENERATOR PHASE B POWER FACTOR LAGGING**\$00A0 (160) - 1 REGISTER (2 BYTES) LONG - READ**

Lead/lag status for generator phase B power factor.

BIT DEFINITIONS:

00 = Power factor leading

01 = Power factor lagging

10 = Error

11 = Not available

GENERATOR PHASE C POWER FACTOR LAGGING**\$00A1 (161) - 1 REGISTER (2 BYTES) LONG - READ**

Lead/lag status for generator phase C power factor.

BIT DEFINITIONS:

00 = Power factor leading

01 = Power factor lagging

10 = Error

11 = Not available

DESIRED GENSET OUTPUT VOLTAGE**\$0421 (1057) - 1 REGISTER (2 BYTES) LONG - READ**

Applies to EMCP 3.3 only

The desired RMS voltage to be delivered by the genset.

RESOLUTION	OFFSET	DATA RANGE
1 V / bit	0 V	0 to 64255 V

GENERATOR FREQUENCY WITHIN LIMITS

\$042B (1067) - 1 REGISTER (2 BYTES) LONG - READ

Indicates whether the generator frequency is below the threshold for a generator over frequency shutdown and above the threshold for a generator under frequency shutdown.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

GENERATOR VOLTAGE WITHIN LIMITS

\$042C (1068) - 1 REGISTER (2 BYTES) LONG - READ

Indicates whether the generator voltage is below the threshold for a generator over voltage shutdown and above the threshold for a generator under voltage shutdown.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

21.5 EXTERNAL DEVICE PARAMETERS

The SCADA data link allows monitoring of not only parameters internally generated or sensed by the EMCP 3 GSC, but also of parameters transmitted from other devices over the J1939 data link. These may include the engine ECM, the thermocouple module, or any other supported module on the J1939 network(s).

Furthermore, there are parameters available from the EMCP 3 GSC to indicate what optional modules are currently in communication with the EMCP 3 GSC via the Primary or Accessory J1939 data link. These parameters could be monitored, for example, to determine which **EVENT LOGS** to read.

GENSET CONTROL ONLINE

\$0442 (1090) - 1 REGISTER (2 BYTES) LONG - READ

Indicates whether the EMCP 3 GSC is on the communication network. This will always be True.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

ENGINE CONTROL ONLINE

\$0443 (1091) - 1 REGISTER (2 BYTES) LONG - READ

Indicates whether the engine ECM is in communication with the EMCP 3 GSC via J1939.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

SECONDARY ENGINE CONTROL ONLINE

\$0444 (1092) - 1 REGISTER (2 BYTES) LONG - READ

Indicates whether the secondary engine ECM is in communication with the EMCP 3 GSC via J1939.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

EXTERNAL I/O #1 ONLINE

\$0445 (1093) - 1 REGISTER (2 BYTES) LONG - READ

Indicates whether the DIO module instance #1 is in communication with the EMCP 3 GSC via J1939.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

EXTERNAL I/O #2 ONLINE

\$0446 (1094) - 1 REGISTER (2 BYTES) LONG - READ

Indicates whether the DIO module instance #2 is in communication with the EMCP 3 GSC via J1939.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

EXTERNAL I/O #3 ONLINE

\$0447 (1095) - 1 REGISTER (2 BYTES) LONG - READ

Indicates whether the DIO module instance #3 is in communication with the EMCP 3 GSC via J1939.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

EXTERNAL I/O #4 ONLINE**\$0448 (1096) - 1 REGISTER (2 BYTES) LONG - READ**

Indicates whether the DIO module instance #4 is in communication with the EMCP 3 GSC via J1939.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

DIGITAL AVR ONLINE**\$0449 (1097) - 1 REGISTER (2 BYTES) LONG - READ**

Indicates whether the digital AVR module is in communication with the EMCP 3 GSC via J1939.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

RTD MODULE ONLINE**\$044A (1098) - 1 REGISTER (2 BYTES) LONG - READ**

Indicates whether the RTD module is in communication with the EMCP 3 GSC via J1939.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

THERMOCOUPLE #1 ONLINE**\$044B (1099) - 1 REGISTER (2 BYTES) LONG - READ**

Indicates whether the thermocouple module instance #1 is in communication with the EMCP 3 GSC via J1939.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

THERMOCOUPLE #2 ONLINE**\$044C (1100) - 1 REGISTER (2 BYTES) LONG - READ**

Indicates whether the thermocouple module instance #2 is in communication with the EMCP 3 GSC via J1939.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

AVR BIAS PERCENT**\$0422 (1058) - 1 REGISTER (2 BYTES) LONG - READ**

The percentage bias being applied to the voltage regulator desired genset output voltage, as a percentage of the Maximum Generator Voltage Output Bias Percentage setpoint. This will increment by 0.5% each time the Voltage Adjust up or down arrow is pressed on the EMCP 3.2 See APPENDIX A for a programming example.

{Voltage Regulator Desired Genset Output Voltage} = {'Desired Genset Output Voltage' setpoint} x (1 + {'Maximum Generator Voltage Output Bias Percentage' setpoint} x (1 + {'AVR Bias Percent' register}))

RESOLUTION	OFFSET	DATA RANGE
0.0078125 % / bit	-251%	-251 to 250.99 %

AVR BIAS PERCENT INCREMENT COMMAND**\$0423 (1059) - 1 REGISTER (2 BYTES) LONG - WRITE**

Increments the percentage bias to be applied to the Automatic Voltage Regulator. For more information on these commands, refer to the Programming Examples Chapter. See APPENDIX A for a programming example.

RESOLUTION	OFFSET	DATA RANGE
0.0078125 % / bit	-251%	-251 to 250.99 %

SPEED BIAS PERCENT**\$0425 (1061) - 1 REGISTER (2 BYTES) LONG - READ**

Read the percentage bias being applied to the speed command output. This is a percent of the Maximum Engine Speed Bias setpoint. This will increment by 0.5% each time the Speed Adjust left or right arrow is pressed on the EMCP 3 GSC display.

RESOLUTION	OFFSET	DATA RANGE
0.0078125 % / bit	-251%	-251 to 250.99 %

SPEED BIAS PERCENT INCREMENT COMMAND**\$0426 (1062) - 1 REGISTER (2 BYTES) LONG - WRITE**

Increments the percentage bias being applied to the speed command output. For more information on these commands, refer to the Programming Examples Chapter.

RESOLUTION	OFFSET	DATA RANGE
0.0078125 % / bit	-251%	-251 to 250.99 %

GENERATOR FRONT BEARING TEMPERATURE FROM DATA LINK**\$0095 (149) - 1 REGISTER (2 BYTES) LONG - READ**

Temperature of the bearing inside the alternator. This is the right or front bearing.

Applies to EMCP 3.3 only

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

GENERATOR REAR BEARING TEMPERATURE FROM DATA LINK

\$0096 (150) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Temperature of the bearing inside the alternator. This is the left or rear bearing.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

GENERATOR PHASE A WINDING TEMPERATURE FROM DATA LINK

\$0097 (151) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Temperature of the Phase A winding inside the alternator.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

GENERATOR PHASE B WINDING TEMPERATURE FROM DATA LINK

\$0098 (152) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Temperature of the Phase B winding inside the alternator.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

GENERATOR PHASE C WINDING TEMPERATURE FROM DATA LINK

\$0099 (153) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Temperature of the Phase C winding inside the alternator.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

ENGINE OIL PRESSURE FROM DATA LINK

\$00D9 (217) - 1 REGISTER (2 BYTES) LONG - READ

Gage pressure of oil in engine lubrication system as broadcast on the J939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.125 kPa / bit	0 kPa	0 to 8031.875 kPa

ENGINE COOLANT TEMPERATURE FROM DATA LINK**\$00DB (219) - 1 REGISTER (2 BYTES) LONG - READ**

Temperature of liquid found in engine cooling system, as broadcast on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

**CYLINDER #1 EXHAUST PORT TEMPERATURE FROM DATA LINK (THROUGH)
CYLINDER #20 EXHAUST PORT TEMPERATURE FROM DATA LINK****\$00DD (221) THROUGH \$00F0 (240) - 1 REGISTER (2 BYTES) LONG - READ**

Applies to EMCP 3.3 only

Temperature at the cylinder exhaust port of the engine, as received from another module on the J1939 Data Link.

CYLINDER NUMBER	REGISTER ADDRESS (HEX)	REGISTER ADDRESS (DECIMAL)
1	\$00DD	221
2	\$00DE	222
3	\$00DF	223
4	\$00E0	224
5	\$00E1	225
6	\$00E2	226
7	\$00E3	227
8	\$00E4	228
9	\$00E5	229
10	\$00E6	230
11	\$00E7	231
12	\$00E8	232
13	\$00E9	233
14	\$00EA	234
15	\$00EB	235
16	\$00EC	236
17	\$00ED	237
18	\$00EE	238
19	\$00EF	239
20	\$00F0	240

All have same data structure.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

EXHAUST MANIFOLD #1 TEMPERATURE FROM DATA LINK**\$00F1 (241) - 1 REGISTER (2 BYTES) LONG - READ**

Applies to EMCP 3.3 only

Temperature of combustion byproducts within the left engine exhaust manifold, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

EXHAUST MANIFOLD #2 TEMPERATURE FROM DATA LINK

\$00F2 (242) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Temperature of combustion byproducts within the right engine exhaust manifold, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

INTAKE MANIFOLD #1 TEMPERATURE FROM DATA LINK

\$00F3 (243) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Temperature of pre-combustion air found in intake manifold #1 of engine air supply system, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

INTAKE MANIFOLD #2 TEMPERATURE FROM DATA LINK

\$00F4 (244) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Temperature of pre-combustion air found in intake manifold #2 of engine air supply system, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

ENGINE OIL TEMPERATURE FROM DATA LINK

\$00F5 (245) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Temperature of the engine lubricant, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

ENGINE FUEL TEMPERATURE FROM DATA LINK

\$00F6 (246) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Temperature of the engine fuel as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

FUEL PRESSURE FROM DATA LINK

\$00F7 (247) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Gage pressure of fuel in system as delivered from supply pump to the injection pump, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.125 kPa / bit	0 kPa	0 to 8031.875 kPa

CRANKCASE PRESSURE FROM DATA LINK

\$00F8 (248) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Gage pressure inside engine crankcase, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
1 / 128 kPa / bit	-250 kPa	-250 to 251.99 kPa

BOOST PRESSURE FROM DATA LINK

\$00F9 (249) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Gage pressure of air measured downstream on the compressor discharge side of the turbocharger, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.125 kPa / bit	0 kPa	0 to 8031.875 kPa

OIL FILTER DIFFERENTIAL PRESSURE FROM DATA LINK

\$00FB (251) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Change in engine oil pressure, measured across the filter, due to the filter and any accumulation of solid or semisolid material on or in the filter, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.125 kPa / bit	0 kPa	0 to 8031.875 kPa

FUEL FILTER DIFFERENTIAL PRESSURE FROM DATA LINK**\$00FC (252) - 1 REGISTER (2 BYTES) LONG - READ**

Applies to EMCP 3.3 only

Change in fuel delivery pressure, measured across the filter, due to accumulation of solid or semisolid matter on the filter element, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.125 kPa / bit	0 kPa	0 to 8031.875 kPa

AIR FILTER 1 DIFFERENTIAL PRESSURE FROM DATA LINK**\$00FD (253) - 1 REGISTER (2 BYTES) LONG - READ**

Applies to EMCP 3.3 only

Change in engine air system pressure, measured across the filter, due to the filter and any accumulation of solid foreign matter on or in the filter, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
1 / 128 kPa / bit	-250 kPa	-250 to 251.99 kPa

TOTAL FUEL CONSUMPTION FROM DATA LINK**\$00FE (254) - 2 REGISTERS (4 BYTES) LONG - READ**

Applies to EMCP 3.3 only

Accumulated amount of fuel used during engine operation, as received from another module on the J1939 Data Link..

RESOLUTION	OFFSET	DATA RANGE
0.5 L / bit	0 L	0 to 2105540607.5 L

INSTANTANEOUS FUEL CONSUMPTION FROM DATA LINK**\$0100 (256) - 1 REGISTER (2 BYTES) LONG - READ**

Applies to EMCP 3.3 only

Amount of fuel used by engine per unit time, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.05 L / h per bit	0 L/h	0 to 3212.75 L/h

ATMOSPHERIC PRESSURE FROM DATA LINK**\$0101 (257) - 1 REGISTER (2 BYTES) LONG - READ**

Applies to EMCP 3.3 only

Absolute air pressure of the atmosphere, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.125 kPa / bit	0 kPa	0 to 8031.875 kPa

FUEL LEVEL FROM DATA LINK

\$0102 (258) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Ratio of volume of fuel to the total volume of fuel tank, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.0078125 % / bit	-251%	-251 to 250.99 %

NET BATTERY CURRENT FROM DATA LINK

\$0103 (259) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Net flow of electrical current into or out of the battery or batteries, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
1 A / bit	-125 A	-125 to 125 A

TURBOCHARGER 1 COMPRESSOR INLET TEMPERATURE

\$081A (2074) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Temperature of the air entering the compressor side of the turbocharger, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

TURBOCHARGER 1 TURBINE INLET TEMPERATURE

\$081E (2078) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Temperature of the combustion by-products entering the turbine side of the turbocharger, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

TURBOCHARGER 1 TURBINE OUTLET TEMPERATURE

\$081F (2079) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Temperature of the combustion by-products exiting the turbine side of the turbocharger, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

TURBOCHARGER 2 COMPRESSOR INLET TEMPERATURE

\$081B (2075) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Temperature of the air entering the compressor side of the turbocharger, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

TURBOCHARGER 2 TURBINE INLET TEMPERATURE

\$0820 (2080) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Temperature of the combustion by-products entering the turbine side of the turbocharger, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

TURBOCHARGER 2 TURBINE OUTLET TEMPERATURE

\$0821 (2081) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Temperature of the combustion by-products exiting the turbine side of the turbocharger, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

TURBOCHARGER 3 COMPRESSOR INLET TEMPERATURE

\$081C (2076) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Temperature of the air entering the compressor side of the turbocharger, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

TURBOCHARGER 3 TURBINE INLET TEMPERATURE**\$0822 (2082) - 1 REGISTER (2 BYTES) LONG - READ**

Applies to EMCP 3.3 only

Temperature of the combustion by-products entering the turbine side of the turbocharger, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

TURBOCHARGER 3 TURBINE OUTLET TEMPERATURE**\$0823 (2083) - 1 REGISTER (2 BYTES) LONG - READ**

Applies to EMCP 3.3 only

Temperature of the combustion by-products exiting the turbine side of the turbocharger, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

TURBOCHARGER 4 COMPRESSOR INLET TEMPERATURE**\$081D (2077) - 1 REGISTER (2 BYTES) LONG - READ**

Applies to EMCP 3.3 only

Temperature of the air entering the compressor side of the turbocharger, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

TURBOCHARGER 4 TURBINE INLET TEMPERATURE**\$0824 (2084) - 1 REGISTER (2 BYTES) LONG - READ**

Applies to EMCP 3.3 only

Temperature of the combustion by-products entering the turbine side of the turbocharger, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

TURBOCHARGER 4 TURBINE OUTLET TEMPERATURE**\$0825 (2085) - 1 REGISTER (2 BYTES) LONG - READ**

Applies to EMCP 3.3 only

Temperature of the combustion by-products exiting the turbine side of the turbocharger, as received from another module on the J1939 Data Link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

EXHAUST TEMPERATURE FROM DATA LINK

\$0826 (2086) - 1 REGISTER (2 BYTES) LONG - READ

Applies to EMCP 3.3 only

Temperature of combustion byproducts leaving the engine, as received from another module over the J1939 data link.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

21.6 GENERATOR SET STATE CONTROL

Remote control of the generator set is accomplished by reading from a set of status registers, and writing to a set of control registers.

AUTOMATIC START/STOP STATE

\$00CE (206) - 1 REGISTER (2 BYTES) LONG - READ

Current state of the Automatic Start/Stop sequence.

BIT DEFINITIONS:

- 0000 (\$0000) = INIT
- 0001 (\$0001) = PRE_CRANK
- 0010 (\$0002) = STARTING
- 0011 (\$0003) = RUNNING
- 0100 (\$0004) = PRE_COOLDOWN
- 0101 (\$0005) = COOLDOWN
- 0110 (\$0006) = STOPPING
- 0111 (\$0007) = STOPPED
- 1000 (\$0008) = IDLING

BYPASS COOLDOWN

\$012C (300) - 1 REGISTER (2 BYTES) LONG - WRITE

Command to bypass remaining cooldown duration and immediately stop engine.

This is applicable only when the engine is in the Cooldown state. Setting this has the same functionality as pressing and holding the STOP key (and verifying with Enter) on the EMCP 3.2. The cooldown bypass command is retained until cooldown is re-enabled by writing 00 to this register. If the EMCP 3 GSC undergoes a power cycle, that will also clear this register and re-enable the cooldown.

BIT DEFINITIONS:

- 00 = FALSE
- 01 = TRUE

ENGINE OPERATING MODE**\$012D (301) - 1 REGISTER (2 BYTES) LONG - READ**

Indicates current desired mode of operation of the engine generator set.

This parameter indicates the status corresponding to the Run, Auto, and Stop keys on the EMCP 3.2 To change the operating mode, see the Engine Operating Mode Command parameter.

BIT DEFINITIONS:

00 (\$0000) = STOP

01 (\$0001) = AUTO

10 (\$0002) = RUN

ENGINE OPERATING MODE COMMAND**\$012E (302) - 1 REGISTER (2 BYTES) LONG - WRITE**

SCADA command to change of desired mode of operation of the engine generator set. Writing to this register has the same functionality as pressing the corresponding key (Run, Auto, or Stop) on the EMCP 3.2 To read the current mode, see the Engine Operating Mode parameter.

BIT DEFINITIONS:

00 (\$0000) = STOP

01 (\$0001) = AUTO

10 (\$0002) = RUN

ENGINE STATUS**\$041D (1053) - 1 REGISTER (2 BYTES) LONG - READ**

Current operating state of the engine generator set. See APPENDIX A for a programming example.

BIT DEFINITIONS:

000 (\$0000) = NOT READY TO GO

001 (\$0001) = GOING IN AUTO

010 (\$0002) = GOING IN RUN

011 (\$0003) = READY IN AUTO

100 (\$0004) = STOPPING IN AUTO

101 (\$0005) = STOPPING NOT READY TO GO

COOLDOWN DURATION REMAINING**\$041E (1054) - 1 REGISTER (2 BYTES) LONG - READ**

Time remaining in cooldown until engine is stopped. This value is only meaningful while the engine is in the Cooldown state.

RESOLUTION	OFFSET	DATA RANGE
1 second / bit	0 seconds	0 to 64255 seconds

REMOTE INITIATE COMMAND

\$041F (1055) - 1 REGISTER (2 BYTES) LONG - WRITE

When the control is in Auto mode, this commands the engine to Start when TRUE and Stop when FALSE.

The Remote Initiate is also assigned to a digital input switch. Either the digital input going active or this SCADA command going TRUE will trigger an automatic start if the Engine Operating Mode is Auto. This SCADA command is unaffected by the digital input state configuration.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

EMERGENCY STOP COMMAND

\$0420 (1056) - 1 REGISTER (2 BYTES) LONG - WRITE

Will cause the engine to immediately stop without cooling down.

Emergency Stop is also assigned to a switch for digital input. Either the digital input going active or this SCADA command going TRUE will trigger an emergency stop event. This SCADA command is unaffected by the digital input state configuration.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

21.7 TIMERS AND COUNTERS

The EMCP 3.2 and 3.3 have a real-time clock and counters that provide energy-related and service-related information.

The EMCP 3 GSC calculates real and reactive energy provided by the generator set by measuring the power provided by the generator set over the amount of time the generator set is providing the power.

The EMCP 3 GSC provides service-related information such as the number of crank and start attempts and successes, and allows resetting of these counters. It also counts down to a recommended service interval, and reports the countdown in weeks, days, and hours. Service personnel can reset the service interval counter to restart the countdown at the end of a service call.

ENGINE OPERATING HOURS

\$00CC (204) - 2 REGISTERS (4 BYTES) LONG - READ

Accumulated time that the engine is running.

RESOLUTION	OFFSET	DATA RANGE
0.05 hour / bit	0 hr	0 to 210554060.75 hour

SERVICE MAINTENANCE INTERVAL HOURS REMAINING**\$00D2 (210) - 1 REGISTER (2 BYTES) LONG - READ**

Maximum time in operation until the next service inspection is required. This number is negative if a service inspection is overdue.

