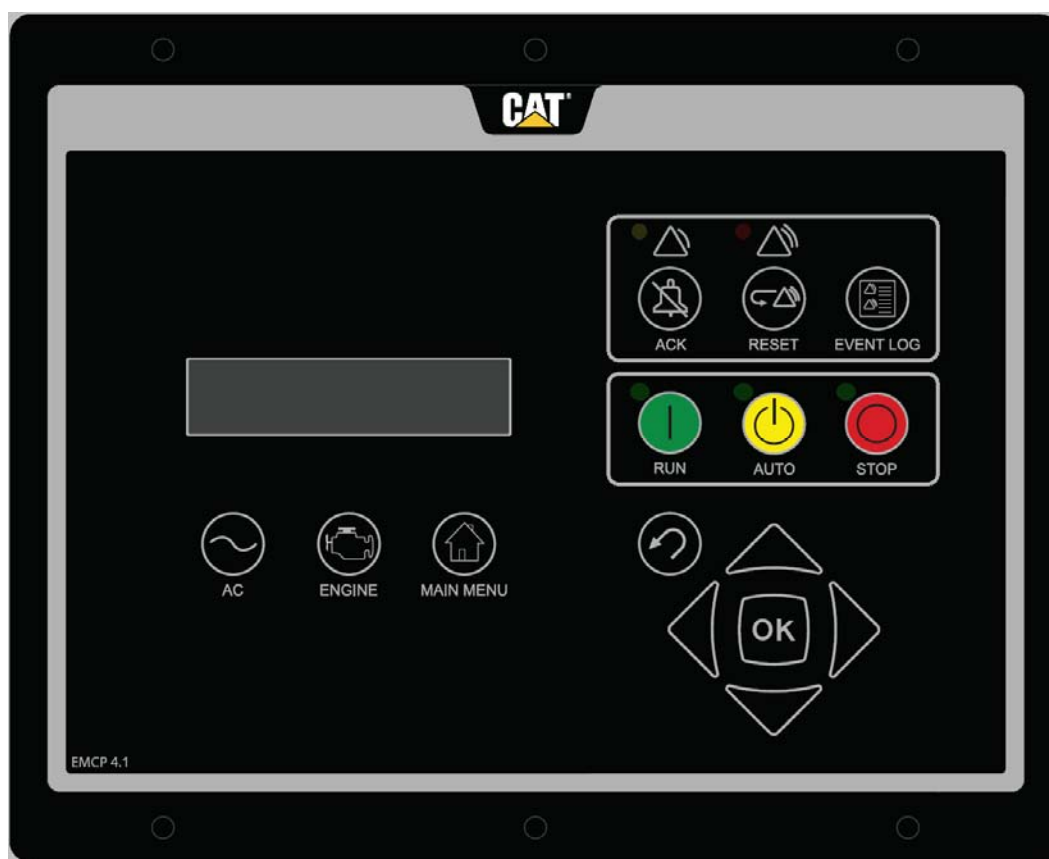


APPLICATION AND INSTALLATION GUIDE

EMCP 4.1, 4.2 GENERATOR SET CONTROL



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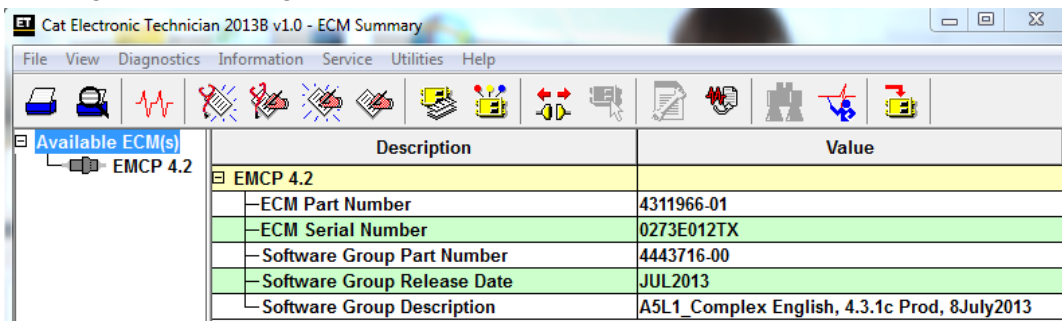
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Foreword

This Application and Installation Guide describes the EMCP 4.1 and 4.2 series electric 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 4 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 4 may differ from the actual screens depending on flash file language, flash file version, setpoint configuration, engine interface, or series of the EMCP (4.1 versus 4.2).