RESOLUTION	OFFSET	DATA RANGE
1 hr / bit	-32127 hr	-32127 to 32128 hr

SERVICE MAINTENANCE INTERVAL DAYS REMAINING**\$00D4 (212) - 1 REGISTER (2 BYTES) LONG - READ**

Maximum calendar days until the next service inspection is required. This number is negative if a service inspection is overdue.

RESOLUTION	OFFSET	DATA RANGE
1 day / bit	-32127 days	-32127 to 32128 days

SERVICE MAINTENANCE INTERVAL WEEKS REMAINING**\$012B (299) - 1 REGISTER (2 BYTES) LONG - READ**

The number of full calendar weeks until the next service inspection is required. This number is negative if a service inspection is overdue.

RESOLUTION	OFFSET	DATA RANGE
1 week / bit	-125 weeks	-125 to 125 weeks

NUMBER OF CRANK ATTEMPTS**\$00D5 (213) - 2 REGISTERS (4 BYTES) LONG - READ**

Accumulated number of crank attempts made by the engine.

RESOLUTION	OFFSET	DATA RANGE
1 / bit	0	0 to 4211081215

NUMBER OF SUCCESSFUL STARTS**\$00D7 (215) - 2 REGISTERS (4 BYTES) LONG - READ**

Accumulated number of successful starts of the engine.

RESOLUTION	OFFSET	DATA RANGE
1 / bit	0	0 to 4211081215

REAL TIME CLOCK**\$0384 (900) - 3 REGISTERS (6 BYTES) LONG - READ**

Clock containing year, month, day, hour, minute, and second information.

BYTE	RESOLUTION	OFFSET	DATA RANGE
5	1 year / bit	1985 years	1985 to 2235 years
4	0.25 days / bit	0.75 days (12:00-6:00am on day 1 = \$01)	0 to 62.5 days
3	1 month / bit	1 month (Jan = \$01)	0 to 250 months
2	1 hour / bit	0 hours (midnight = \$00)	0 to 250 hours
1	1 minute / bit	0 minutes (HH:00 = \$00)	0 to 250 minutes
0	0.25 seconds / bit	0 seconds (HH:MM:00 = \$00)	0 to 62.5 seconds

DATA INTERPRETATION EXAMPLE

The 1985 year offset implies that \$14 in byte 5 translates to 20 years past 1985, or year 2005. The day offset implies that \$1F (31) in byte 4 translates to the 8th day of the month (and the third quarter of the day – noon to 6pm). One month offset implies that \$07 in byte 3 translates to the seventh month, July.

Zero hour offset implies that \$00 in byte 2 translates to 12:00 midnight, and with the 24-hour format, \$0D translates to 13:00 or 1:00 pm. Zero minute offset implies that \$05 in byte 1 translates to 5 minutes past the hour (i.e. 12:05pm). Zero second offset implies that \$4D (77) in byte 0 translates to 19 and a quarter seconds past the minute (i.e. 12:05:19 pm).

Therefore, \$4D 05 0D 07 1F 14 is 1:05:19pm on July 8, 2005.

UPDATE REAL TIME CLOCK COMMAND

\$0387 (903) - 3 REGISTERS (6 BYTES) LONG - WRITE

SCADA command to change the real time clock information.

Date and time data is entered in the same format as the Real Time Clock read parameter.

RESET CRANK ATTEMPT COUNTER

\$0404 (1028) - 1 REGISTER (2 BYTES) LONG - WRITE

Resets the accumulated number of crank attempts made by the engine.

Write \$AA55 followed by \$55AA within 2 seconds to reset the counter to zero.

RESET SUCCESSFUL START COUNTER

\$0405 (1029) - 1 REGISTER (2 BYTES) LONG - WRITE

Resets the accumulated number of successful starts of the engine.

Write \$AA55 followed by \$55AA within 2 seconds to reset the counter to zero.

RESET KW HOUR METER

\$0406 (1030) - 1 REGISTER (2 BYTES) LONG - WRITE

Resets the total kilowatt-hours that have been exported by the generator.

Write \$AA55 followed by \$55AA within 2 seconds to reset the meter to zero.

RESET KVAR HOUR METER**\$0407 (1031) - 1 REGISTER (2 BYTES) LONG - WRITE**

Resets the total kilovar-hours that have been exported by the generator.

Write \$AA55 followed by \$55AA within 2 seconds to reset the meter to zero.

RESET SERVICE INTERVAL COUNTER**\$0408 (1032) - 1 REGISTER (2 BYTES) LONG - WRITE**

Resets the countdown until the next service inspection is required. This is usually performed at the end of a service call.

Write \$AA55 followed by \$55AA within 2 seconds to reset the counter to zero.

21.8 EVENT SYSTEM

The EMCP 3 GSC displays both internal events and those transmitted over the J1939 data link. Over SCADA, the status of the warning and shutdown lamps on the display can be viewed, and events can be acknowledged. Events can be acknowledged individually or as a group, and the event count can be read. Details of both EMCP 3 GSC and supported optional module events can be read over SCADA.

The Event System as accessible over SCADA is very similar to the Event System on the EMCP 3.2. However, there is one significant difference: The list of events as read over SCADA is not sorted in order of event priority. Therefore, in order to find the details of any particular event, all 20 registers must first be read and the particular event must be found.

ACKNOWLEDGE ALL EVENTS COMMAND**\$0130 (304) - 1 REGISTER (2 BYTES) LONG - WRITE**

SCADA command to acknowledge all events, similar to pressing the Alarm Acknowledge key on the control.

Each time a TRUE is written to this register, all of the events are momentarily acknowledged.

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

SYSTEM EVENT COUNT**\$014E (334) - 1 REGISTER (2 BYTES) LONG - READ**

Number of system events (present or active).

Bits 15:8 UNUSED

Bits 7:0 Count of Present and Active Events

RESOLUTION	OFFSET	DATA RANGE
1 / bit	0	0 to 99

SYSTEM EVENT LAMP STATUS

\$014F (335) - 1 REGISTER (2 BYTES) LONG - READ

Indicates the status of the amber and red event status lamps on the control.

The Amber lamp being on signifies a warning event, and the Red lamp being on signifies a shutdown event. This status parameter does not distinguish between a flashing lamp and a solid lamp.

Bits 15:4 UNUSED

Bits 3:2 Amber Lamp Status: Bits 00 = off, 01 = on

Bits 1:0 Red Lamp Status: Bits 00 = off, 01 = on

LOG ENTRY INDEX

\$0409 (1033) - 1 REGISTER (2 BYTES) LONG - WRITE

Selects the index of the genset control event log to be read from Log Entry Modbus register.

This is a legacy parameter, and has been superseded by the Module Event Log Entry # parameters.

RESOLUTION	OFFSET	DATA RANGE
1 / bit	0	0 to 19

LOG ENTRY

\$040A (1034) - 14 REGISTERS (28 BYTES) LONG - READ

Reads the entry of the Genset Control Log as specified by the Log Entry Index Modbus register.

For a list of the SPN/FMI combinations supported, please refer to the Systems Operation, Troubleshooting, Testing and Adjusting manual.

(Register numbers listed below are offsets from the starting register number of this parameter, given above).

This is a legacy parameter, and has been superseded by the Module Event Log Entry # parameters.

Register 13 = Log Entry Index (for data format, see Log Entry Index parameter)

Register 12:11 = SPN/FMI

Bits 31:24 = UNUSED

Bits 23:5 = SPN

Bits 4:0 = FMI

Register 10 = Flags / Count

Bits 15:12 UNUSED

Bits 11:8 Event Status:

Bits 0000 = Inactive, 0100 = Active, 0101 = Present, 1111 = Unavailable

Bits 7:0 Occurrence Count

Register 9:8 = First Hourmeter

RESOLUTION	OFFSET	DATA RANGE
0.05 hour / bit	0 hr	0 to 210554060.75 hour

Register 7:6 = Last Hourmeter

RESOLUTION	OFFSET	DATA RANGE
0.05 hour / bit	0 hr	0 to 210554060.75 hour

Register 5:3 = First Timestamp

(for data format, see Real Time Clock parameter under Timers and Counters Chapter)

Register 2:0 = Last Timestamp

(for data format, see Real Time Clock parameter under Timers and Counters Chapter)

RESET EVENT

\$0418 (1048) - 2 REGISTERS (4 BYTES) LONG - WRITE

SCADA command to reset a single EMCP 3 GSC interval event, identified by the SPN and FMI numbers.

For a list of the SPN/FMI combinations supported, please refer to the Systems Operation, Troubleshooting, Testing and Adjusting manual.

Bits 31:24 = UNUSED

Bits 23:5 = SPN

Bits 4:0 = FMI

EVENT LOG MODULE SELECTION COMMAND

\$05DA (1498) - 1 REGISTERS (2 BYTES) LONG - WRITE

Write a value to this register to select which module events are currently accessible via the Module Event Log Entry # parameters (registers 1500 through 1576). Writing a value to this register changes the value of the Event Log Module Selection parameter (register 1499).

MODULE DEFINITIONS:

0 = GENSET CONTROL

7 = DIGITAL AVR

1 = ENGINE CONTROL

8 = RTD MODULE

2 = SECONDARY ENGINE CONTROL

9 = THERMOCOUPLE MODULE #1

3 = EXTERNAL I/O #1

10 = THERMOCOUPLE MODULE #2

4 = EXTERNAL I/O #2

EVENT LOG MODULE SELECTION

\$05DB (1499) - 1 REGISTERS (2 BYTES) LONG - READ

Read this register to determine which module events are currently accessible via the Module Event Log Entry # parameters (registers 1500 through 1576).

Module definitions are the same as for the Event Log Module Selection Command parameter (register 1498).

MODULE EVENT LOG ENTRY 1 (THROUGH) MODULE EVENT LOG ENTRY 20

\$05DC (1500) THROUGH \$06E6 (1766) - 14 REGISTERS (28 BYTES) LONG - READ

Reads the corresponding entry of the Event Log for the module specified in the Event Log Module Selection register.

MODULE EVENT LOG ENTRY NUMBER	REGISTER ADDRESS (HEX)	REGISTER ADDRESS (DECIMAL)
1	\$05DC	1500
2	\$05EA	1514
3	\$05F8	1528
4	\$0606	1542
5	\$0614	1556
6	\$0622	1570
7	\$0630	1584
8	\$063E	1598
9	\$064C	1612
10	\$065A	1626
11	\$0668	1640
12	\$0676	1654
13	\$0684	1668
14	\$0692	1682
15	\$06A0	1696
16	\$06AE	1710
17	\$06BC	1724
18	\$06CA	1738
19	\$06D8	1752
20	\$06E6	1766

All of these parameters have the same data structure. Register numbers are offsets from the base register address given above:

Register 13 = Log Entry Index (0 through 19)

Register 12:11 = SPN/FMI

Bits 31:24 = UNUSED

Bits 23:5 = SPN

Bits 4:0 = FMI

Register 10 = Flags / Count

Bits 15:12 UNUSED

Bits 11:8 Event Status: 0000 = Inactive, 0100 = Active, 0101 = Present, 1111 = Unavailable

Bits 7:0 Occurrence Count

Register 9:8 = First Hourmeter

RESOLUTION	OFFSET	DATA RANGE
0.05 hour / bit	0 hr	0 to 210554060.75 hours

Register 7:6 = Last Hourmeter

(same data format as First Hourmeter)

Register 5:3 = First Timestamp

(same data format as Real Time Clock parameter)

BYTE	RESOLUTION	OFFSET	DATA RANGE
5	1 year / bit	1985 years	1985 to 2235 years
4	0.25 days / bit	0.75 days	0 to 62.5 days
3	1 month / bit	0 months	0 to 250 months
2	1 hour / bit	0 hours	0 to 250 hours
1	1 minute / bit	0 minutes	0 to 250 minutes
0	0.25 seconds / bit	0 seconds	0 to 62.5 seconds

Register 2:0 = Last Timestamp

(same data format as First Timestamp)

For an example of the use of the Event Log Module Selection parameter and the Module Event Log Entry # parameters, see page 202.

EMERGENCY SHUTDOWN OVERRIDE LOG ENTRY 1 (THROUGH) EMERGENCY SHUTDOWN OVERRIDE LOG ENTRY 10

\$0514 (1300) THROUGH \$056E (1390) - 10 REGISTERS (20 BYTES) LONG - READ

Reads the corresponding entry of the Emergency Shutdown Override Log, which records the past 20 times Emergency Shutdown Override mode was activated.

Emergency Shutdown Override is an optional feature.

MODULE EVENT LOG ENTRY NUMBER	REGISTER ADDRESS (HEX)	REGISTER ADDRESS (DECIMAL)
1	\$0514	1300
2	\$051E	1310
3	\$0528	1320
4	\$0532	1330
5	\$053C	1340
6	\$0546	1350
7	\$0550	1360
8	\$055A	1370
9	\$0564	1380
10	\$056E	1390

All of these parameters have the same data structure. Register numbers are offsets from the base register address given above:

Register 9:8 = Last Hourmeter

RESOLUTION	OFFSET	DATA RANGE
0.05 hour / bit	0 hr	0 to 210554060.75 hours

Register 7:5 = Last Timestamp

(same data format as Real Time Clock parameter)

BYTE	RESOLUTION	OFFSET	DATA RANGE
5	1 year / bit	1985 years	1985 to 2235 years
4	0.25 days / bit	0.75 days	0 to 62.5 days
3	1 month / bit	0 months	0 to 250 months
2	1 hour / bit	0 hours	0 to 250 hours
1	1 minute / bit	0 minutes	0 to 250 minutes
0	0.25 seconds / bit	0 seconds	0 to 62.5 seconds

Register 4:3 = First Hourmeter

(same data format as Last Hourmeter)

Register 2:0 = First Timestamp

(same data format as Last Timestamp)

21.9 ENGINE MONITORING

The EMCP 3 GSC can communicate some standard engine parameters over the data link.

ENGINE OIL PRESSURE

\$00C8 (200) - 1 REGISTER (2 BYTES) LONG - READ

Gage pressure of oil in engine lubrication system as provided by oil pump.

RESOLUTION	OFFSET	DATA RANGE
0.125 kPa / bit	0 kPa	0 to 8031.875 kPa

ENGINE COOLANT TEMPERATURE

\$00C9 (201) - 1 REGISTER (2 BYTES) LONG - READ

Temperature of liquid found in engine cooling system.

RESOLUTION	OFFSET	DATA RANGE
0.03125 C / bit	-273 C	-273 to 1735 C

ENGINE RPM

\$00CB (203) - 1 REGISTER (2 BYTES) LONG - READ

Actual engine speed, calculated over a minimum crankshaft angle of 720 degrees divided by the number of cylinders.

RESOLUTION	OFFSET	DATA RANGE
0.125 rpm / bit	0 rpm	0 to 8031.875 rpm

REQUESTED ENGINE SPEED

\$0424 (1060) - 1 REGISTER (2 BYTES) LONG - READ

Engine speed currently being requested by the EMCP 3 GSC genset control.

RESOLUTION	OFFSET	DATA RANGE
0.125 rpm / bit	0 rpm	0 to 8031.875 rpm

ENGINE PROTECTION HAS SHUT DOWN ENGINE FROM DATA LINK

\$04FB (1275) - 1 REGISTER (2 BYTES) LONG - READ

Indicates that the engine protection system has shut down the engine, as opposed to the engine shutting down based on a command from the EMCP 3.2

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

MANUAL FUEL PRIMING DURATION REMAINING

\$082B (2091) - 1 REGISTER (2 BYTES) LONG - READ

Time remaining in manual fuel priming, in seconds.

RESOLUTION	OFFSET	DATA RANGE
1 second / bit	0 seconds	0 to 64255 seconds

21.10 EMCP 3 GSC SETPOINTS

All of the configuration possible at the EMCP 3 GSC can be done over the data link, by reading from and writing to EMCP 3 GSC setpoints. As on the display, each setpoint has a minimum security level required to change it associated with it. This required security level can be read by reading the Setpoint Information register for a particular setpoint.

Setpoints are grouped in the EMCP 3 GSC into Blocks. These Blocks are actually pieces of software that, in some cases, may occur more than once in the software. Blocks are uniquely identified by the combination of their Block Number and Instance Number, and this unique identifier is called the Block ID.

This, in combination with a Setpoint Number that identifies the setpoint within that block, is called the Setpoint ID. This Setpoint ID uniquely identifies a setpoint in the EMCP 3 GSC. See FIGURE 107 for a sample illustration of this concept.

Note that Instance Number and Setpoint Number start from zero. Therefore, the 1st setpoint, shown in the figure as Setpoint #1, actually has the hexadecimal address of \$00.

The same holds for instance numbers, where the first instance is enumerated as 00\$.

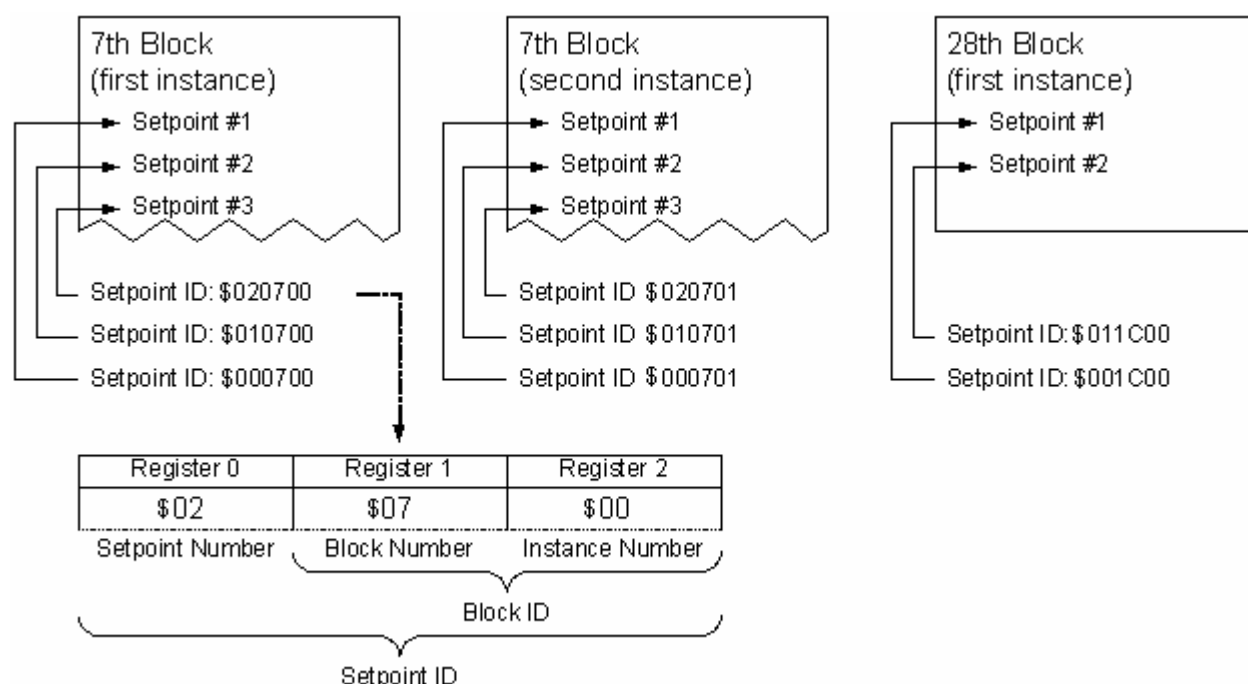


FIGURE 107: STRUCTURE OF SETPOINT ID

To read a setpoint data or related information, first the Setpoint ID for Read parameter must be set to the appropriate Setpoint ID.

Then, either the Setpoint Information parameter or Setpoint Data Value parameter can be read. Setpoint Information contains various pieces of information regarding the setpoint, as detailed below.

To write to a setpoint, the Setpoint Write parameter must be sent, which contains both the Setpoint ID and the data value.

Immediately prior to reading setpoint information, the Setpoint ID field should be checked to verify that the correct setpoint is being read.

The Setpoint ID and Setpoint Information parameters contain multiple pieces of information, and span multiple Modbus registers. The registers may be read separately, but caution should be taken to maintain integrity of the data being read.

The list of blocks supported on the EMCP 3 GSC are given in APPENDIX C.

The list of setpoints as well as security and data format information are given in APPENDIX D.

For the setpoints which use Setpoint Value Lists, the list of values and their meanings is given in APPENDIX E.

SETPOINT DATA TYPE

Setpoints have minimum and maximum engineering values, as given in the MIN and MAX fields of the table in APPENDIX C. They are stored with a maximum resolution as listed in the RESOLUTION field. The parameters can take on non-integer values in some cases, so in order to be stored as integer data types, are scaled (bit-shifted) by the number of bits listed in the SCALING field.

Setpoints are stored as a 32-bit signed integer value, using 2's complement to represent negative values. This is a standard data type in computer programming, termed INT32. It can represent integer values from negative 2,147,483,648 to positive 2,147,483,647; that is, hexadecimal \$ 80 00 00 00 to \$ 7F FF FF FF. Other conversion examples:

Decimal -1 = \$ FF FF FF FF

Decimal 0 = \$ 00 00 00 00

Decimal 1000 = \$ 00 00 03 E8

Decimal -1000 = \$ FF FF FC 18

$$\text{REGISTER_VALUE} = 2^{\text{RESOLUTION}} * \text{ENGINEERING_VALUE}$$

$$\text{ENGINEERING VALUE} = (0.5)^{\text{RESOLUTION}} * \text{REGISTER_VALUE}$$

For a setpoint interpretation and calculation example, see Setpoint Interpretation and Calculation Chapter APPENDIX D.

SETPOINT ID FOR READ

\$03EA (1002) - 3 REGISTERS (6 BYTES) LONG - WRITE

Specifies the ID for the setpoint to be read by the Setpoint Information Modbus register or the Setpoint Data Value Modbus register. See APPENDIX A for a programming example.

(Register numbers listed below are offsets from the starting register number of this parameter, given above).

Register 2:1 = Block ID

Register 0 = Setpoint Number

SETPOINT INFORMATION

\$03ED (1005) - 12 REGISTERS (24 BYTES) LONG - READ

Reads the setpoint information structure associated with the setpoint specified by the Setpoint ID for Read Modbus register, see APPENDIX A: SCADA Programming Examples.

(Register numbers listed below are offsets from the starting register number of this parameter, given above).

Register 11:9 = Setpoint ID

Register 8 = Access Level needed to modify

Register 7:6 = Value

Register 5:4 = Minimum

Register 3:2 = Maximum

Register 1:0 = Resolution

SETPOINT WRITE

\$03F9 (1017) - 5 REGISTERS (10 BYTES) LONG - WRITE

Writes a specific Setpoint ID and value to change a setpoint.

(Register numbers listed below are offsets from the starting register number of this parameter, given above).

Register 4:2 = Setpoint ID

Register 1:0 = New Value

SETPOINT DATA VALUE

\$03FE (1022) - 2 REGISTERS (4 BYTES) LONG - READ

Reads the value of the setpoint specified by the Setpoint ID for Read Modbus register.

21.11 MISCELLANEOUS

BATTERY VOLTAGE

\$00CA (202) - 1 REGISTER (2 BYTES) LONG - READ

Measured electrical potential of the battery voltage at the control.

The EMCP 3 GSC can report the voltage of the supply that is powering it over the data link by means of the Battery Voltage parameter. This is usually the cranking battery or batteries. Note that the voltage is read at the EMCP, not at the battery terminals. For high power draw cases, this voltage may be noticeably lower than the voltage at the battery terminals. See APPENDIX A for a programming example.

RESOLUTION	OFFSET	DATA RANGE
0.05 V / bit	0 V	0 to 3212.75 V

LAMP TEST COMMAND

\$012F (303) - 1 REGISTER (2 BYTES) LONG - WRITE

Commands the control to conduct a lamp/display test of the EMCP 3 GSC. Writing TRUE turns on all of the LEDs, but does not darken the LCD display on the control panel, as the Lamp Test button on the control panel does. To end the lamp test, a FALSE must be written to this register.

RESOLUTION	OFFSET	DATA RANGE
1 / bit	0	0 to 1

BIT DEFINITIONS:

00 = FALSE

01 = TRUE

CONTROL SERIAL NUMBER

\$04FC (1276) - 6 REGISTERS (12 BYTES) LONG - READ

Reads the SERIAL NUMBER of the EMCP 3 GSC. This is the number that is label printed on the back cover of the control panel. See FIGURE 108.

BYTE 0: Character count

BYTES 1-11: ASCII data, characters \$30 through \$5A valid (numbers and capital letters). String terminates with a NULL character (\$00).

EXAMPLE: Reading the Control Serial Number would return the following:
\$0A31 3738 3342 3030 3648 5100

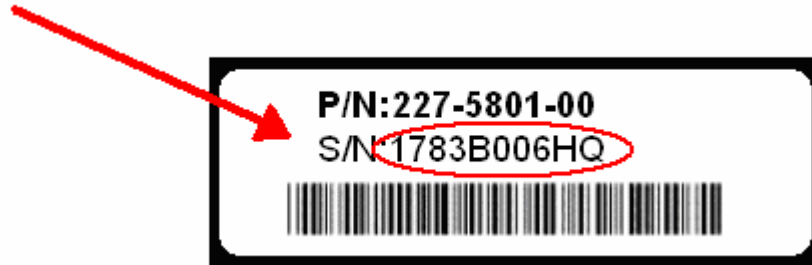


FIGURE 108: SAMPLE CONTROL SERIAL NUMBER ON EMCP 3 GSC LABEL

APPENDIX A SCADA PROGRAMMING EXAMPLES

In the following examples, the EMCP 3 GSC SCADA Data Link Slave Address setpoint is assumed to be set to 01. The last 2 bytes (shown as xx xx in this Chapter) of each message consist of the CRC. The CRC is typically automatically generated and checked by SCADA communication software, and therefore is not discussed below.

These are only examples of specific conditions and the responses from the control under those conditions, and are not intended to represent the complete functionality of the control or all the possible conditions that can result in these responses. In particular, Exception Responses or other error conditions are not considered here.

READING DATA REGISTERS

BATTERY VOLTAGE

REQUEST: \$ 01 03 00 C9 00 01 xx xx

\$ 01 = slave address of EMCP 3 GSC

\$ 03 = function code (Read Registers).

\$ 00 C9 → (1 bit offset) → \$ 00 CA = Battery Voltage.

\$ 00 01 = register count (1 register).

Reply: \$ 01 03 02 01 FD xx xx

\$ 01 = slave address of EMCP 3 GSC

\$ 03 = function code (Read Registers).

\$ 02 = byte count (2 bytes – 1 register).

\$ 01 FD = $509.509 \times 0.05 \text{ V/bit} = 25.45\text{V}$.

GENERATOR OVERALL POWER FACTOR

Request: \$ 01 03 00 66 00 01 xx xx

\$ 01 = slave address of EMCP 3 GSC

\$ 03 = function code (Read Registers)

\$ 00 66 → (1 bit offset) → \$00 67 = Generator Overall Power Factor.

\$ 00 01 = register count (1 register)

Reply: \$ 01 03 02 80 00 xx xx

\$ 01 = slave address of EMCP 3 GSC

\$ 03 = function code (Read Registers)

\$ 02 = byte count (2 bytes = 1 register)

\$ 80 00 = $32768 \times (1 / 16384) - 1.0 = 1.0 \text{ PF}$.

It may be convenient to consider these equations when converting between engineering units and stored data:

$\text{ENGINEERING_DATA} = (\text{STORED_DATA} \times \text{RESOLUTION}) + \text{OFFSET}$

STORED_DATA = (ENGINEERING_DATA - OFFSET) / RESOLUTION

ENGINE STATUS

Let's consider the reply under two different conditions to the following request for Engine Status.

Request: \$ 01 03 04 1C 00 01 xx xx

\$ 01 = slave address of EMCP 3 GSC

\$ 03 = function code (read register)

\$ 04 1C → (1 bit offset) → \$ 04 1D → Engine Status

Condition 1

If the engine RPM is set to 15 and the mode is Auto and there is not a remote start signal from any source, then the EMCP 3 GSC display reads Stopping, and the following is the reply to the above Modbus request:

Reply (1): \$ 01 03 02 00 03 xx xx

\$ 01 = slave address of EMCP 3 GSC

\$ 03 = function code (Read Register)

\$ 02 = byte count (2 bytes = 1 register)

\$ 00 03 = 3 = Ready in Auto

The Engine Status is Ready in Auto because the engine RPM is below the Crank Terminate RPM setpoint. (The minimum value of the Crank Terminate setpoint is 100 rpm).

Condition 2

If the engine RPM is set to zero, the mode to Stop, and the oil pressure below 80kPa, then the EMCP 3 GSC display reads Stopped, and the following is the reply to the above Modbus request.

Reply (2): \$ 01 03 02 00 00 xx xx

\$ 01 = slave address of EMCP 3 GSC

\$ 03 = function code (Read Register)

\$ 02 = byte count (2 bytes = 1 register)

\$ 00 00 = 0 = Not Ready to Go

The Engine Status is Not Ready to Go, which indicates that the control is in Stop mode, and is not ready to be started via a Remote Initiate command.

SCADA SECURITY LEVELS

This example demonstrates setting a password, and then entering the password to gain access to a certain SCADA security level. There are also some examples given of valid versus invalid passwords.

Assume the EMCP 3 GSC contains default values. By default, all three passwords (SCADA, Level 1, and Level 2) are disabled.

Read and verify the current security level:

Step 1: Verify current security level

Request: \$ 01 03 02 DB 00 01 xx xx

\$ 01 = slave address of EMCP 3 GSC

\$ 03 = function code (read register)

\$ 02 DB → (1 bit offset) → \$ 02 DC → Current Security Level

Reply: \$ 01 03 02 00 02 xx xx

\$ 02 = byte count (2 bytes = 1 register)

\$ 00 02 = security access level 2.

This is correct. It should be at level 2, because no passwords exist. Now, enter a SCADA password as well as a new level 1 password. It will set the SCADA password to 123, which is \$313233.

Set the new level 1 password to 1, which is \$31:

Step 2: Set a new level 1 password

Request: \$ 01 10 02 C3 00 08 10 31 20 20 20 20 20 20 20 20 20 20 20 20 xx xx

\$ 01 = slave address of EMCP 3 GSC

\$ 10 = function code (write multiple registers)

\$ 02 C3 → (1 bit offset) → \$ 02 C4 → Level 1 Password

\$ 00 08 = register count (8)

\$ 10 = byte count (16)

\$ 31 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 = data (1, followed by 15 spaces)

Reply: \$ 01 10 02 C3 00 08 xx xx

\$ 02 C3 → (1 bit offset) → \$ 02 C4 → Level 1 Password

\$ 00 08 = register count (8)

Step 3: Set a new SCADA password

Request: \$ 01 10 02 D3 00 08 10 31 32 33 20 20 20 20 20 20 20 20 20 20 xx xx

\$ 01 = slave address of EMCP 3 GSC

\$ 10 = function code (write multiple registers)

\$ 02 D3 → (1 bit offset) → \$ 02 D4 → SCADA Password

\$ 00 08 = register count (8)

\$ 10 = byte count (16)

\$ 31 32 33 20 20 20 20 20 20 20 20 20 20 20 20 20 = data (123, followed by 13 spaces)

Reply: \$ 01 10 02 C3 00 08 xx xx

\$ 02 C3 → (1 bit offset) → \$ 02 C4 → Level 1 Password

\$ 00 08 = register count (8)

Now, wait for the duration of the Level 0 Timeout, which is 10 minutes, without doing any *writes* over SCADA. Repeat **Step 1** to verify that the current security level is now zero. The reply should be as follows:

Reply: \$ 01 03 02 00 00 xx xx

The level is now zero. Now, disconnect from SCADA completely (i.e. no reads nor writes) for the duration of the SCADA Timeout, which depends on the SCADA Data Link Connect Timeout Interval setpoint. If the timeout interval is set to the default of 30 seconds, then wait for 30 seconds, and then reconnect. Repeating **Step 1**, the reply should be as follows:

Reply: \$ 01 03 02 FF FF xx xx

This is the correct response. No read or write can be done to any register since the SCADA access has timed out, with a couple of exceptions such as the Write Access Password register. Knowing the password to any level, it can be entered and therefore, be granted access to SCADA. Now, enter the SCADA password that we set in **Step 3**:

Step 4: Enter SCADA password to gain level 0 access

Request: \$ 01 10 02 BB 00 08 10 31 32 33 20 20 20 20 20 20 20 20 20 20 20 xx xx

\$ 01 = slave address of EMCP 3 GSC

\$ 10 = function code (write multiple registers)

\$ 02 D3 → (1 bit offset) → \$ 02 D4 → Write Access Password

\$ 00 08 = register count (8)

\$ 10 = byte count (16)

\$ 31 32 33 20 20 20 20 20 20 20 20 20 20 20 20 20 = data (123, followed by 13 spaces)

Reply: \$ 01 10 02 BB 00 08 xx xx

\$ 02 C3 → (1 bit offset) → \$ 02 C4 → Write Access Password

\$ 00 08 = register count (8)

Again, repeat **Step 1** to verify the current security level.

Reply: \$ 01 03 02 00 00 xx xx

This verifies that the SCADA password worked, and did indeed give access to level 0 security. Notice that the level did not increase to 1 or 2 because a level 1 password is set. If the level 1 password is entered, access level 2 would be granted because there is no level 2 password set.

MORE NOTES ON SCADA PASSWORDS

Note that the SCADA password is stored as a numeric value. The password is right-justified in the field shown on the EMCP 3 GSC, and left-justified when set/written over SCADA, but it is numerically the same (00000001 is the same as 1_____ -- 1 with seven spaces after it). Just as with any number, leading zeros get dropped, and trailing zeros are kept (so 01 is stored as 1, but 10 is stored as 10).

Also, the first space terminates the string, so an entry of 12 3 (space between the 2 and the 3) will return an exception because only spaces (or nulls, after the first 8 bytes) are accepted after the first space.

SETPPOINT INTERPRETATION AND CALCULATION

This example lays out the method of reading and writing to setpoints, including the data conversion between the register data and engineering value.

Let us consider Block # 1 Setpoint # 2, Low Engine Oil Pressure Warning Event Threshold.

Reading the value, you may get:

\$ 00 A0 00 00

That corresponds to a decimal value of 655,360.

Now look at the SCALING and divide by 2^{12} to get a decimal value of 360.

The current setpoint for Low Engine Oil Pressure Warning Event Threshold is then 360 kPa.

For example: to change the Low Engine Oil Pressure Warning Event Threshold to 327.8 kPa:

1. Check the RESOLUTION. The setpoint will be rounded to the nearest 1 kPa (round 327.8 kPa to 328 kPa).
2. Next, make sure it is within the MIN and MAX range (34 to 690). It is (328 kPa).
3. Look at the SCALING and multiply by 2^{12} to get a decimal value of 1,343,488.
4. Convert it to 32-bit signed integer (see Setpoint Data Type Chapter 0) to get: \$ 00 14 80 00
5. Write this value to the New Value registers of the Setpoint Write parameter.

READING AND WRITING AVR REGISTERS AND SETPOINTS

This example demonstrates the data link commands to read setpoints, read registers, and write to registers. Furthermore, it illustrates the functionality of integration with an external Automatic Voltage Regulator.

Check the Maximum Generator Voltage Output Bias Percentage setpoint. This could be done via the display but, read the setpoint via Modbus instead.

To begin, select the setpoint that is to be read, by writing the Setpoint ID to the Setpoint ID for Read register.

Request: \$ 01 06 03 E9 00 03 06 00 6C 00 xx xx

\$ 01 = slave address of EMCP 3 GSC

\$ 06 = function code (write multiple registers)

\$ 03 E9 → (1 bit offset) → \$ 03 EA → Setpoint ID for Read

\$ 00 03 = register count

\$ 06 = byte count (2 bytes = 1 register)

\$ 00 6C 00 = setpoint # 1, block # 108, instance # 1 = Maximum Generator Voltage Output Bias Percentage

Reply: \$ 01 06 03 E9 00 03 xx xx

\$ 03 E9 → (1 bit offset) → \$ 03 EA → Setpoint ID for Read

\$ 00 03 = register count

The reply confirms that the write was successful. Read the portion of the Setpoint Information register span that contains the Value. This is register offsets 7:6 of the Setpoint Information register, or registers 1011 and 1012.

Request: \$ 01 03 03 F2 00 02 xx xx

\$ 01 = slave address of EMCP 3 GSC

\$ 03 = function code (read registers)

\$ 03 F2 → (1 bit offset) → \$ 03 F3 → Setpoint Information: Value

\$ 00 02 = register count (Setpoint Information: Value is 2 registers long)

Reply: \$ 01 03 04 00 14 00 00 xx xx

\$ 04 = byte count (2 bytes = 1 register)

\$ 00 14 00 00 → 1,310,720 → (divide by 2^{16}) → 20% max bias

So the Maximum Generator Voltage Output Bias Percentage is 20%. Read the AVR Bias Percent and the Desired Genset Output Voltage before any bias is applied.

Request: \$ 01 03 04 21 00 01 xx xx

\$ 01 = slave address of EMCP 3 GSC

\$ 03 = function code (read register)

\$ 04 21 → (1 bit offset) → \$ 04 22 → AVR Bias Percent

\$ 00 01 = register count

Reply: \$ 01 03 02 7D 80 xx xx

\$ 02 = byte count (2 bytes = 1 register)

\$ 7D 80 → 32128 → 251% → (-251% offset) → 0.0% bias

Request: \$ 01 03 04 20 00 01 xx xx

\$ 01 = slave address of EMCP 3 GSC

\$ 03 = function code (read register)

\$ 04 20 → (1 bit offset) → \$ 04 21 → Desired Genset Output Voltage

\$ 00 01 = register count

Reply: \$ 01 03 02 01 E0 xx xx

\$ 02 = byte count (2 bytes = 1 register)

\$ 01 E0 → 480V desired

To adjust the voltage, navigate to the Control menu and press the up arrow *ten* times, re-read the AVR Bias Percent register.

Request: \$ 01 03 04 21 00 01 xx xx

\$ 01 = slave address of EMCP 3 GSC

\$ 03 = function code (read register)

\$ 04 21 → (1 bit offset) → \$ 04 22 → AVR Bias Percent

\$ 00 01 = register count

Reply: \$ 01 03 02 80 00 xx xx

\$ 02 = byte count (2 bytes = 1 register)

\$ 80 00 → 32768 → 256% → (-251% offset) → 5.0% bias

This verifies that each key-press adjusts the percentage by 0.5% (since we did ten key-presses). Now we can check the actual voltage command that is sent to the AVR by reading the Desired Genset Output Voltage register.

Request: \$ 01 03 04 20 00 01 xx xx

\$ 01 = slave address of EMCP 3 GSC

\$ 03 = function code (read register)

\$ 04 20 → (1 bit offset) → \$ 04 21 → Desired Genset Output Voltage

\$ 00 01 = register count

Reply: \$ 01 03 02 01 E5 xx xx

\$ 02 = byte count (2 bytes = 1 register)

\$ 01 E5 → 485V desired

This is correct. because the AVR Bias Percent represents a percentage of the Maximum Generator Voltage Output Bias Percentage, which was 20%, the overall bias percentage is 5% (AVR Bias Percent) of 20%, which is 1%.

Therefore; 101% of 480V is 484.8V, which rounds up to 485V.

Using the AVR Bias Percent Increment Command Modbus register, re-adjust the desired voltage to nominal, which is 480V. This time however, we want to *increment* the bias by -1% (negative one percent) since the current bias is 1%.

Request: \$ 01 06 04 22 7D 00 xx xx

\$ 01 = slave address of EMCP 3 GSC

\$ 06 = function code (write single register)

\$ 04 22 → (1 bit offset) → \$ 04 23 → AVR Bias Percent Increment Command

\$ 7D 00 = 32000 → (divide by 128) = 250 → (-251 offset) → -1%

Reply: \$ 01 06 04 22 7D 00 xx xx

\$ 04 22 – echo of address

\$ 7D 00 – echo of data

Finally, re-check the AVR Bias Percent to verify that the bias has returned to zero.

Request: \$ 01 03 04 21 00 01 xx xx

\$ 01 = slave address of EMCP 3 GSC

\$ 03 = function code (read register)

\$ 04 21 → (1 bit offset) → \$ 04 22 → AVR Bias Percent

\$ 00 01 = register count

Reply: \$ 01 03 02 7D 80 xx xx

\$ 02 = byte count (2 bytes = 1 register)

\$ 7D 80 → 32128 → 251% → (-251% offset) → 0.0% bias

APPENDIX B ALPHABETIC REFERENCE OF MODBUS REGISTERS

Below is a quick-reference chart of the Modbus parameters detailed in this document. It contains the decimal register address, number of registers the parameter spans, parameter name, parameter description, and Chapter location for the information about that parameter.