In various places throughout this document, reference is made to the release date of the EMCP 4 software. This information can be found by connecting to the subject module using the Cat 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 Figure 1, showing the release date for an EMCP 4.2 flash file.



Description	Value
ECM 4.2	
ECM Part Number	4311966-01
ECM Serial Number	0273E012TX
Software Group Part Number	4443716-00
Software Group Release Date	JUL2013
Software Group Description	A5L1_Complex English, 4.3.1c Prod, 8July2013

Figure 1: EMCP Software Release Date

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

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1 GENERAL INFORMATION

1.1 INTRODUCTION

Caterpillar has developed a product line of Generator Set Controls for use in the Electronic Modular Control Panel 4 (EMCP 4). They are available in four versions based on Generator Set Control feature sets.

The EMCP 4 Generator Set Control, or GSC, is the primary controller within the Generator Set Control system. The EMCP 4 line of Generator Set Controllers includes EMCP 4.1, 4.2, 4.3, and 4.4. Appendix B shows a front view of the EMCP 4.1 and 4.2.

This Application and Installation Guide is intended to cover the EMCP 4.1 and 4.2 Generator Set Control and its application in generator set systems. It also includes information on optional add-on modules. The intended audience for this guide includes Cat generator set system designers, Caterpillar service support personnel, Cat Dealers and Service Technicians, contractors, and customers.

1.2 APPLICATIONS

The EMCP 4 product line of generator set controllers is designed for use in a wide range of applications. They can be used on standby and prime Cat brand power generator sets. The configurability of the controllers allows them to be used, in some cases, on other applications such as Marine auxiliary generators, switchgear applications, and industrial engines and generator sets.

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

1.3 REFERENCES

The System Operation Testing, Troubleshooting, and Adjusting manual (UENR 1209) is also available for EMCP 4.1 and 4.2 Generator Set Controls. The genset Operations and Maintenance manual contains details for specific products.

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 Cat dealer for replacement manuals. Proper care is your responsibility.



2.2 ELECTROSTATIC DISCHARGE AWARENESS

EMCP 4 control contains components that are sensitive to **ELECTROSTATIC DISCHARGE (ESD)**. An electrostatic charge can damage the control resulting in EMCP 4 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 4, 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 4, consider the following:

- Protection from high-voltage and high-current devices.
- Protection from devices which may produce electromagnetic interference.
- Protection from excessive vibration. The EMCP 4 controls are designed to withstand normal generator set vibrations. They should not be mounted directly to the engine block.
- Protection from direct exposure to water. Once installed with gasket, the EMCP 4 controllers are sealed to a level of IP Level 56 for resistance to moisture.

Suitable for Flat Surface Mounting in a Type 1 Enclosure only.

3.2 OPERATING TEMPERATURE RANGE

EMCP 4 has a continuous operating temperature range of -20°C (-4°F) to +70°C (158°F) ambient.

3.3 POWER REQUIREMENTS

The EMCP 4.1 and 4.2 require a nominal voltage of 12 VDC or 24 VDC. 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. The maximum power consumption of the EMCP 4.1 and 4.2 with all I/O at maximum power drain will not exceed 5A at 12VDC, or 3.5A at 24VDC.

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 4 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 2).

As shown in Figure 2, 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**. This point is the genset customer ground connection. The **CHASSIS GROUND** should be bonded separately to the customer ground connection and not be used as the electronics reference.

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.