TABLE 23: MODBUS CHAPTER TITLE INDEX

MODBUS CHAPTER TITLE	CHAPTER
EVENT SYSTEM	21.8
EXTERNAL DEVICE PARAMETERS	21.5
SPARE ANALOG INPUT	21.2
GENERATOR SET STATE CONTROL	21.6
MISCELLANEOUS	21.11
DATA LINK SECURITY	21.1
GENERATOR AC PARAMETERS	21.4
DISCRETE INPUTS AND OUTPUTS	21.3
ENGINE MONITORING	21.9
TIMERS AND COUNTERS	21.7
EMCP 3 GSC SETPOINTS	21.10

TABLE 24: MODBUS REGISTERS CHAPTER INDEX

ALPHABETIC REFERENCE OF MODBUS REGISTERS		
ADDRESS	PARAMETER NAME	CHAPTER
304	Acknowledge All Events Command	21.8
253	Air Filter 1 Differential Pressure from Data Link	21.5
810	Air Filter 1 Differential Pressure from I/O Pin	21.2
814	Ambient Air Temperature from I/O Pin	21.2
257	Atmospheric Pressure from Data Link	21.5
206	Automatic Start/Stop State	21.6
1058	AVR Bias Percent	21.5
1059	AVR Bias Percent Increment Command	21.5
202	Battery Voltage	21.11
249	Boost Pressure from Data Link	21.5
300	Bypass Cooldown	21.6
1276	Control S/N	21.11
1054	Cooldown Duration Remaining	21.6
248	Crankcase Pressure from Data Link	21.5
732	Current Security Level	21.1
221	Cylinder #1 Exhaust Port Temperature from Data Link	21.5
222	Cylinder #2 Exhaust Port Temperature from Data Link	21.5
223	Cylinder #3 Exhaust Port Temperature from Data Link	21.5

ALPHABETIC REFERENCE OF MODBUS REGISTERS		
ADDRESS	PARAMETER NAME	CHAPTER
224	Cylinder #4 Exhaust Port Temperature from Data Link	21.5
225	Cylinder #5 Exhaust Port Temperature from Data Link	21.5
226	Cylinder #6 Exhaust Port Temperature from Data Link	21.5
227	Cylinder #7 Exhaust Port Temperature from Data Link	21.5
228	Cylinder #8 Exhaust Port Temperature from Data Link	21.5
229	Cylinder #9 Exhaust Port Temperature from Data Link	21.5
230	Cylinder #10 Exhaust Port Temperature from Data Link	21.5
231	Cylinder #11 Exhaust Port Temperature from Data Link	21.5
232	Cylinder #12 Exhaust Port Temperature from Data Link	21.5
233	Cylinder #13 Exhaust Port Temperature from Data Link	21.5
234	Cylinder #14 Exhaust Port Temperature from Data Link	21.5
235	Cylinder #15 Exhaust Port Temperature from Data Link	21.5
236	Cylinder #16 Exhaust Port Temperature from Data Link	21.5
237	Cylinder #17 Exhaust Port Temperature from Data Link	21.5
238	Cylinder #18 Exhaust Port Temperature from Data Link	21.5
239	Cylinder #19 Exhaust Port Temperature from Data Link	21.5
240	Cylinder #20 Exhaust Port Temperature from Data Link	21.5
1057	Desired Genset Output Voltage	21.4
1097	Digital AVR Online	21.5
600	Digital Input #1 Active State	21.3
601	Digital Input #2 Active State	21.3
602	Digital Input #3 Active State	21.3
603	Digital Input #4 Active State	21.3
604	Digital Input #5 Active State	21.3
605	Digital Input #6 Active State	21.3
606	Digital Input #7 Active State	21.3
607	Digital Input #8 Active State	21.3
624	Digital Output #1 Active State	21.3
625	Digital Output #2 Active State	21.3
628	Digital Selector #1 Activate Command	21.3
638	Digital Selector #1 Commanded Value	21.3
629	Digital Selector #2 Activate Command	21.3
639	Digital Selector #2 Commanded Value	21.3
630	Digital Selector #3 Activate Command	21.3
640	Digital Selector #3 Commanded Value	21.3
631	Digital Selector #4 Activate Command	21.3
641	Digital Selector #4 Commanded Value	21.3
632	Digital Selector #5 Activate Command	21.3
642	Digital Selector #5 Commanded Value	21.3
633	Digital Selector #6 Activate Command	21.3

ALPHABETIC REFERENCE OF MODBUS REGISTERS		
ADDRESS	PARAMETER NAME	CHAPTER
643	Digital Selector #6 Commanded Value	21.3
634	Digital Selector #7 Activate Command	21.3
644	Digital Selector #7 Commanded Value	21.3
635	Digital Selector #8 Activate Command	21.3
645	Digital Selector #8 Commanded Value	21.3
636	Digital Selector #9 Activate Command	21.3
646	Digital Selector #9 Commanded Value	21.3
637	Digital Selector #10 Activate Command	21.3
647	Digital Selector #10 Commanded Value	21.3
1300	Emergency Shutdown Override Log Entry 1	21.8
1310	Emergency Shutdown Override Log Entry 2	21.8
1320	Emergency Shutdown Override Log Entry 3	21.8
1330	Emergency Shutdown Override Log Entry 4	21.8
1340	Emergency Shutdown Override Log Entry 5	21.8
1350	Emergency Shutdown Override Log Entry 6	21.8
1360	Emergency Shutdown Override Log Entry 7	21.8
1370	Emergency Shutdown Override Log Entry 8	21.8
1380	Emergency Shutdown Override Log Entry 9	21.8
1390	Emergency Shutdown Override Log Entry 10	21.8
1056	Emergency Stop Command	21.6
1091	Engine Control Online	21.5
807	Engine Coolant Level from I/O Pin	21.2
201	Engine Coolant Temperature	21.9
219	Engine Coolant Temperature from Data Link	21.5
246	Engine Fuel Temperature from Data Link	21.5
806	Engine Oil Level from I/O Pin	21.2
200	Engine Oil Pressure	21.9
217	Engine Oil Pressure from Data Link	21.5
245	Engine Oil Temperature from Data Link	21.5
800	Engine Oil Temperature from I/O Pin	21.2
204	Engine Operating Hours	21.7
301	Engine Operating Mode	21.6
302	Engine Operating Mode Command	21.6
1275	Engine Protection has Shut Down Engine	21.9
203	Engine rpm	21.9
1053	Engine Status	21.6
1499	Event Log Module Selection	21.8
1498	Event Log Module Selection Command	21.8
241	Exhaust Manifold #1 Temperature from Data Link	21.5
242	Exhaust Manifold #2 Temperature from Data Link	21.5

ALPHABETIC REFERENCE OF MODBUS REGISTERS		
ADDRESS	PARAMETER NAME	CHAPTER
2086	Exhaust Temperature from Data Link	21.5
801	Exhaust Temperature from I/O Pin	21.2
1093	External I/O #1 Online	21.5
1094	External I/O #2 Online	21.5
1095	External I/O #3 Online	21.5
1096	External I/O #4 Online	21.5
805	External Tank Fuel Level from I/O Pin	21.2
808	Fire Extinguisher Pressure from I/O Pin	21.2
252	Fuel Filter Differential Pressure from Data Link	21.5
811	Fuel Filter Differential Pressure from I/O Pin	21.2
258	Fuel Level from Data Link	21.5
804	Fuel Level from I/O Pin	21.2
247	Fuel Pressure from Data Link	21.5
101	Generator Average AC RMS Current	21.4
102	Generator Average AC RMS Frequency	21.4
100	Generator Average Line-Line AC RMS Voltage	21.4
163	Generator Average Line-Line AC RMS Voltage Percent	21.4
148	Generator Average Line-Neutral AC RMS Voltage	21.4
1067	Generator Frequency within Limits	21.4
149	Generator Front Bearing Temperature from Data Link	21.5
103	Generator Overall Power Factor	21.4
104	Generator Overall Power Factor Lagging	21.4
111	Generator Phase A AC RMS Current	21.4
123	Generator Phase A Apparent Power	21.4
108	Generator Phase A Line-Line AC RMS Voltage	21.4
114	Generator Phase A Line-Neutral AC RMS Voltage	21.4
135	Generator Phase A Power Factor	21.4
159	Generator Phase A Power Factor Lagging	21.4
129	Generator Phase A Reactive Power	21.4
117	Generator Phase A Real Power	21.4
151	Generator Phase A Winding Temperature from Data Link	21.5
112	Generator Phase B AC RMS Current	21.4
125	Generator Phase B Apparent Power	21.4
109	Generator Phase B Line-Line AC RMS Voltage	21.4
115	Generator Phase B Line-Neutral AC RMS Voltage	21.4
136	Generator Phase B Power Factor	21.4
160	Generator Phase B Power Factor Lagging	21.4
131	Generator Phase B Reactive Power	21.4
119	Generator Phase B Real Power	21.4
152	Generator Phase B Winding Temperature from Data Link	21.5

ALPHABETIC REFERENCE OF MODBUS REGISTERS		
ADDRESS	PARAMETER NAME	CHAPTER
113	Generator Phase C AC RMS Current	21.4
127	Generator Phase C Apparent Power	21.4
110	Generator Phase C Line-Line AC RMS Voltage	21.4
116	Generator Phase C Line-Neutral AC RMS Voltage	21.4
137	Generator Phase C Power Factor	21.4
161	Generator Phase C Power Factor Lagging	21.4
133	Generator Phase C Reactive Power	21.4
121	Generator Phase C Real Power	21.4
153	Generator Phase C Winding Temperature from Data Link	21.5
150	Generator Rear Bearing Temperature from Data Link	21.5
162	Generator Rear Bearing Temperature from I/O Pin	21.2
138	Generator Total Apparent Power	21.4
146	Generator Total kVAr Hours Export	21.4
144	Generator Total kW Hours Export	21.4
140	Generator Total Percent kVA	21.4
143	Generator Total Percent kVAr	21.4
105	Generator Total Percent kW	21.4
141	Generator Total Reactive Power	21.4
106	Generator Total Real Power	21.4
1068	Generator Voltage within Limits	21.4
1090	Genset Control Online	21.5
256	Instantaneous Fuel Consumption from Data Link	21.5
243	Intake Manifold #1 Temperature from Data Link	21.5
244	Intake Manifold #2 Temperature from Data Link	21.5
310	Key Press	21.1
303	Lamp Test Command	21.11
802	Left Manifold Exhaust Temperature from I/O Pin	21.2
708	Level 1 Password	21.1
716	Level 2 Password	21.1
734	Level 3 Password Phone In Prompt	21.1
1034	Log Entry	21.8
1033	Log Entry Index	21.8
2091	Manual Fuel Priming Duration Remaining	21.9
1500	Module Event Log Entry 1	21.8
1514	Module Event Log Entry 2	21.8
1528	Module Event Log Entry 3	21.8
1542	Module Event Log Entry 4	21.8
1556	Module Event Log Entry 5	21.8
1570	Module Event Log Entry 6	21.8
1584	Module Event Log Entry 7	21.8

ALPHABETIC REFERENCE OF MODBUS REGISTERS		
ADDRESS	PARAMETER NAME	CHAPTER
1598	Module Event Log Entry 8	21.8
1612	Module Event Log Entry 9	21.8
1626	Module Event Log Entry 10	21.8
1640	Module Event Log Entry 11	21.8
1654	Module Event Log Entry 12	21.8
1668	Module Event Log Entry 13	21.8
1682	Module Event Log Entry 14	21.8
1696	Module Event Log Entry 15	21.8
1710	Module Event Log Entry 16	21.8
1724	Module Event Log Entry 17	21.8
1738	Module Event Log Entry 18	21.8
1752	Module Event Log Entry 19	21.8
1766	Module Event Log Entry 20	21.8
259	Net Battery Current from Data Link	21.5
213	Number of Crank Attempts	21.7
215	Number of Successful Starts	21.7
251	Oil Filter Differential Pressure from Data Link	21.5
809	Oil Filter Differential Pressure from I/O Pin	21.2
900	Real Time Clock	21.7
616	Relay Output #1 Active State	21.3
617	Relay Output #2 Active State	21.3
618	Relay Output #3 Active State	21.3
619	Relay Output #4 Active State	21.3
620	Relay Output #5 Active State	21.3
621	Relay Output #6 Active State	21.3
622	Relay Output #7 Active State	21.3
623	Relay Output #8 Active State	21.3
1055	Remote Initiate Command	21.6
1060	Requested Engine Speed	21.9
1028	Reset Crank Attempt Counter	21.7
1048	Reset Event	21.8
1031	Reset kVAr Hour Meter	21.7
1030	Reset kW Hour Meter	21.7
1032	Reset Service Interval Counter	21.7
1029	Reset Successful Start Counter	21.7
803	Right Manifold Exhaust Temperature from I/O Pin	21.2
1098	RTD Module Online	21.5
724	SCADA Password	21.1
1092	Secondary Engine Control Online	21.5
212	Service Maintenance Interval Days Remaining	21.7

ALPHABETIC REFERENCE OF MODBUS REGISTERS		
ADDRESS	PARAMETER NAME	CHAPTER
210	Service Maintenance Interval Hours Remaining	21.7
299	Service Maintenance Interval Weeks Remaining	21.7
1022	Setpoint Data Value	21.10
1002	Setpoint ID for Read	21.10
1005	Setpoint Information	21.10
1017	Setpoint Write	21.10
207	Spare Analog Input Percentage	21.2
209	Spare Analog Input Pressure	21.2
208	Spare Analog Input Temperature	21.2
1061	Speed Bias Percent	21.5
1062	Speed Bias Percent Increment Command	21.5
813	Starting Air Pressure from I/O Pin	21.2
334	System Event Count	21.8
335	System Event Lamp Status	21.8
1099	Thermocouple #1 Online	21.5
1100	Thermocouple #2 Online	21.5
254	Total Fuel Consumption from Data Link	21.5
2074	Turbocharger 1 Compressor Inlet Temperature	21.5
2078	Turbocharger 1 Turbine Inlet Temperature	21.5
2079	Turbocharger 1 Turbine Outlet Temperature	21.5
2075	Turbocharger 2 Compressor Inlet Temperature	21.5
2080	Turbocharger 2 Turbine Inlet Temperature	21.5
2081	Turbocharger 2 Turbine Outlet Temperature	21.5
2076	Turbocharger 3 Compressor Inlet Temperature	21.5
2082	Turbocharger 3 Turbine Inlet Temperature	21.5
2083	Turbocharger 3 Turbine Outlet Temperature	21.5
2077	Turbocharger 4 Compressor Inlet Temperature	21.5
2084	Turbocharger 4 Turbine Inlet Temperature	21.5
2085	Turbocharger 4 Turbine Outlet Temperature	21.5
903	Update Real Time Clock Command	21.7
700	Write Access Password	21.1
733	Write Current Security Level	21.1

APPENDIX C BLOCKS FOR SETPOINT CONFIGURATION

This appendix contains information on the various software blocks in the EMCP 3 GSC. Blocks are functional groups of setpoints. Blocks can occur in multiple instances, and in order to program a setpoint, the block number as well as the instance number must be referenced.

These numbers reflect the standard production software. For custom designed-to-order (DTO) software, consult your DTO contact.

TABLE 25: BLOCKS FOR SETPOINT CONFIGURATION

BLOCK #	BLOCK NAME	EMCP 3.2 GSC NUMBER OF INSTANCES	EMCP 3.3 GSC NUMBER OF INSTANCES
1	Engine Oil Pressure Monitor	1	1
2	Programmable Cycle Timer	1	1
4	Engine Coolant Temperature Monitor	1	1
6	Engine Speed Monitor	1	1
7	Battery Voltage Monitor	1	1
8	Engine Operating Hours Monitor	1	1
9	Crank Attempt/Successful Start Counter	1	1
10	Engine Protection Events Configuration	1	1
11	Generator Protection Events Configuration	1	1
12	Other System Events Configuration	1	1
17	Diagnostics Configuration	1	1
18	Automatic Start/Stop	1	1
19	Generator AC Monitor	1	1
21	Generator Over/Under Voltage	1	1
22	Generator Over/Under Frequency	1	1
23	Generator Over Current	1	1
24	Generator Reverse Power	0	1
26	Programmable Trip Point Function	1	1
34	Utility Breaker Control	0	0
35	Generator Breaker Control	0	0
53	Digital Inputs	8	8
56	Relay Outputs	8	8
72	Event System	1	1
75	Electronic Control Module Reduced Power Mode	1	1
88	Digital Outputs	1	2
94	Data Link - SCADA	1	1
96	Enhanced Engine Monitor	0	1
97	Event Output Functions	1	1
98	Generator AC Power Monitor	1	1
100	Service Maintenance Interval	1	1
102	Governor Desired Engine Speed Request	1	1
104	Digital Selectors	8	8
105	Event Input Functions	6	6
106	Spare Analog Input	1	1
107	Transfer Switch	0	0
108	AVR Desired Voltage Request	1	1
109	Enhanced Generator Monitor	0	1

APPENDIX D SETPOINT INFORMATION FOR CONFIGURATION

TABLE 26: SETPOINT INFORMATION FOR SETPOINT CONFIGURATION

SETPOINT INFORMATION FOR SETPOINT CONFIGURATION								
BLK #	SP #	SETPOINT NAME	SECURITY LEVEL	SCALE	MIN	MAX	RESOLUTION	UNITS
1	1	Engine Oil Pressure Sensor Configuration	Lvl 3	0	Setpoint Value List			
	2	Low Engine Oil Pressure Warning Event Threshold	Lvl 2	12	34	690	1	kPa
	3	Low Idle Low Engine Oil Pressure Warning Event Threshold	Lvl 2	12	34	690	1	kPa
	4	Low Engine Oil Pressure Warning Event Notification Delay Time	Lvl 2	4	0	30	1	seconds
	5	Low Engine Oil Pressure Shutdown Event Threshold	Lvl 2	12	34	690	1	kPa
	6	Low Idle Low Engine Oil Pressure Shutdown Event Threshold	Lvl 2	12	34	690	1	kPa
	7	Low Engine Oil Pressure Shutdown Event Notification Delay Time	Lvl 2	4	0	30	1	seconds
	8	Low Engine Oil Pressure Step Speed	Lvl 2	12	400	1800	1	rpm
	9	Oil Pressure Sensor Map Selection Number	Lvl 3	0	1	5	1	N/A
2	1	Programmable Cycle Timer #1 Activation Day of the Week	Lvl 1	0	0	127	1	N/A
	2	Programmable Cycle Timer #1 Activation Start Time	Lvl 1	0	00:00	23:59	00:01	hours
	3	Programmable Cycle Timer #1 Active Time	Lvl 1	0	00:01	24:00	00:01	hours
	4	Programmable Cycle Timer #1 Output #1 Activation Configuration	Lvl 1	0	Setpoint Value List			
	5	Programmable Cycle Timer #1 Output #2 Activation Configuration	Lvl 1	0	Setpoint Value List			
4	1	Engine Coolant Temperature Sensor Configuration	Lvl 3	0	Setpoint Value List			
	2	High Engine Coolant Temperature Warning Event Threshold	Lvl 2	12	49	120	1	deg. C
	3	High Engine Coolant Temperature Warning Event Notification Delay Time	Lvl 2	4	0	30	1	seconds
	4	High Engine Coolant Temperature Shutdown Event Threshold	Lvl 2	12	49	120	1	deg. C
	5	High Engine Coolant Temperature Shutdown Event Notification Delay Time	Lvl 2	4	0	30	1	seconds
	6	Low Engine Coolant Temperature Warning Event Threshold	Lvl 2	12	0	36	1	deg. C
	7	Low Engine Coolant Temperature Warning Event Notification Delay Time	Lvl 2	4	0	30	1	seconds
	8	Coolant Temperature Sensor Map Selection Number	Lvl 3	0	1	5	1	N/A
6	1	Flywheel Teeth	Lvl 3	0	95	350	1	N/A
	2	Engine Over Speed Shutdown Threshold	Lvl 3	12	400	4330	1	rpm
	3	Engine Under Speed Warning Event Threshold	Lvl 3	12	400	4330	1	rpm
	4	Engine Under Speed Warning Event Notification Delay Time	Lvl 2	4	0.0	20.0	0.1	seconds
	5	Engine Under Speed Shutdown Event Threshold	Lvl 3	12	400	4330	1	rpm
	6	Engine Under Speed Shutdown Event Notification Delay Time	Lvl 2	4	0.0	20.0	0.1	seconds
	7	Engine Speed Sensor Configuration	Svc Tool	0	Setpoint Value List			
7	1	High Battery Voltage Warning Event Threshold	Lvl 1	12	12	50	0.1	V DC
	2	High Battery Voltage Warning Event Notification Delay Time	Lvl 1	4	0	240	1	seconds
	3	High Battery Voltage Shutdown Event Threshold	Lvl 1	12	12.0	50.0	0.1	V DC
	4	High Battery Voltage Shutdown Event Notification Delay Time	Lvl 1	4	0	240	1	seconds

SETPOINT INFORMATION FOR SETPOINT CONFIGURATION								
BLK #	SP #	SETPOINT NAME	SECURITY LEVEL	SCALE	MIN	MAX	RESOLUTION	UNITS
	5	Low Battery Voltage Warning Event Threshold	Lvl 1	12	0.0	25.0	0.1	V DC
	6	Low Battery Voltage Warning Event Notification Delay Time	Lvl 1	4	0	240	1	seconds
	7	Low Battery Charging System Voltage Warning Event Threshold	Lvl 1	12	0.0	30.0	0.1	V DC
	8	Low Battery Charging System Voltage Warning Event Notification Delay Time	Lvl 1	4	0	240	1	seconds
9	1	Customer Password Security Level to Reset Crank/Start Counters	Lvl 3	0	0	4	1	N/A
10	1	Air Damper Closed Event Response Configuration	Lvl 2	0	0	266	N/A	BitMask [†]
	2	High Air Filter Differential Pressure Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	3	High Air Filter Differential Pressure Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	4	Low Air Filter Differential Pressure Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	5	Low Air Filter Differential Pressure Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	6	Emergency Stop Activated Event Response Configuration	Lvl 2	0	8	106	N/A	BitMask [†]
	7	High Engine Coolant Level Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	8	High Engine Coolant Level Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	9	Low Engine Coolant Level Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	10	Low Engine Coolant Level Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	11	High Engine Coolant Temperature Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	12	High Engine Coolant Temperature Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	13	Low Engine Coolant Temperature Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	14	Engine Failure to Start Shutdown Event Response Configuration	Lvl 2	0	8	106	N/A	BitMask [†]
	15	High Engine Oil Level Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	16	High Engine Oil Level Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	17	Low Engine Oil Level Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	18	Low Engine Oil Level Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	19	Low Engine Oil Pressure Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	20	Low Engine Oil Pressure Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	21	High Engine Oil Temperature Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	22	High Engine Oil Temperature Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	23	Low Engine Oil Temperature Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	24	Low Engine Oil Temperature Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	25	Unexpected Engine Shutdown Event Response	Lvl 2	0	8	106	N/A	BitMask [†]

[†] See APPENDIX F Bitmask Value Lists, on how to set the setpoint value.

[†] See APPENDIX F Bitmask Value Lists, on how to set the setpoint value.

SETPOINT INFORMATION FOR SETPOINT CONFIGURATION								
BLK #	SP #	SETPOINT NAME	SECURITY LEVEL	SCALE	MIN	MAX	RESOLUTION	UNITS
		Configuration						
	26	Engine Over Speed Shutdown Event Response Configuration	Lvl 2	0	8	106	N/A	BitMask [†]
	27	Engine Under Speed Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	28	Engine Under Speed Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	29	High Exhaust Temperature Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	30	High Exhaust Temperature Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	31	Low Exhaust Temperature Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	32	Low Exhaust Temperature Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	33	High Right Exhaust Temperature Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	34	High Right Exhaust Temperature Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	35	Low Right Exhaust Temperature Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	36	Low Right Exhaust Temperature Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	37	High Left Exhaust Temperature Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	38	High Left Exhaust Temperature Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	39	Low Left Exhaust Temperature Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	40	Low Left Exhaust Temperature Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	41	High Fuel Filter Differential Pressure Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	42	High Fuel Filter Differential Pressure Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	43	Low Fuel Filter Differential Pressure Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	44	Low Fuel Filter Differential Pressure Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	45	High Fuel Level Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	46	High Fuel Level Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	47	Low Fuel Level Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	48	Low Fuel Level Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	49	External Tank High Fuel Level Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	50	External Tank High Fuel Level Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	51	External Tank Low Fuel Level Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	52	External Tank Low Fuel Level Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	53	Fuel Leak Event Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	54	High Engine Oil Filter Differential Pressure Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]

[†] See APPENDIX F Bitmask Value Lists, on how to set the setpoint value.

SETPOINT INFORMATION FOR SETPOINT CONFIGURATION								
BLK #	SP #	SETPOINT NAME	SECURITY LEVEL	SCALE	MIN	MAX	RESOLUTION	UNITS
	55	High Engine Oil Filter Differential Pressure Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	56	Low Engine Oil Filter Differential Pressure Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	57	Low Engine Oil Filter Differential Pressure Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	58	Service Maintenance Interval Warning Event Response Configuration	Svc Tool	0	0	3	N/A	BitMask [†]
	59	High Starting Air Pressure Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	60	High Starting Air Pressure Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	61	Low Starting Air Pressure Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	62	Low Starting Air Pressure Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	63	High Gas Pressure Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	64	High Gas Pressure Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	65	Low Gas Pressure Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	66	Low Gas Pressure Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	67	Engine Inlet Manifold Charge Combustion Event Response Configuration	Lvl 3	0	0	511	N/A	BitMask [†]
11	1	High Generator Bearing #1 Temperature Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	2	High Generator Bearing #1 Temperature Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	3	Low Generator Bearing #1 Temperature Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	4	Low Generator Bearing #1 Temperature Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	5	Generator Over Current (Amp) Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	6	Generator Over Current (Amp) Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	7	Generator Over Frequency Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	8	Generator Over Frequency Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	9	Generator Under Frequency Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	10	Generator Under Frequency Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	11	Generator Reverse Power Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	12	Generator Reverse Power Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	13	Generator Over Voltage Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	14	Generator Over Voltage Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	15	Generator Under Voltage Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	16	Generator Under Voltage Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	17	Earth Fault Event Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]

[†] See APPENDIX F Bitmask Value Lists, on how to set the setpoint value.

SETPOINT INFORMATION FOR SETPOINT CONFIGURATION								
BLK #	SP #	SETPOINT NAME	SECURITY LEVEL	SCALE	MIN	MAX	RESOLUTION	UNITS
	18	High Generator Winding #1 Temperature Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	19	High Generator Winding #1 Temperature Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	20	High Generator Winding #2 Temperature Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	21	High Generator Winding #2 Temperature Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	22	High Generator Winding #3 Temperature Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	23	High Generator Winding #3 Temperature Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	23	High Generator Winding #3 Temperature Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
12	1	High Ambient Air Temperature Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	2	High Ambient Air Temperature Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	3	Low Ambient Air Temperature Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	4	Low Ambient Air Temperature Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	5	Automatic Transfer Switch in Normal Position Event Response Configuration	Lvl 2	0	0	259	N/A	BitMask [†]
	6	Automatic Transfer Switch in Emergency Position Event Response Configuration	Lvl 2	0	0	259	N/A	BitMask [†]
	7	High Battery Voltage Warning Event Response Configuration	Lvl 1	0	0	99	N/A	BitMask [†]
	8	High Battery Voltage Shutdown Event Response Configuration	Lvl 1	0	0	110	N/A	BitMask [†]
	9	Low Battery Voltage Warning Event Response Configuration	Lvl 1	0	0	227	N/A	BitMask [†]
	10	Low Battery Charging System Voltage Warning Event Response Configuration	Lvl 1	0	0	227	N/A	BitMask [†]
	11	Generator Breaker Failure to Open Event Response Configuration	Lvl 3	0	0	111	N/A	BitMask [†]
	12	Generator Breaker Failure to Close Event Response Configuration	Lvl 3	0	0	111	N/A	BitMask [†]
	13	Generator Breaker Open Event Response Configuration	Lvl 1	0	0	259	N/A	BitMask [†]
	14	Generator Breaker Closed Event Response Configuration	Lvl 1	0	0	259	N/A	BitMask [†]
	15	Utility Breaker Failure to Open Event Response Configuration	Lvl 3	0	0	111	N/A	BitMask [†]
	16	Utility Breaker Failure to Close Event Response Configuration	Lvl 3	0	0	115	N/A	BitMask [†]
	17	Utility Breaker Open Event Response Configuration	Lvl 1	0	0	259	N/A	BitMask [†]
	18	Utility Breaker Closed Event Response Configuration	Lvl 1	0	0	259	N/A	BitMask [†]
	19	Emergency Shutdown Override Mode Active Warning Event Response Configuration	Lvl 2	0	1	3	N/A	BitMask [†]
	20	Engine in Cooldown Event Response Configuration	Lvl 1	0	0	259	N/A	BitMask [†]
	21	Engine Speed-Generator Output Frequency Mismatch Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	22	High Fire Extinguisher Pressure Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	23	High Fire Extinguisher Pressure Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	24	Low Fire Extinguisher Pressure Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	25	Low Fire Extinguisher Pressure Shutdown Event	Lvl 2	0	0	238	N/A	BitMask [†]

[†] See APPENDIX F Bitmask Value Lists, on how to set the setpoint value.

SETPOINT INFORMATION FOR SETPOINT CONFIGURATION								
BLK #	SP #	SETPOINT NAME	SECURITY LEVEL	SCALE	MIN	MAX	RESOLUTION	UNITS
		Response Configuration						
	26	Generator Control Not in Automatic Warning Event Response Configuration	Lvl 1	0	0	259	N/A	BitMask [†]
	27	Loss of Utility Event Response Configuration	Lvl 1	0	0	371	N/A	BitMask [†]
	28	Utility to Generator Transfer Failure Warning Event Response Configuration	Lvl 2	0	0	99	N/A	BitMask [†]
	29	Utility to Generator Transfer Failure Shutdown Event Response Configuration	Lvl 2	0	0	110	N/A	BitMask [†]
	30	Generator to Utility Transfer Failure Warning Event Response Configuration	Lvl 2	0	0	115	N/A	BitMask [†]
	31	Generator Breaker Locked Out Warning Event Response Configuration	Lvl 2	0	0	367	N/A	BitMask [†]
	32	Utility Breaker Locked Out Warning Event Response Configuration	Lvl 2	0	0	371	N/A	BitMask [†]
	33	Earth Leakage Event Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	34	Custom Event #1 High Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	35	Custom Event #1 High Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	36	Custom Event #1 Low Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	37	Custom Event #1 Low Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	38	Custom Event #1 Event Response Configuration	Lvl 2	0	0	511	N/A	BitMask [†]
	39	Custom Event #2 High Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	40	Custom Event #2 High Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	41	Custom Event #2 Low Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	42	Custom Event #2 Low Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	43	Custom Event #2 Event Response Configuration	Lvl 2	0	0	511	N/A	BitMask [†]
	44	Custom Event #3 High Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	45	Custom Event #3 High Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	46	Custom Event #3 Low Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	47	Custom Event #3 Low Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	48	Custom Event #3 Event Response Configuration	Lvl 2	0	0	511	N/A	BitMask [†]
	49	Custom Event #4 High Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	50	Custom Event #4 High Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	51	Custom Event #4 Low Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	52	Custom Event #4 Low Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	53	Custom Event #4 Event Response Configuration	Lvl 2	0	0	511	N/A	BitMask [†]
	54	Custom Event #5 High Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	55	Custom Event #5 High Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	56	Custom Event #5 Low Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	57	Custom Event #5 Low Shutdown Event Response	Lvl 2	0	0	238	N/A	BitMask [†]

[†] See APPENDIX F Bitmask Value Lists, on how to set the setpoint value.

SETPOINT INFORMATION FOR SETPOINT CONFIGURATION								
BLK #	SP #	SETPOINT NAME	SECURITY LEVEL	SCALE	MIN	MAX	RESOLUTION	UNITS
		Configuration						
	58	Custom Event #5 Event Response Configuration	Lvl 2	0	0	511	N/A	BitMask [†]
	59	Custom Event #6 High Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	60	Custom Event #6 High Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	61	Custom Event #6 Low Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	62	Custom Event #6 Low Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	63	Custom Event #6 Event Response Configuration	Lvl 2	0	0	511	N/A	BitMask [†]
	64	Custom Event #7 High Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	65	Custom Event #7 High Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	66	Custom Event #7 Low Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	67	Custom Event #7 Low Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	68	Custom Event #7 Event Response Configuration	Lvl 2	0	0	511	N/A	BitMask [†]
	69	Custom Event #8 High Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	70	Custom Event #8 High Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	71	Custom Event #8 Low Warning Event Response Configuration	Lvl 2	0	0	227	N/A	BitMask [†]
	72	Custom Event #8 Low Shutdown Event Response Configuration	Lvl 2	0	0	238	N/A	BitMask [†]
	73	Custom Event #8 Event Response Configuration	Lvl 2	0	0	511	N/A	BitMask [†]
	122	Utility Breaker System Fault Event Response Configuration	Lvl 2	0	0	115	N/A	BitMask [†]
	123	EPS Supplying Load Event Response Configuration	Lvl 2	0	0	259	N/A	BitMask [†]
17	1	Accessory Data Link Diagnostic Response Configuration	Svc Tool	0	0	111	N/A	BitMask [†]
	2	Air Filter Differential Pressure Sensor Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	3	Ambient Air Temperature Sensor Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	4	Digital Output #1 Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	5	Digital Output #2 Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	6	Engine Coolant Level Sensor Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	7	Engine Coolant Temperature Sensor Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	8	Engine Oil Level Sensor Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	9	Engine Oil Pressure Sensor Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	10	Engine Oil Temperature Sensor Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	11	Engine Speed Sensor Diagnostic Response Configuration	Lvl 2	0	8	106	N/A	BitMask [†]
	12	Exhaust Temperature Sensor Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	13	Right Exhaust Temperature Sensor Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]

[†] See APPENDIX F Bitmask Value Lists, on how to set the setpoint value.

SETPOINT INFORMATION FOR SETPOINT CONFIGURATION								
BLK #	SP #	SETPOINT NAME	SECURITY LEVEL	SCALE	MIN	MAX	RESOLUTION	UNITS
	14	Left Exhaust Temperature Sensor Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	15	Fire Extinguisher Pressure Sensor Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	16	Fuel Filter Differential Pressure Sensor Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	17	Fuel Level Sensor Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	18	External Tank Fuel Level Sensor Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	19	Generator Bearing #1 Temperature Sensor Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	20	Generator Output Sensing System Diagnostic Response Configuration	Svc Tool	0	0	111	N/A	BitMask [†]
	21	Engine Oil Filter Differential Pressure Sensor Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	22	Primary Data Link Diagnostic Response Configuration	Lvl 3	0	0	111	N/A	BitMask [†]
	23	SCADA Data Link Diagnostic Response Configuration	Lvl 2	0	0	239	N/A	BitMask [†]
	24	Starting Air Pressure Sensor Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	25	Battery Charger Failure Diagnostic Response Configuration	Lvl 2	0	0	259	N/A	BitMask [†]
	26	Multiple Genset Control Data Link Communication Failure Diagnostic Response Configuration	Lvl 2	0	1	363	N/A	BitMask [†]
	27	Multiple Genset Control Data Link Configuration Error Diagnostic Response Configuration	Lvl 2	0	1	363	N/A	BitMask [†]
	28	Control is Offline Multiple Genset Control Data Link Diagnostic Response Configuration	Lvl 2	0	1	259	N/A	BitMask [†]
	29	Digital Output #3 Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	30	Digital Output #4 Diagnostic Response Configuration	Lvl 2	0	0	111	N/A	BitMask [†]
	31	Engine Controller Not Responding Diagnostic Response Configuration	Lvl 3	0	0	111	N/A	BitMask [†]
18	1	Engine Start Fault Protection Activation Delay Time	Lvl 2	4	0	300	1	seconds
	2	Crank Duration	Lvl 2	4	5	300	1	seconds
	3	Crank Cycle Rest Interval	Lvl 2	4	5	300	1	seconds
	4	Engine Purge Cycle Time	Lvl 2	4	0	20	1	seconds
	5	Maximum Number of Crank Cycles	Lvl 2	0	1	20	1	N/A
	6	Cooldown Duration	Lvl 2	12	0	30	1	minutes
	7	Start Aid Activation Time	Lvl 2	4	0	240	1	seconds
	8	Crank Alert Activation Time	Lvl 1	4	0	60	1	seconds
	9	Crank Terminate RPM	Lvl 3	12	100	1000	1	rpm
	10	Engine Fuel Type Configuration	Svc Tool	0	Setpoint Value List			
	11	Fuel Shutoff Solenoid Type Configuration	Svc Tool	0	Setpoint Value List			
	12	Engine Type Configuration	Svc Tool	0	Setpoint Value List			
	13	Engine Controller J1939 Data Link Support Configuration	Svc Tool	0	Setpoint Value List			
	14	Engine Cooldown Speed Configuration	Lvl 2	0	Setpoint Value List			
	15	Engine Operating State Input Configuration	Svc Tool	0	Setpoint Value List			
	16	Engine Idle Operation Enable Status	Svc Tool	0	Setpoint Value List			
	17	Engine Fuel Priming Feature Enable Status	Svc Tool	0	Setpoint Value List			
19	1	Generator Connection Configuration	Lvl 3	0	Setpoint Value List			
	2	Generator Potential Transformer Primary Winding Rating	Lvl 3	12	1	50000	1	V

[†] See APPENDIX F Bitmask Value Lists, on how to set the setpoint value.

SETPOINT INFORMATION FOR SETPOINT CONFIGURATION								
BLK #	SP #	SETPOINT NAME	SECURITY LEVEL	SCALE	MIN	MAX	RESOLUTION	UNITS
	3	Generator Potential Transformer Secondary Winding Rating	Lvl 3	12	1	240	1	V
	4	Generator Current Transformer Primary Winding Rating	Lvl 3	12	1	7000	1	A
	5	Generator Current Transformer Secondary Winding Rating	Lvl 3	12	1	5	4	A
	6	Number of Generator Poles	Svc Tool	0	0	200	2	N/A
	7	Generator Rated Frequency	Lvl 3	0	Setpoint Value List			
	8	Generator Rated Voltage	Lvl 2	12	100	50000	1	V
	9	Generator Rated Power	Lvl 3	12	1	50000	1	kW
	10	Generator Rated Apparent Power	Lvl 3	12	1	50000	1	kVA
21	1	Generator Over Voltage Warning Event Percentage Threshold	Lvl 2	16	100	125	1	%
	2	Generator Over Voltage Warning Event Notification Delay Time	Lvl 2	4	0	120	1	seconds
	3	Generator Over Voltage Shutdown Event Percentage Threshold	Lvl 2	16	100	125	1	%
	4	Generator Over Voltage Shutdown Event Notification Delay Time	Lvl 2	4	0	120	1	seconds
	5	Generator Under Voltage Warning Event Percentage Threshold	Lvl 2	16	60	100	1	%
	6	Generator Under Voltage Warning Event Notification Delay Time	Lvl 2	4	0	120	1	seconds
	7	Generator Under Voltage Shutdown Event Threshold	Lvl 2	16	60	100	1	%
	8	Generator Under Voltage Shutdown Event Notification Delay Time	Lvl 2	4	0	120	N/A	seconds
22	1	Generator Over Frequency Warning Event Percentage Threshold	Lvl 2	16	80	120	0.1	%
	2	Generator Over Frequency Warning Event Notification Delay Time	Lvl 2	4	0	120	1	seconds
	3	Generator Over Frequency Shutdown Event Percentage Threshold	Lvl 2	16	80.0	120.0	0.1	%
	4	Generator Over Frequency Shutdown Event Notification Delay Time	Lvl 2	4	0	120	1	seconds
	5	Generator Under Frequency Warning Event Percentage Threshold	Lvl 2	16	80.0	120.0	0.1	%
	6	Generator Under Frequency Warning Event Notification Delay Time	Lvl 2	4	0	120	1	seconds
	7	Generator Under Frequency Shutdown Event Percentage Threshold	Lvl 2	16	80.0	120.0	0.1	%
	8	Generator Under Frequency Shutdown Event Notification Delay Time	Lvl 2	4	0	120	1	seconds
23	1	Generator Definite Time Over Current (Amp) Warning Event Percentage Threshold	Lvl 2	16	80	130	1	%
	2	Generator Inverse Time Over Current (Amp) Shutdown Event Time Multiplier	Lvl 2	16	0.05	10.00	0.01	seconds
	3	Generator Definite Time Over Current (Amp) Shutdown Event Percentage Threshold	Lvl 2	16	100	300	1	%
	4	Generator Definite Time Over Current (Amp) Shutdown Event Notification Delay Time	Lvl 2	4	0.1	20.0	0.1	seconds
24	1	Generator Reverse Power Warning Event Percentage Threshold	Lvl 2	16	1	20	1	%
	2	Generator Reverse Power Warning Event Notification Delay Time	Lvl 2	4	0	30	1	seconds
	3	Generator Reverse Power Shutdown Event Percentage Threshold	Lvl 2	16	1	20	1	%
	4	Generator Reverse Power Shutdown Event Notification Delay Time	Lvl 2	4	0	30	1	seconds
26	1	Programmable Trip Point Function #1 Trigger Condition	Lvl 2	0	Setpoint Value List			