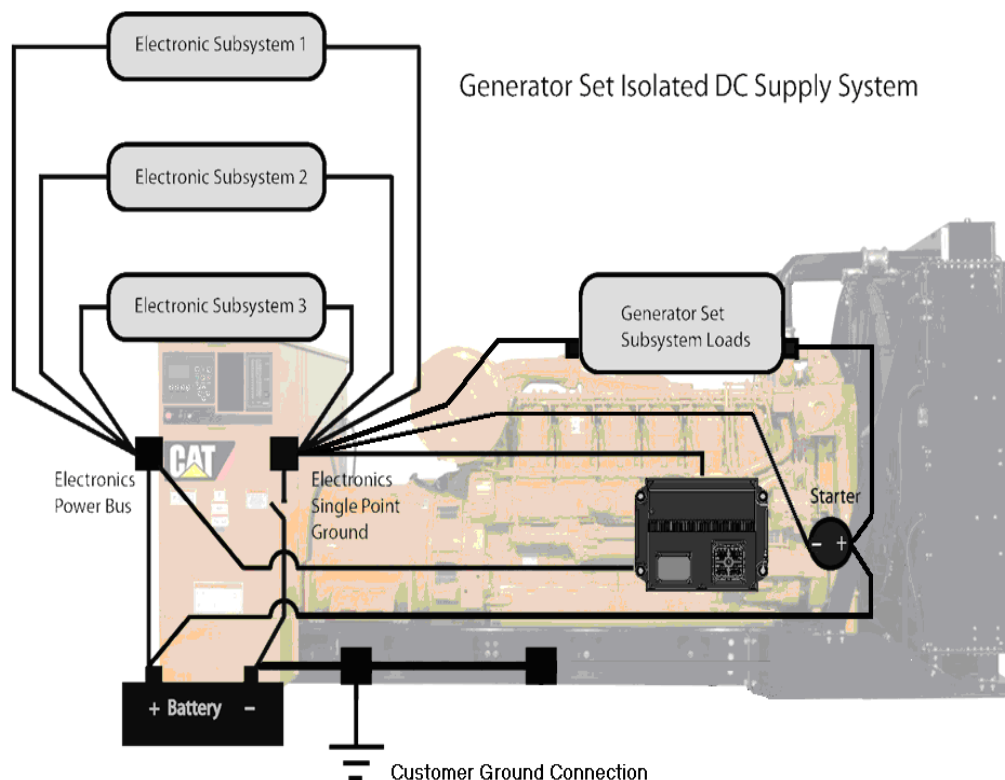


Figure 2: Generator Set Network Isolation

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 usually located on the negative side 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. Most battery chargers are not to be used as power supplies. Proper battery charger operation requires that the actual battery load be present.

If battery charger fault condition wiring is connected to the EMCP Digital Inputs and these Digital Inputs are set to **DISABLED**, then any battery charger faults or events will not be broadcast or annunciated on the network. See Chapter 8.

3.5 ELECTRICAL CONNECTIONS

The EMCP 4.1 and 4.2 share the same 70-pin connector on the back of the controller (not all of the 70 pins are used). The 70-pin connector on the EMCP 4.4 is not the same as the 70-pin connector on the EMCP 4.1 and 4.2.

Figure 3 and Figure 4 show:

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

3.6 EUI ENGINES

For EUI engines, the Oil Pressure and Coolant Temperature sensors will typically be wired to the engine ECM and the EMCP 4 will get that information from the engine ECM via the Primary CAN Data Link. Ensure the EMCP 4 Oil Pressure and Coolant Temperature setpoints are configured for Data Link.

In order for the genset to function properly in Cooldown mode, some setpoints in the EMCP 4 must be coordinated with some engine ECM setpoints. For gensets where the engine ECM controls cooldown, the cooldown time should be set to 0 seconds in the EMCP. For gensets where the engine ECM does not control cooldown, the cooldown time should be set to 0 seconds in the engine ECM.