SETPOINT INFORMATION FOR SETPOINT CONFIGURATION								
BLK #	SP #	SETPOINT NAME	SECURITY LEVEL	SCALE	MIN	MAX	RESOLUTION	UNITS
	2	Programmable Trip Point Function #1 Percentage Threshold	Lvl 2	16	-100	100	1	%
	3	Programmable Trip Point Function #1 Hysteresis Percentage	Lvl 2	16	0	100	1	%
	4	Programmable Trip Point Function #1 Trip Activation Delay Time	Lvl 2	4	0	120	1	seconds
	5	Programmable Trip Point Function #1 Trip Deactivation Delay Time	Lvl 2	4	0	120	1	seconds
34	1	Utility Breaker Closing Pulse Active Time	Lvl 3	4	0.1	10	0.1	seconds
	2	Utility Breaker Closing Pulse Rest Interval	Lvl 3	4	0	60	1	seconds
	3	Utility Breaker Maximum Closing Time	Lvl 3	4	1	120	1	seconds
	4	Utility Breaker Maximum Opening Time	Lvl 3	4	1	20	1	seconds
	5	Utility Breaker Lockout Configuration	Lvl 2	0	Setpoint Value List			
	6	Utility Breaker Type Configuration	Lvl 3	0	Setpoint Value List			
	7	Automatic Utility Breaker Control Source Configuration	Lvl 3	0	Setpoint Value List			
35	1	Generator Breaker Closing Pulse Active Time	Lvl 3	4	0.1	10	0.1	seconds
	2	Generator Breaker Closing Pulse Rest Interval	Lvl 3	4	0	60	1	seconds
	3	Generator Breaker Maximum Closing Time	Lvl 3	4	1	120	1	seconds
	4	Generator Breaker Maximum Opening Time	Lvl 3	4	1	20	1	seconds
	5	Generator Breaker Lockout Configuration	Lvl 2	0	Setpoint Value List			
	6	Generator Breaker Type Configuration	Lvl 3	0	Setpoint Value List			
	7	Automatic Generator Breaker Control Source Configuration	Lvl 3	0	Setpoint Value List			
53	1	Digital Input #NN Active State Configuration	Lvl 2	0	Setpoint Value List			
56	1	Relay Output #N Active State Configuration	read-only	0	Setpoint Value List			
72	1	Event Warning Condition Response Auto Reset Enable Status	Svc Tool	0	Setpoint Value List			
	2	Event Audible Alert Response Auto Reset Enable Status	Svc Tool	0	Setpoint Value List			
	3	Event Loss of Utility Response Auto Reset Enable Status	Svc Tool	0	Setpoint Value List			
	4	Event Breaker #1 Trip Response Auto Reset Enable Status	Svc Tool	0	Setpoint Value List			
	5	Event Breaker #2 Trip Response Auto Reset Enable Status	Svc Tool	0	Setpoint Value List			
75	1	Electronic Control Module Reduced Power Mode Enable Status	Lvl 3	0	Setpoint Value List			
	2	Electronic Control Module Reduced Power Mode Delay Time	Lvl 2	4	1	120	1	minutes
88	1	Digital Output #N Active State Configuration	Lvl 2	0	Setpoint Value List			
94	1	SCADA Data Link Baud Rate	Lvl 2	0	Setpoint Value List			
	2	SCADA Data Link Parity	Lvl 2	0	Setpoint Value List			
	3	SCADA Data Link Slave Address	Lvl 2	0	1	247	1	N/A
	4	SCADA Data Link Access Password	Lvl 2	0	0	0xffffffff	1	N/A
	5	SCADA Data Link Connection Timeout Interval	Lvl 2	4	0.1	3600.0	0.1	seconds
	6	RS-485 Bias Resistor Enable Status	Lvl 2	0	Setpoint Value List			
96	1	Engine Cylinder Temperature Sensor Installation Status	Lvl 2	0	Setpoint Value List			
	2	Number of Engine Cylinders	Lvl 2	0	1	20	1	N/A
97	1	Event Output Function #1 Trigger Condition	Lvl 2	0	Setpoint Value List			
	2	Event Output Function #1 Suspect Parameter Number	Lvl 2	0	Setpoint Value List			
98	1	Customer Password Security Level to Reset Generator Energy Meters	Lvl 3	0	0	3	1	N/A
100	1	Service Maintenance Interval Hours	Svc Tool	0	0	2000	1	hours
	2	Service Maintenance Interval Days	Svc Tool	0	0	365	1	days
	3	Customer Password Security Level to Reset Service Maintenance Interval	Lvl 3	0	0	4	1	N/A

SETPOINT INFORMATION FOR SETPOINT CONFIGURATION								
BLK #	SP #	SETPOINT NAME	SECURITY LEVEL	SCALE	MIN	MAX	RESOLUTION	UNITS
102	1	Maximum Engine Speed Bias	Lvl 2	12	0	400	1	rpm
	2	Generator Nominal Output Frequency	Lvl 2	12	40	500	0.1	Hz
104	1	Digital Selector #NN Source Configuration	Lvl 2	0	Setpoint Value List			
105	1	Event Input Function #NN Active State Configuration	Lvl 2	0	Setpoint Value List			
	2	Event Input Function #NN Event Notification Delay Time	Lvl 2	4	0	250	1	seconds
	3	Event Input Function #NN Suspect Parameter Number	Lvl 2	0	Setpoint Value List			
	4	Event Input Function #NN Failure Mode Identifier	Lvl 2	0	Setpoint Value List			
106	1	Spare Analog Input Enable Status	Lvl 2	0	Setpoint Value List			
	2	Spare Analog Input Type Configuration	read-only	0	Setpoint Value List			
	3	Spare Analog Input Suspect Parameter Number	Lvl 2	0	Setpoint Value List			
	4	Spare Analog Input High Percentage Warning Event Threshold	Lvl 2	16	0	100	1	%
	5	Spare Analog Input High Temperature Warning Event Threshold	Lvl 2	12	-273	1735	1	deg. C
	6	Spare Analog Input High Pressure Warning Event Threshold	Lvl 2	12	-250	10000	1	kPa
	7	Spare Analog Input High Warning Event Notification Delay Time	Lvl 2	4	0	60	1	seconds
	8	Spare Analog Input High Percentage Shutdown Event Threshold	Lvl 2	16	0	100	1	%
	9	Spare Analog Input High Temperature Shutdown Event Threshold	Lvl 2	12	-273	1735	1	deg. C
	10	Spare Analog Input High Pressure Shutdown Event Threshold	Lvl 2	12	-250	10000	1	kPa
	11	Spare Analog Input High Shutdown Event Notification Delay Time	Lvl 2	4	0	60	1	seconds
	12	Spare Analog Input Low Percentage Warning Event Threshold	Lvl 2	16	0	100	1	%
	13	Spare Analog Input Low Temperature Warning Event Threshold	Lvl 2	12	-273	1735	1	deg. C
	14	Spare Analog Input Low Pressure Warning Event Threshold	Lvl 2	12	-250	10000	1	kPa
	15	Spare Analog Input Low Warning Event Notification Delay Time	Lvl 2	4	0	60	1	seconds
	16	Spare Analog Input Low Percentage Shutdown Event Threshold	Lvl 2	16	0	100	1	%
	17	Spare Analog Input Low Temperature Shutdown Event Threshold	Lvl 2	12	-273	1735	1	deg. C
	18	Spare Analog Input Low Pressure Shutdown Event Threshold	Lvl 2	12	-250	10000	1	kPa
	19	Spare Analog Input Low Shutdown Event Notification Delay Time	Lvl 2	4	0	60	1	seconds
	20	Spare Analog Input Map Selection Number	Lvl 3	0	1	10	1	N/A
107	1	Generator/Utility Automatic Transfer Enable Status	Lvl 1	0	Setpoint Value List			
	2	Loss of Utility Event Notification Delay Time	Lvl 2	4	0	60	0.1	seconds
	3	Utility to Generator Transfer Delay Time	Lvl 1	4	0	60	0.1	seconds
	4	Generator to Utility Transfer Delay Time	Lvl 1	4	30	3600	1	seconds
	5	Generator to Utility Fast Transfer Delay Time	Lvl 1	4	0	60	1	seconds
	6	Utility to Generator Transfer Failure Warning Event Threshold	Lvl 2	4	1	240	1	seconds
	7	Utility to Generator Transfer Failure Shutdown Event Threshold	Lvl 2	4	1	240	1	seconds
	8	Generator to Utility Transfer Failure Warning Event Threshold	Lvl 2	4	1	240	1	seconds
	9	Generator/Utility Automatic Transfer Minimum Unpowered Load Time	Lvl 2	4	0	30	1	seconds
	10	Generator Ready to Accept Load Threshold	Lvl 2	16	60	100	1	%

SETPOINT INFORMATION FOR SETPOINT CONFIGURATION								
BLK #	SP #	SETPOINT NAME	SECURITY LEVEL	SCALE	MIN	MAX	RESOLUTION	UNITS
	11	Percentage	Lvl 2	4	0	60	0.1	seconds
	12	Generator Ready to Accept Load Delay Time	Lvl 2	0	Setpoint Value List			
108	1	Maximum Generator Voltage Output Bias	Lvl 2	16	0	100	1	%
	2	Percentage	Lvl 2	12	100	50000	1	V
109	1	Generator Nominal Output Voltage	Lvl 2	0	Setpoint Value List			
	2	Generator Winding Temperature Sensor Installation Status	Lvl 2	0	Setpoint Value List			
		Generator Bearing Temperature Sensor Installation Configuration	Lvl 2	0	Setpoint Value List			

APPENDIX E SETPOINT VALUE LISTS

Some setpoints in APPENDIX C refer to Setpoint Value Lists. Those setpoints are programmed with integer values with each integer having a specific definition. These integer values and representations are given here.

TABLE 27: SETPOINT VALUE LISTS

SETPOINT VALUE LISTS				
BLK #	SP #	SETPOINT NAME	VALUE	DEFINITION
1	1	Engine Oil Pressure Sensor Configuration	0 Sensor 1 Data Link	
2	4	Programmable Cycle Timer #1 Output #1 Activation Configuration	0 Inactive 1 Active	
	5	Programmable Cycle Timer #1 Output #2 Activation Configuration	0 Inactive 1 Active	
4	1	Engine Coolant Temperature Sensor Configuration	0 Sensor 1 Data Link	
6	7	Engine Speed Sensor Configuration	0 Sensor 1 Data Link	
18	10	Engine Fuel Type Configuration	0 Diesel 1 Natural Gas	
	11	Fuel Shutoff Solenoid Type Configuration	0 Energized to Run 1 Energized to Stop	
	12	Engine Type Configuration	0 Mechanical 1 Electronic	
	13	Engine Controller J1939 Data Link Support Configuration	0 No J1939 Support 1 Basic J1939 Support 2 Enhanced J1939 Support	
	14	Engine Cooldown Speed Configuration	0 Rated Speed 1 Low Idle	
	15	Engine Operating State Input Configuration	0 Hard Wired Input 1 CAN Input	
	17	Engine Fuel Priming Feature Enable Status	0 Disabled 1 Enabled	
19	1	Generator Connection Configuration	0 Wye (or Star) 1 Delta (3-Wire) 2 Delta (4-Wire) 3 Single Phase (2-Wire) 4 Single Phase (3-Wire)	
	7	Generator Rated Frequency	0 50 Hz 1 60 Hz 2 400 Hz	
26	1	Programmable Trip Point Function #NN Trigger Condition	0 Disabled 1 Trip Above Threshold 2 Trip Below Threshold	
34	5	Utility Breaker Lockout Configuration	0 Not Locked Out 1 Locked Out	
	6	Utility Breaker Type Configuration	0 Not Installed 1 Manual 2 Automatic	
	7	Automatic Utility Breaker Control Source Configuration	0 Genset Controlled 1 Externally Controlled	
35	5	Generator Breaker Lockout Configuration	0 Not Locked Out	

SETPOINT VALUE LISTS				
BLK #	SP #	SETPOINT NAME	VALUE	DEFINITION
			1	Locked Out
	6	Generator Breaker Type Configuration	0	Manual
			1	Automatic
	7	Automatic Generator Breaker Control Source Configuration	0	Genset Controlled
			1	Externally Controlled
53	1	Digital Input #NN Active State Configuration	0	Low
			1	High
56	1	Relay Output #N Active State Configuration	0	Low
			1	High
72	1	Event Warning Condition Response Auto Reset Enable Status	713	Custom Event #13
			714	Custom Event #14
	2	Event Audible Alert Response Auto Reset Enable Status	715	Custom Event #15
			716	Custom Event #16
	3	Event Loss of Utility Response Auto Reset Enable Status	0	Disabled
			1	Enabled
	4	Event Breaker #1 Trip Response Auto Reset Enable Status	0	Disabled
			1	Enabled
	5	Event Breaker #2 Trip Response Auto Reset Enable Status	0	Disabled
			1	Enabled
75	1	Electronic Control Module Reduced Power Mode Enable Status	0	Disabled
			1	Enabled
88	1	Digital Output #N Active State Configuration	0	Low
			1	High
94	1	SCADA Data Link Baud Rate	0	2400 baud
			1	4800 baud
			2	9600 baud
			3	14400 baud
			4	19200 baud
			5	28800 baud
			6	38400 baud
			7	57600 baud
			8	115200 baud
	2	SCADA Data Link Parity	0	None
			1	Odd
			2	Even
	6	RS-485 Bias Resistor Enable Status	0	Disabled
			1	Enabled
96	1	Engine Cylinder Temperature Sensor Installation Status	0	Not Installed
			1	Installed
97	1	Event Output Function #NN Trigger Condition	0	High Shutdown
			0	Disabled
			1	Low Shutdown
			17	Low Warning
			31	Status
			8320	General Event - High or Low Warning
			8352	General Event - High or Low Shutdown
			8448	General Event - High or Low Warning or High or Low Shutdown
			8480	General Event - High or Low Warning or High or Low Shutdown or Diagnostic
			8512	General Diagnostic
			16384	Specific Event - Low Warning
			16416	Specific Event - Low Shutdown
			16448	Specific Event - High Warning

SETPOINT VALUE LISTS				
BLK #	SP #	SETPOINT NAME	VALUE	DEFINITION
			16480	Specific Event - High Shutdown
			16512	Specific Event - High or Low Warning
			16544	Specific Event - High or Low Shutdown
			16576	Specific Event - Low Warning or Low Shutdown
			16608	Specific Event - High Warning or High Shutdown
			16640	Specific Event - High or Low Warning or High or Low Shutdown
			16672	Specific Event - High or Low Warning or High or Low Shutdown or Diagnostic
			16738	Specific Diagnostic - Data Erratic, Intermittent, or Incorrect
			16739	Specific Diagnostic - Voltage Above Normal, or Shorted to High Source
			16740	Specific Diagnostic - Voltage Below Normal, or Shorted to Low Source
			16741	Specific Diagnostic - Current Below Normal or Open Circuit
			16742	Specific Diagnostic - Current Above Normal or Grounded Circuit
			16743	Specific Diagnostic - Mechanical System Not Responding or Out of Adjustment
			16744	Specific Diagnostic - Abnormal Frequency or Pulse Width or Period
			16745	Specific Diagnostic - Abnormal Update Rate
			16746	Specific Diagnostic - Abnormal Rate of Change
			16747	Specific Diagnostic - Root Cause Not Known
			16768	Specific Event - Condition Exists
	2	Event Output Function #NN Suspect Parameter Number	38	External Tank Fuel Level
			82	Starting Air Pressure
			95	Fuel Filter Differential Pressure
			96	Fuel Level
			98	Engine Oil Level
			99	Engine Oil Filter Differential Pressure
			100	Engine Oil Pressure
			107	Air Filter Differential Pressure
			110	Engine Coolant Temperature
			111	Engine Coolant Level
			137	Fire Extinguisher Pressure
			167	Battery Charging System Voltage
			168	Battery Voltage
			171	Ambient Air Temperature
			173	Exhaust Temperature
			175	Engine Oil Temperature
			190	Engine Speed
			625	SCADA Data Link
			639	Primary Data Link

SETPOINT VALUE LISTS				
BLK #	SP #	SETPOINT NAME	VALUE	DEFINITION
			701	Custom Event #1
			702	Custom Event #2
			703	Custom Event #3
			704	Custom Event #4
			705	Custom Event #5
			706	Custom Event #6
			707	Custom Event #7
			708	Custom Event #8
			709	Custom Event #9
			710	Custom Event #10
			711	Custom Event #11
			712	Custom Event #12
			924	Digital Output #1
			925	Digital Output #2
			926	Digital Output #3
			970	Auxiliary Engine Shutdown Switch
			1122	Generator Rear Bearing Temperature
			1124	Generator Winding #1 Temperature
			1125	Generator Winding #2 Temperature
			1126	Generator Winding #3 Temperature
			1231	Accessory Data Link
			1237	Emergency Shutdown Override Switch
			1239	Fuel Leak
			1383	Unexpected Engine Shutdown
			1390	Gas Pressure
			1664	Engine Failure to Start
			2433	Right Exhaust Temperature
			2434	Left Exhaust Temperature
			2436	Generator Output Frequency
			2440	Generator Output Voltage
			2448	Generator Current (Amp)
			2452	Generator Output Power
			2646	Digital Output #4
			2648	Maintenance Lamp
			3543	Engine Controller
			4000	Air Damper Closed
			4001	ATS in Normal Position
			4002	ATS in Emergency Position
			4003	Battery Charger Failure
			4004	Generator Circuit Breaker Closed
			4005	Utility Breaker Closed
			4006	Engine in Cooldown
			4007	Generator Control Not in Automatic
			4009	Generator Circuit Breaker Failure to Open
			4010	Utility Breaker Failure to Open
			4011	Generator Circuit Breaker Failure to Close
			4012	Utility Breaker Failure to Close
			4013	Generator Circuit Breaker Open
			4014	Utility Breaker Open
			4015	Utility to Generator Transfer Failure

SETPOINT VALUE LISTS				
BLK #	SP #	SETPOINT NAME	VALUE	DEFINITION
			4016	Generator to Utility Transfer Failure
			4017	Loss of Utility
			4018	Generator Circuit Breaker Locked Out
			4019	Utility Breaker Locked Out
			4028	Earth Fault
			4029	Earth Leakage
			16748	Specific Diagnostic - Bad Intelligent Device or Component
			16749	Specific Diagnostic - Out of Calibration
			16750	Specific Diagnostic - Special Instructions
			16755	Specific Diagnostic - Received Network Data In Error
104	1	Digital Selector #NN Source Configuration	0	Disabled
			1	Use Input #1
			2	Use Input #2
			3	Use Input #3
			4	Use Input #4
			5	Use Input #5
			6	Use Input #6
			7	Use Input #7
			8	Use Input #8
			9	Use Input #9
			10	Use Input #10
			11	Data Link
105	1	Event Input Function #NN Active State Configuration	0	Low
			1	High
	3	Event Input Function #NN Suspect Parameter Number	38	External Tank Fuel Level
			82	Starting Air Pressure
			95	Fuel Filter Differential Pressure
			96	Fuel Level
			98	Engine Oil Level
			99	Engine Oil Filter Differential Pressure
			100	Engine Oil Pressure
			107	Air Filter Differential Pressure
			110	Engine Coolant Temperature
			111	Engine Coolant Level
			137	Fire Extinguisher Pressure
			167	Battery Charging System Voltage
			168	Battery Voltage
			171	Ambient Air Temperature
			173	Exhaust Temperature
			175	Engine Oil Temperature
			701	Custom Event (Instance #1)
			702	Custom Event (Instance #2)
			703	Custom Event (Instance #3)
			704	Custom Event (Instance #4)
			705	Custom Event (Instance #5)
			706	Custom Event (Instance #6)
			707	Custom Event (Instance #7)
			708	Custom Event (Instance #8)
			709	Custom Event (Instance #9)
			710	Custom Event (Instance #10)
			711	Custom Event (Instance #11)
			712	Custom Event (Instance #12)

SETPOINT VALUE LISTS				
BLK #	SP #	SETPOINT NAME	VALUE	DEFINITION
			1122	Generator Rear Bearing Temperature
			1124	Generator Winding #1 Temperature
			1125	Generator Winding #2 Temperature
			1126	Generator Winding #3 Temperature
			1239	Fuel Leak
			1390	Gas Pressure
			2433	Right Exhaust Temperature
			2434	Left Exhaust Temperature
			2436	Generator Frequency
			2440	Generator Voltage
			2448	Generator Current
			2452	Generator Power
			3783	Engine Inlet Manifold Charge Combustion
			3829	EPS Supplying Load
			4000	Air Damper Closed
			4001	ATS in Normal Position
			4002	ATS in Emergency Position
			4003	Battery Charger Failure
			4004	Generator Circuit Breaker Closed
			4005	Utility Circuit Breaker Closed
			4013	Generator Circuit Breaker Open
			4014	Utility Circuit Breaker Open
			4015	Utility to Generator Transfer Failure
			4016	Generator to Utility Transfer Failure
			4017	Loss of Utility
			4028	Earth Fault
			4029	Earth Leakage
	4	Event Input Function #NN Failure Mode Identifier	15	High Warning
			713	Custom Event (Instance #13)
			714	Custom Event (Instance #14)
			715	Custom Event (Instance #15)
			716	Custom Event (Instance #16)
106	1	Spare Analog Input Enable Status	0	Disabled
			1	Enabled
	2	Spare Analog Input Type Configuration	0	Pressure
			1	Temperature
			2	Level
	3	Spare Analog Input Suspect Parameter Number	38	External Tank Fuel Level
			82	Starting Air Pressure
			95	Fuel Filter Differential Pressure
			96	Fuel Level
			98	Engine Oil Level
			99	Oil Filter Differential Pressure
			107	Air Filter Differential Pressure
			111	Engine Coolant Level
			137	Fire Extinguisher Pressure
			171	Ambient Air Temperature
			173	Exhaust Temperature
			175	Engine Oil Temperature
			1122	Generator Rear Bearing Temperature

SETPOINT VALUE LISTS				
BLK #	SP #	SETPOINT NAME	VALUE	DEFINITION
			2433	Right Exhaust Temperature
			2434	Left Exhaust Temperature
107	1	Generator/Utility Automatic Transfer Enable Status	0	Disabled
			1	Enabled
	12	Generator to Utility Transfer Mode	0	Manual
			1	Automatic
109	1	Generator Winding Temperature Sensor Installation Status	0	Not Installed
			1	Installed
	2	Generator Bearing Temperature Sensor Installation Configuration	0	Not Installed
			1	Rear
			2	Front & Rear

APPENDIX F BITMASK VALUE LISTS

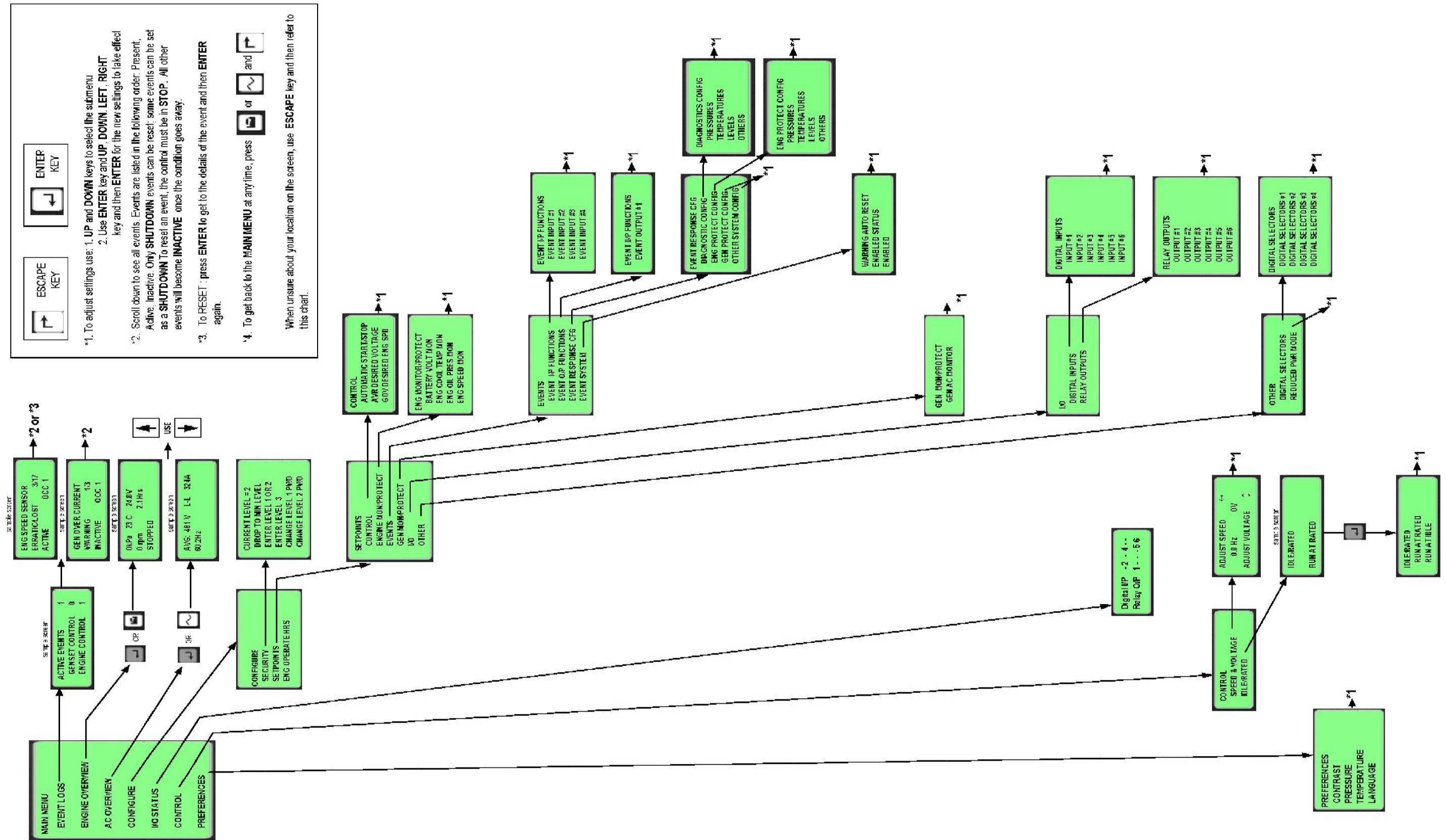
Some setpoints in **APPENDIX C** can take on multiple values simultaneously. This is particularly true for event response configurations, where an event can trigger multiple responses, such as a shutdown as well as a breaker tripping. In these cases, the setpoints are assigned bit-mask values, where different factors of two represent different optional responses. This guarantees that every combination of possible event responses will have a unique value. These possible values are given here.

In order to decode a BitMask value, simply mask it with the value in question and compare it to zero, to determine whether the value is present in the setpoint. For example, in APPENDIX D, Setpoint Information For Configuration, the setpoint Air Damper Closed Event Response Configuration setpoint shows units as BitMask. It has a minimum of zero, meaning all of the responses shown here in Table 28 may be disabled. It has a maximum of 266, which is 256 (Active Only) + 8 (Hard Shutdown) + 2 (Audible Alert). This means that the Air Damper Closed event can be configured to have these three responses.

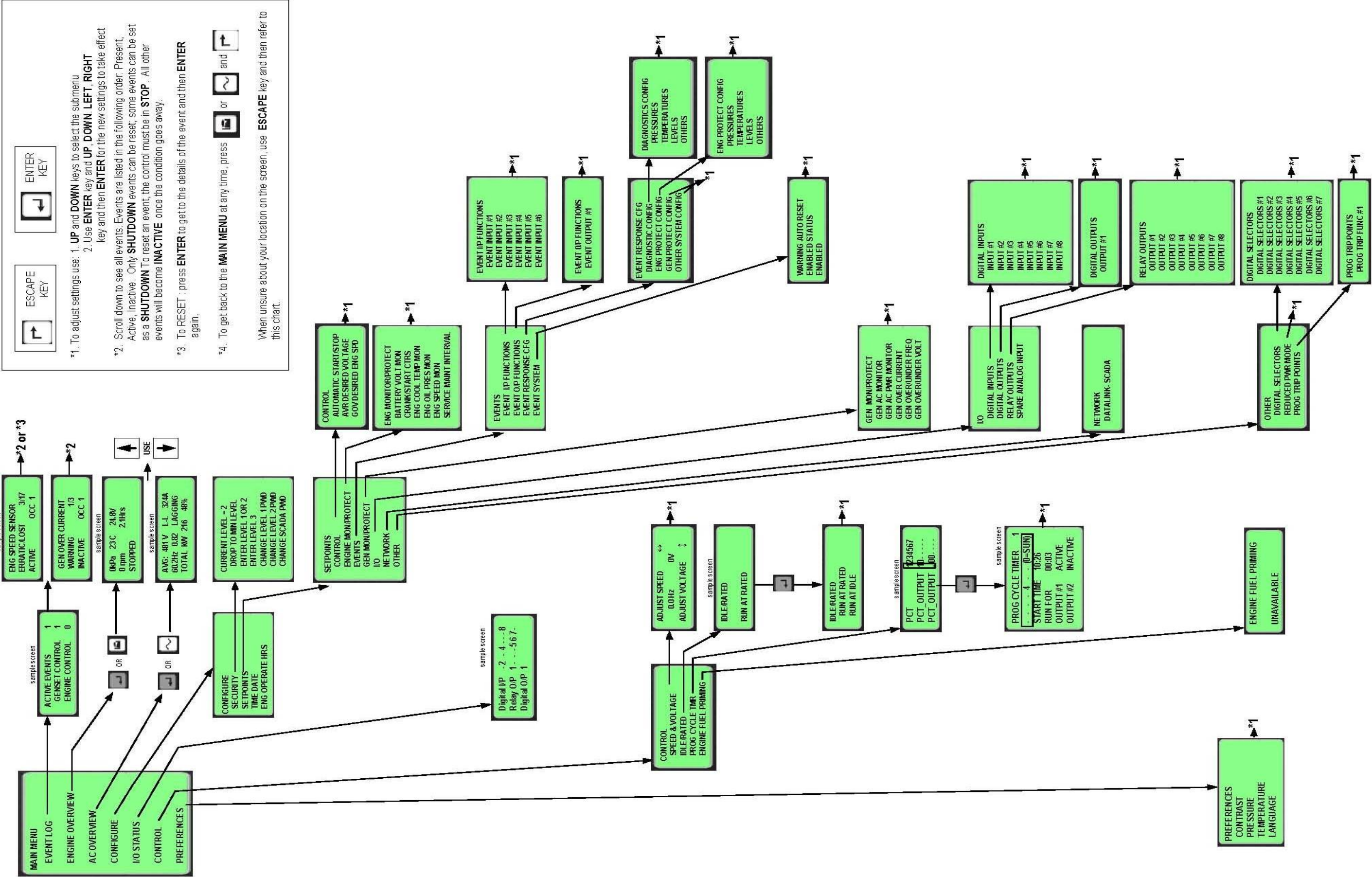
TABLE 28 BITMASK VALUE LISTS

VALUE	VALUE NAME
1	Warning
2	Audible Alert
4	Soft Shutdown
8	Hard Shutdown
16	Utility Failure
32	Breaker #1 Trip
64	Breaker #2 Trip
128	Fault Protection Timer Enabled
256	Active Only

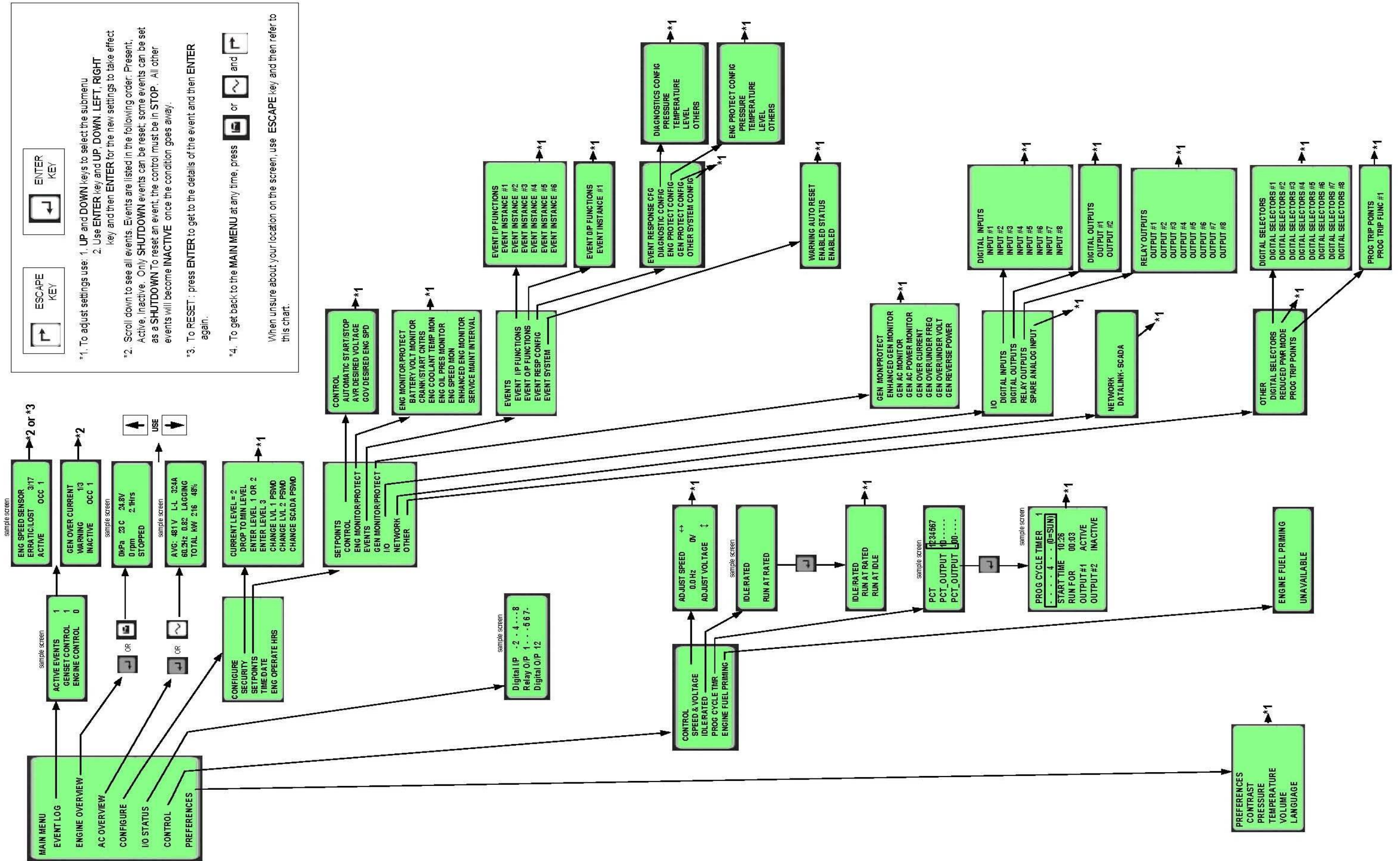
APPENDIX G MENU STRUCTURES



EMCP 3.2 Generator Set Control Menu Structure



EMCP 3.3 Generator Set Control Menu Structure



*1. To adjust settings use: 1. UP and DOWN keys to select the submenu key and then ENTER key and then ENTER key to take effect
2. Use ENTER key and UP, DOWN, LEFT, RIGHT key and then ENTER for the new settings to take effect

*2. Scroll down to see all events. Events are listed in the following order: Present, Active, Inactive. Only SHUTDOWN events can be reset; some events can be set as a SHUTDOWN. To reset an event, the control must be in STOP. All other events will become INACTIVE once the condition goes away.

*3. To RESET: press ENTER to get to the details of the event and then ENTER again.

*4. To get back to the MAIN MENU at any time, press [ESC] or [HOME] and [ENTER]

When unsure about your location on the screen, use ESCAPE key and then refer to this chart.

APPENDIX H EMCP 3 GSC WIRING DIAGRAMS

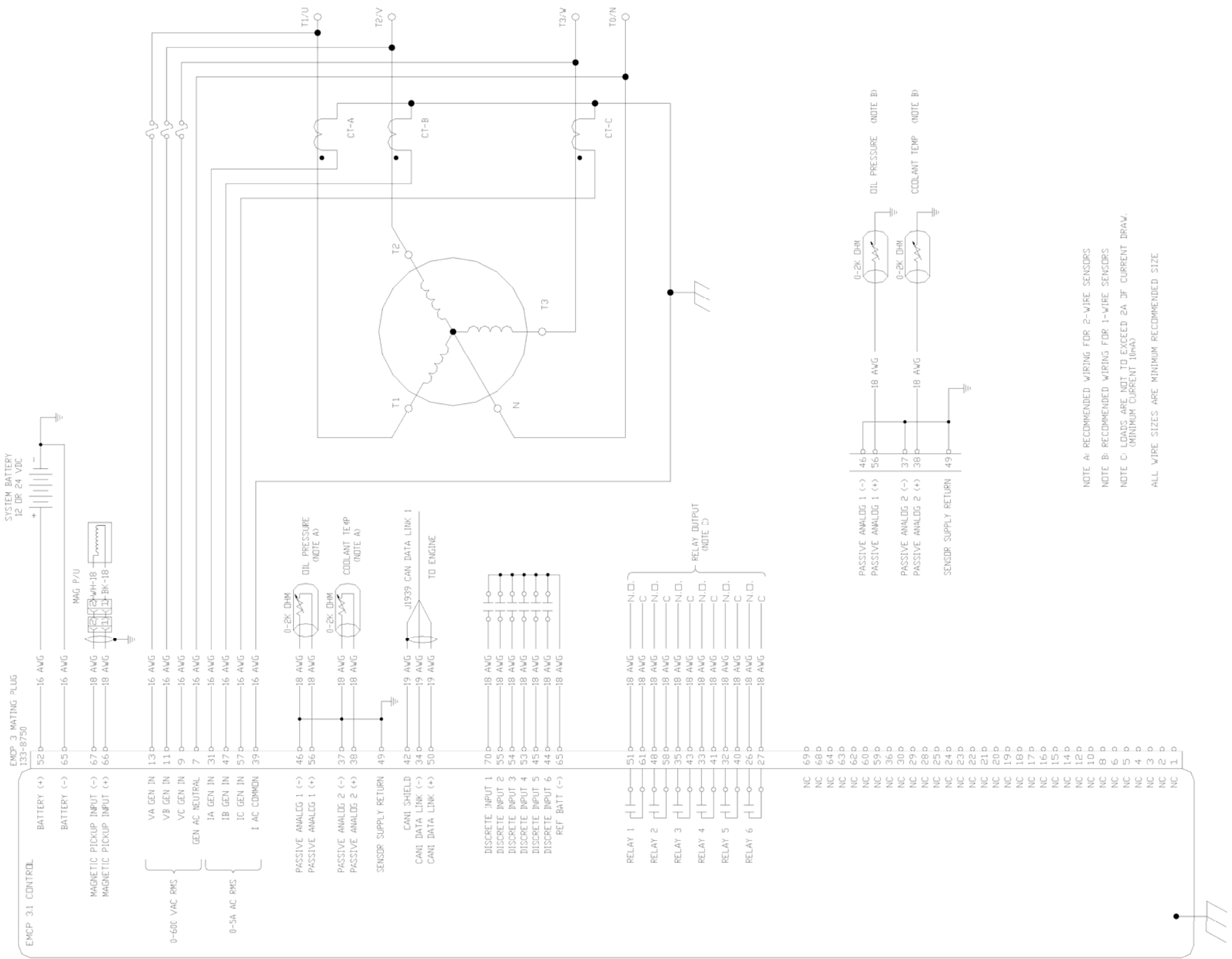
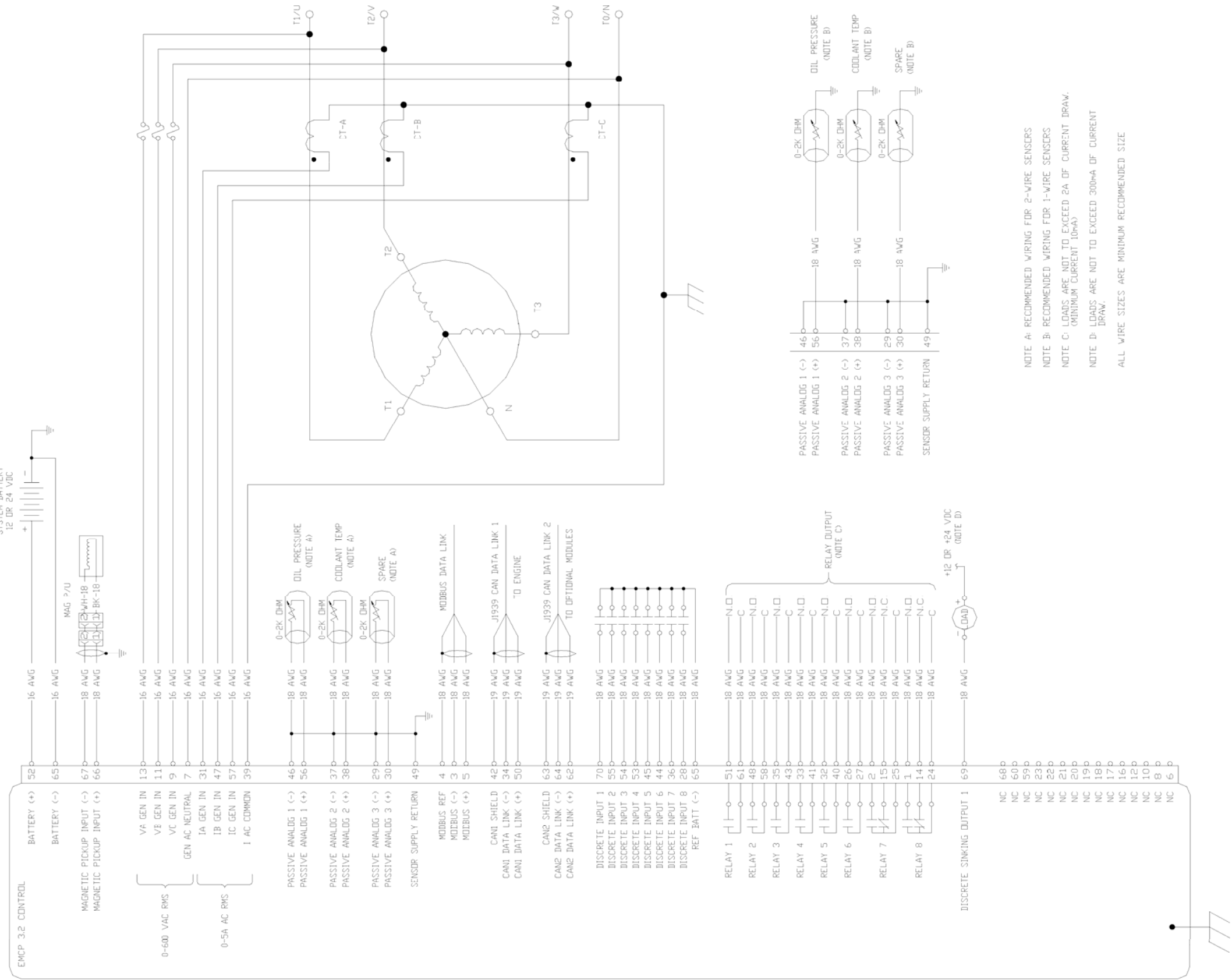