3.7 EMCP 4.1 AND 4.2 ELECTRICAL DIAGRAMS

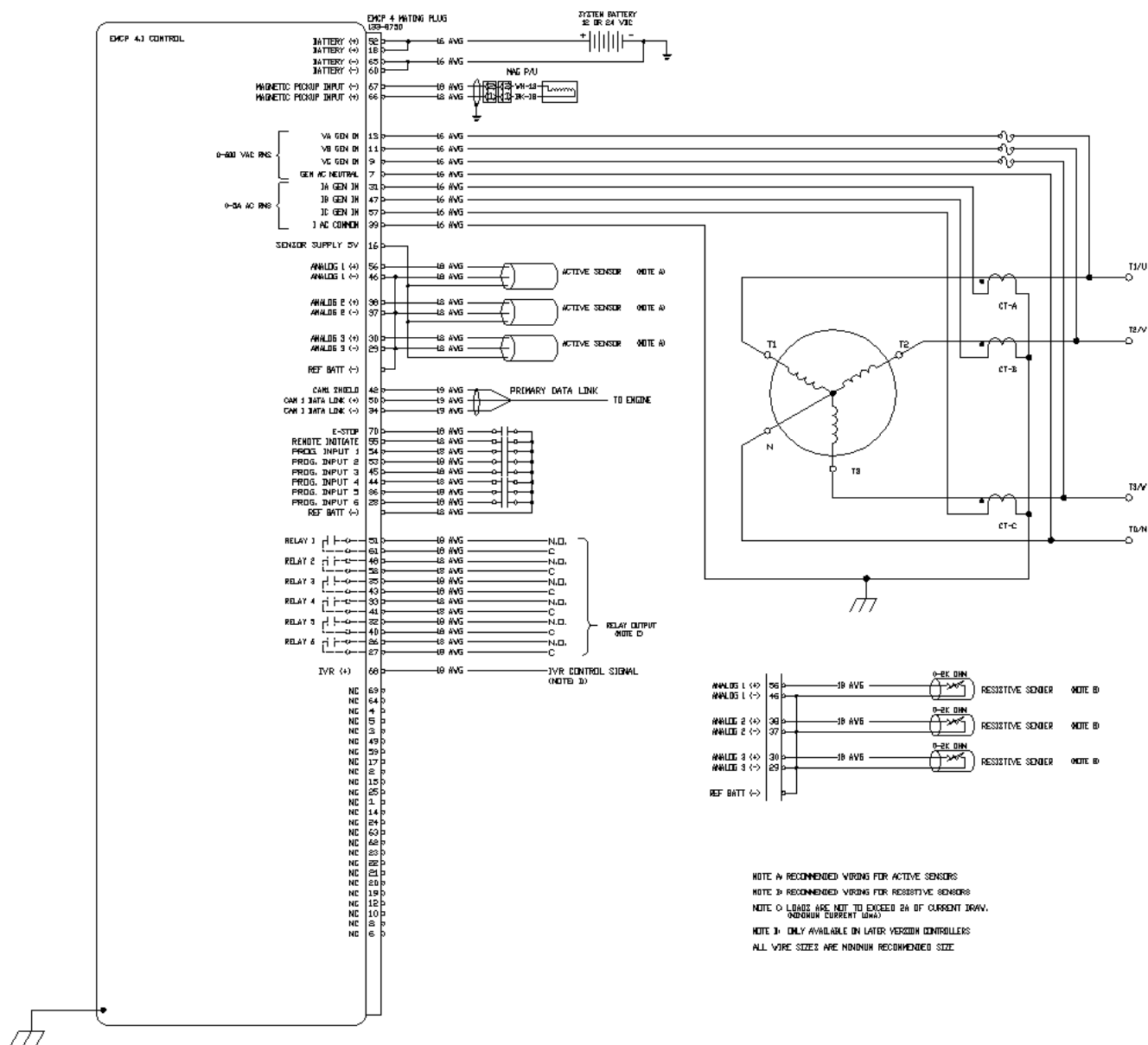


Figure 3: EMCP 4.1 Wiring Diagram

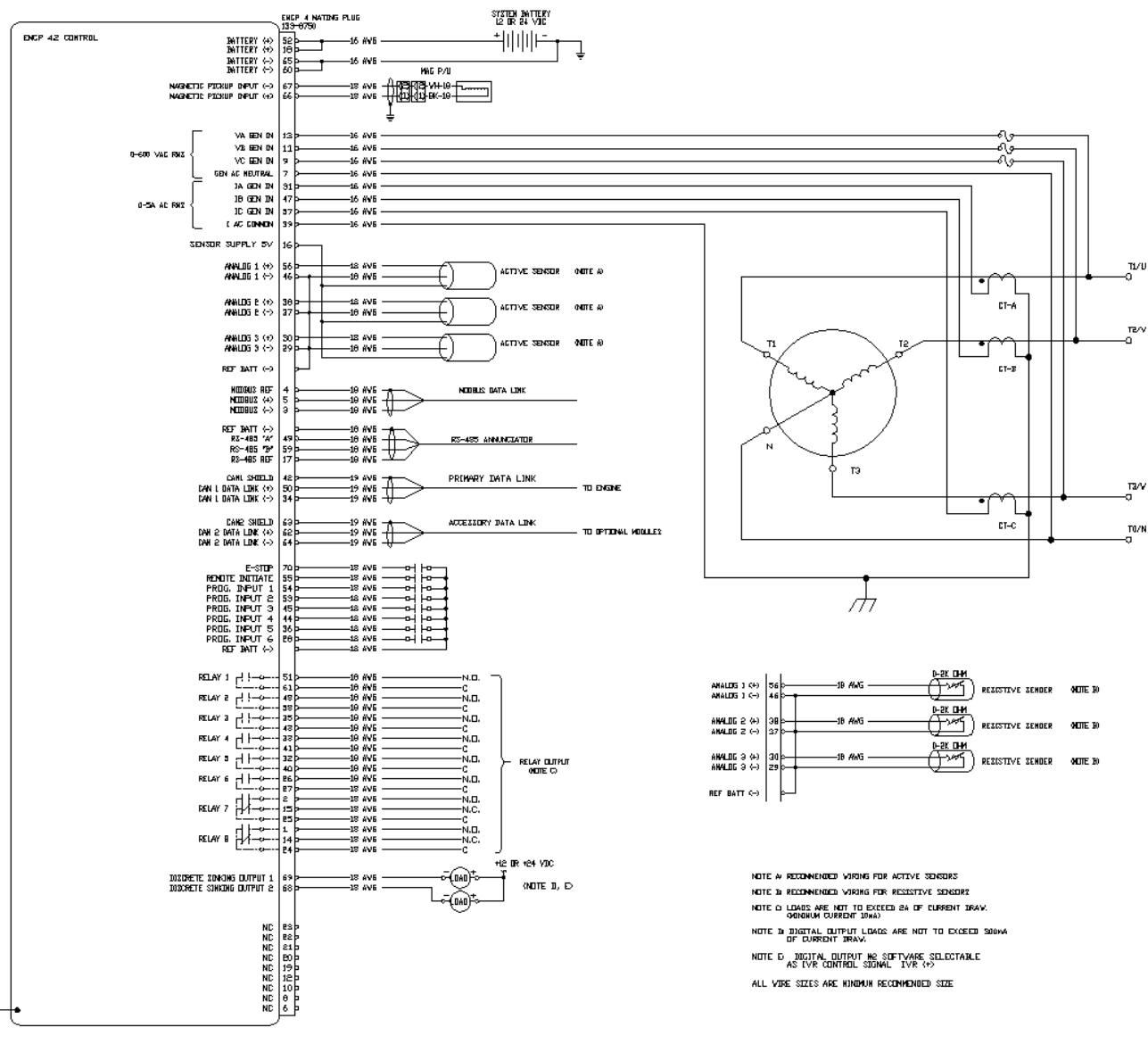


Figure 4: EMCP 4.2 Wiring Diagram

3.8 WINDING CONNECTIONS

The connections between the generator and the EMCP 4 depend on the winding configuration as shown in the connection diagrams below.