FIGURE APPENDIX H EMCP 3.2 WIRING DIAGRAM



NOTE A: RECOMMENDED WIRING FOR 2-WIRE SENSORS
NOTE B: RECOMMENDED WIRING FOR 1-WIRE SENSORS
NOTE C: LOADS ARE NOT TO EXCEED 2A OF CURRENT DRAW.
(MINIMUM CURRENT 10mA)
NOTE D: LOADS ARE NOT TO EXCEED 300mA OF CURRENT
DRAW.
ALL WIRE SIZES ARE MINIMUM RECOMMENDED SIZE

FIGURE APPENDIX H EMCP 3.2 WIRING DIAGRAM

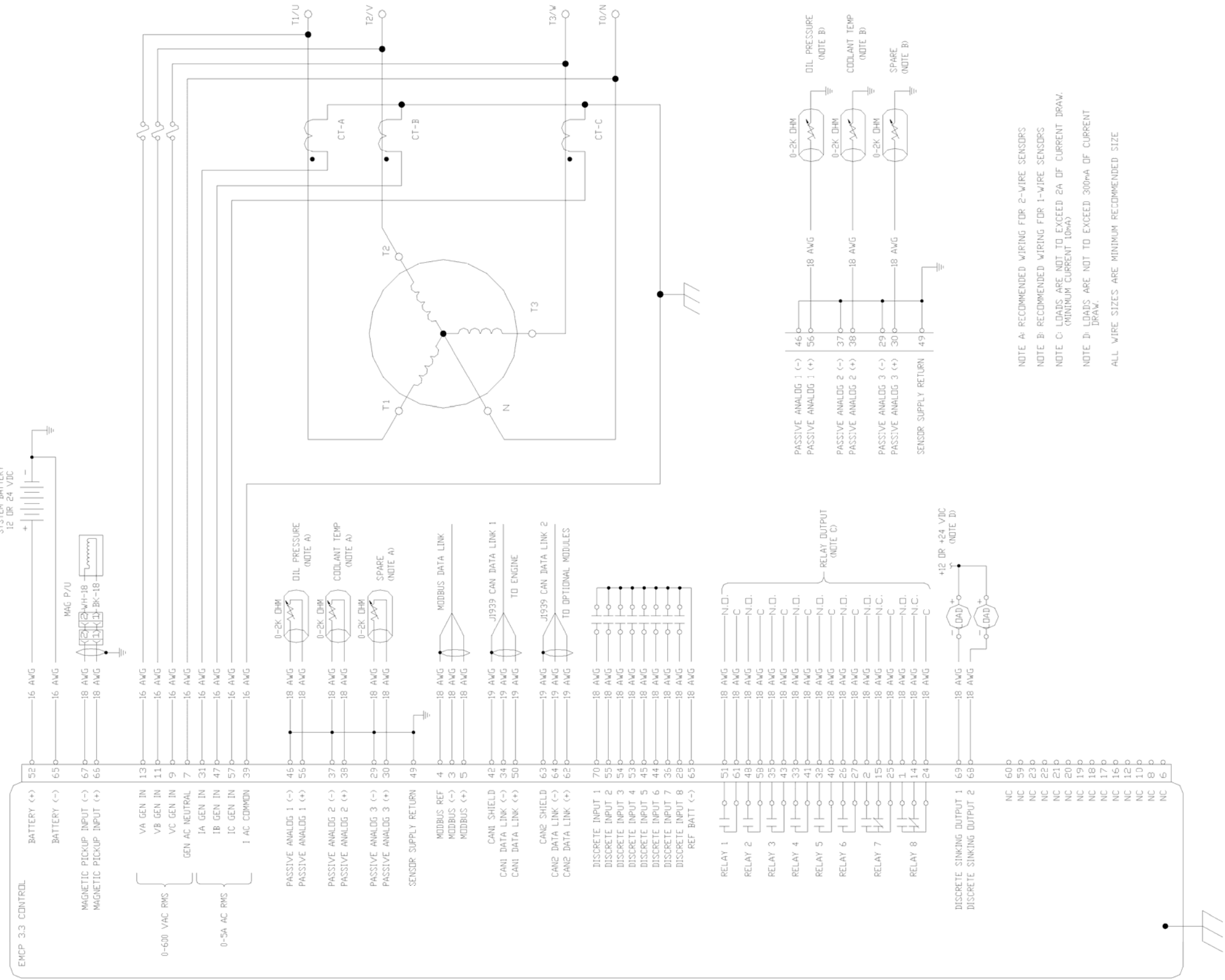
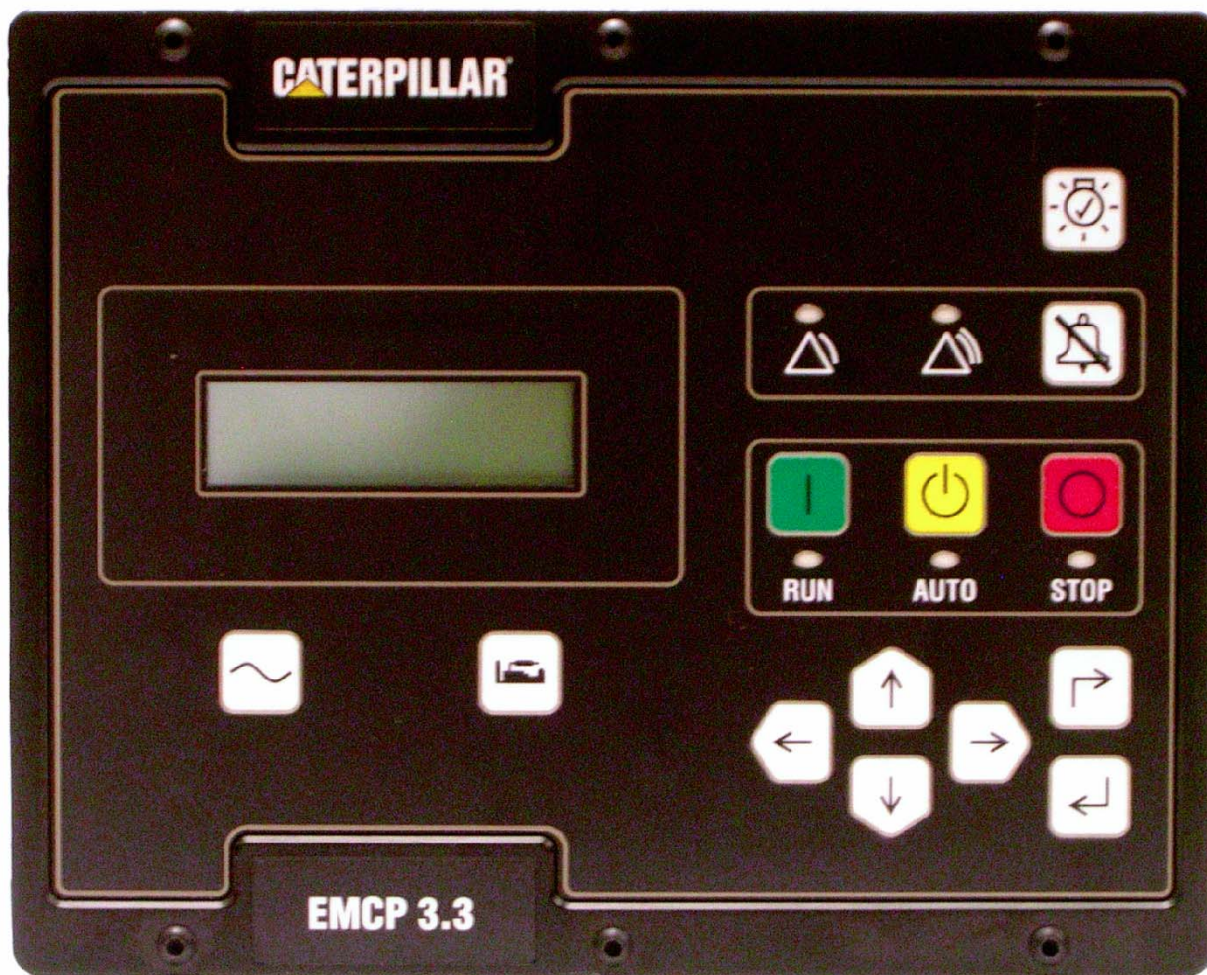


FIGURE APPENDIX H EMCP 3.3 SCHEMATIC

APPENDIX I EMCP 3 GSC FRONT VIEW & NAVIGATION KEYS



APPENDIX I EMCP 3.3 FRONT PANEL VIEW

Navigation Keys

AC OVERVIEW

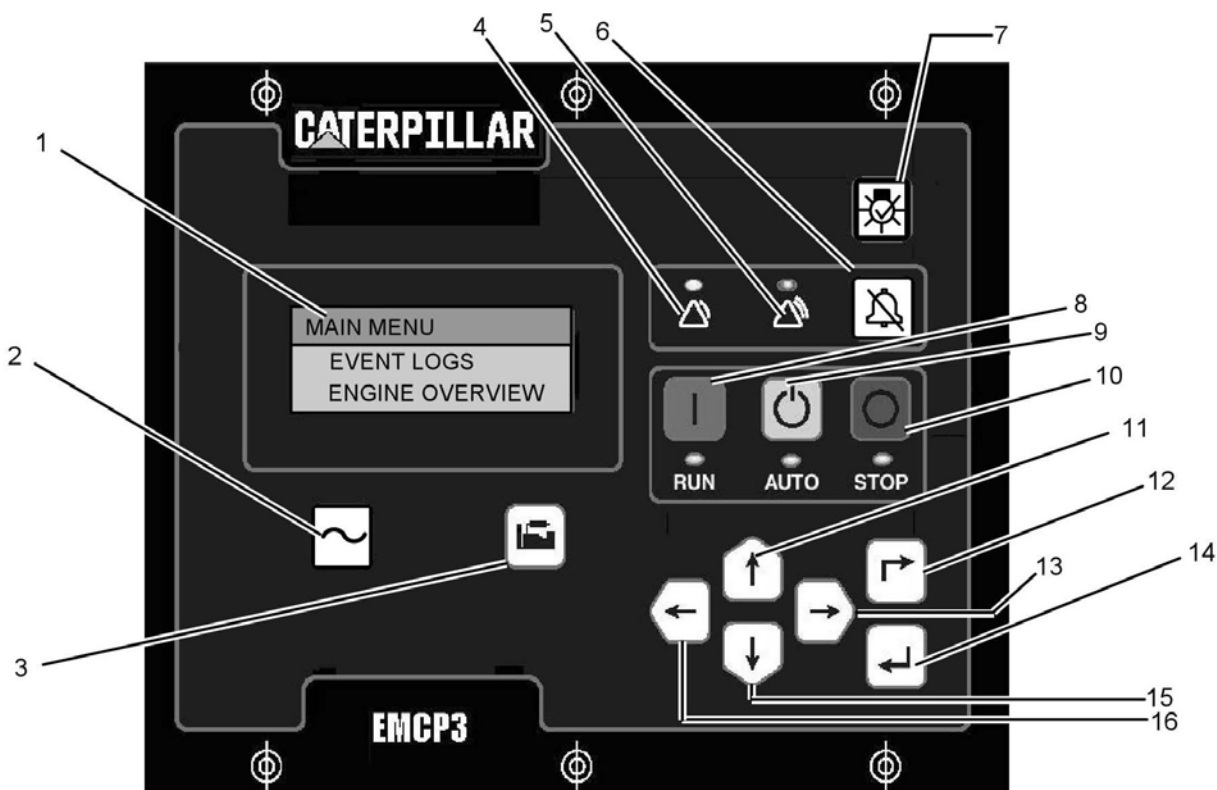
The AC Overview Key (2) will navigate the display the first screen of AC information. The AC Overview Key information contains various AC parameters that summarize the electrical operation of the generator set.

ENGINE OVERVIEW

The Engine Overview Key (3) will navigate the display to the first screen of engine information. The Engine Overview information contains various engine parameters that summarize the operation of the generator set.

ALARM ACKNOWLEDGE / SILENCE

Pressing the Alarm Acknowledge/Silence Key (6) will cause the horn relay output to turn off and silence the horn. Pressing the key will also cause any yellow or red flashing lights to turn off or to become solid depending on the active status of the alarms. The Alarm Acknowledge/Silence Key may also be configured to send out a global alarm silence on the J1939 Data Link which will silence horns on Annunciators.



- | | |
|-----------------------------------|-----------------------|
| (1) Display Screen | (9) Auto Key |
| (2) AC Overview Key | (10) Stop Key |
| (3) Engine Overview Key | (11) Scroll Up Key |
| (4) Yellow Warning Lamp | (12) Escape Key |
| (5) Red Shutdown Lamp | (13) Scroll Right Key |
| (6) Alarm Acknowledge/Silence Key | (14) Enter Key |
| (7) Lamp Test Key | (15) Scroll Down Key |
| (8) Run Key | (16) Scroll Left Key |

LAMP TEST

Pressing and holding the Lamp Test Key (7) will cause all of the LED's and the display screen pixels to turn on solid until the Key is released.

RUN

Pressing the RUN Key (8) will cause the engine to enter the RUN mode.

AUTO

Pressing the AUTO Key (9) will cause the engine to enter the AUTO mode.

SCROLL UP

The Scroll Up Key (11) is used to navigate up through the various menus or monitoring screens. The Scroll Up Key is also used during setpoint entry. During numeric data entry the Scroll Up Key is used in order to increment the digits (0-9). If the setpoint requires selection from a list, the Scroll Up Key is used to navigate through the list.

ESCAPE

The Escape Key (12) is used during menu navigation in order to navigate up through the menu/sub-menu structure. Each key press causes the user to move backwards/upwards through the navigation menus. The Escape Key is also used to cancel out of data entry screens during setpoint programming. If the Escape Key is pressed during setpoint programming,

none of the changes made on screen will be saved to memory.

SCROLL RIGHT

The Scroll Right Key (13) is used during setpoint adjustment. During numeric data entry, the Scroll Right Key is used to choose which digit is being edited. The Scroll Right Key is also used during certain setpoint adjustments to select or deselect a check box. If a box has a check mark inside the box, pressing the Scroll Right Key will cause the check mark to disappear, disabling the function. If the box does not have a check mark inside the box, pressing the Scroll Right Key will cause a check mark to appear, Enabling the function.

ENTER

The Enter Key (14) is used during menu navigation to select menu items in order to navigate forward/downward in the menu/sub-menu structure. The Enter Key is also used during setpoint programming in order to save setpoints changes. Pressing the Enter Key during setpoint programming causes setpoint changes to be saved to memory

DOWN

The Down Key (15) is used to navigate down through the various menus or monitoring screens. The Down Key is also used during setpoint entry. During numeric data entry the Down Key is used in order to decrement the digits (0-9). If the setpoint requires selection from a list, the Down Key is used to navigate down through the list.

SCROLL LEFT

The Scroll Left Key (16) is used during setpoint adjustment. During numeric data entry, the Scroll Left Key is used to choose which digit is being edited. The Scroll Left Key is also used during certain setpoint adjustments to select or deselect a check box. If a box has a check mark inside the box, pressing the Scroll Left Key will cause the check mark to disappear, disabling the function. If the box does not have a check mark inside the box, pressing the Scroll Left Key will cause a check mark to appear, enabling the function.

ALARM INDICATORS

YELLOW WARNING LIGHT

A flashing yellow light indicates that there are unacknowledged active warnings. A solid yellow light indicates that there are acknowledged warnings active. If there are any active warnings, the yellow light will change from flashing yellow to solid yellow after the Alarm Acknowledge/Silence Key (6)is pressed. If there are no longer any active warnings, the yellow light will turn off after the Alarm Acknowledge/Silence Key (6) is pressed.

RED SHUTDOWN LIGHT

A flashing red light indicates that there are unacknowledged active shutdown events. A solid red light indicates that there are acknowledged shutdown events active. If there are any active shutdown events the red light will change from flashing red to solid red after the Alarm Acknowledge/Silence Key (6) is pressed. Any condition that has caused a shutdown event must be manually reset. If there are no longer any active shutdown events, the red light will turn off.

Glossary of Terms

CRC	Cyclic Redundancy Check. This is an algorithm used to catch transmission errors. The CRC is generated and transmitted at the source, then re-generated and compared at the target. The EMCP 3 GSC performs a 16-bit CRC check, which is often called a CRC16 algorithm.
EMCP 3	Electronic Modular Control Panel 3. This is the new generation Caterpillar generator set control panel, consisting of a generator set control (GSC), and may have several other modules such as an engine electronic control module (ECM), voltage regulator module, and input/output modules.
ECM	Electronic Control Module. This is a general term and can refer to any microprocessor-based module that is part of a control system. The engine ECM is an ECM dedicated to the task of engine timing and air/fuel control.
FID	Fault Identifier. This is a term for a range of data that represents an application-level fault. For example, this may communicate that the requested operation is not currently applicable, or that a value requested is out of range.
FMI	Failure Mode Indicator. The J1939 term for a failure code associated with a particular Suspect Parameter Number. For a complete list of FMI codes, refer to the Systems Operation Troubleshooting Testing and Adjusting guide.
GSC	Generator Set Controller. This is the module responsible for the overall generator protection and control functions. It is the master module on the generator set, interfacing with the user as well as the engine ECM and any other accessory modules.
J1939	A communication protocol with widespread use in the transportation and power generation industry. The EMCP 3.1 supports a J1939 data link, termed the Primary Data Link. The EMCP 3.2 and 3.3 support the Primary Data Link, and a second J1939 data link, termed the Accessory Data Link.
NULL CHARACTER	The name for the ASCII character represented by \$00 (1 byte of binary zeroes). This character is commonly used to mark the termination of an ASCII string.
RMS	A mathematical approach of representing a useful average for varying quantities; this is useful to indicate AC quantities.
RS-232	RETMA Standard 232, maintained by the Electronics Industries Alliance (EIA). Also known as EIA-232.
RS-485	RETMA Standard 485, maintained by the Electronics Industries Alliance (EIA). Also known as EIA-485.
RTU	Remote Transmitter Unit. This term refers to a Slave device in a MODBUS network, that merely responds to requests from the Master. The EMCP 3 GSC can function as an RTU on a SCADA system.
SCADA	Supervisory Control And Data Acquisition. This term represents any computing system designed to perform high-level control and monitoring over various subsystems. On the EMCP 3 GSC, we provide a MODBUS interface to allow any SCADA systems to connect and collect data about the operations of the control and the generator set(s).

Glossary of Terms

SPN Suspect Parameter Number. The J1939 term for any parameter whose data is transmitted over a J1939 network, such as the EMCP 3 GSC primary or accessory data link. For a complete list of SPNs supported by the EMCP 3 GSC, refer to the Diagnostic Trouble Code List in the Systems Operation Troubleshooting Testing and Adjusting guide.

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Materials and specifications are subject to change without notice.
Rating ranges listed include the lowest and highest available for a specific engine or family of engines. Load factor and time at rated load and speed will determine the best engine/rating match.
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