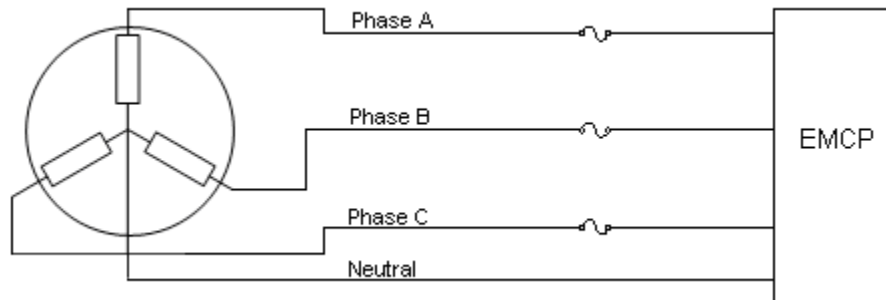


Figure 5: Three Phase Four Wire (Series or Parallel) Wye (Star)

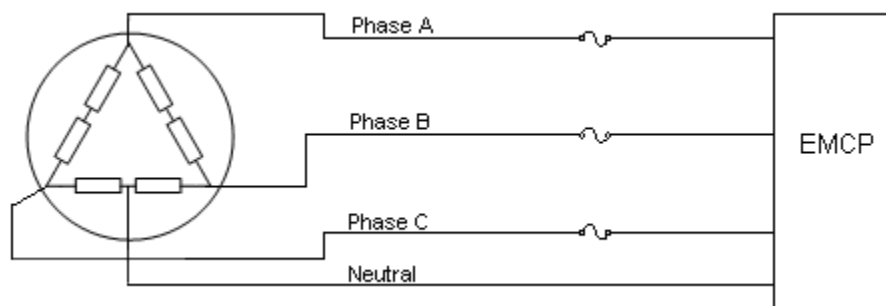


Figure 6: Three Phase Four Wire Delta (L2-N-L3)

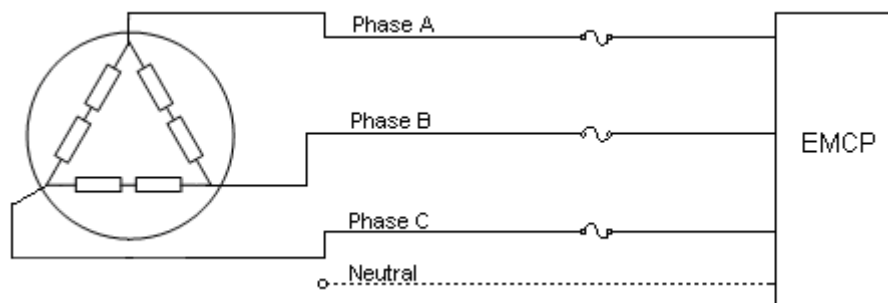


Figure 7: Three Phase Three Wire Delta

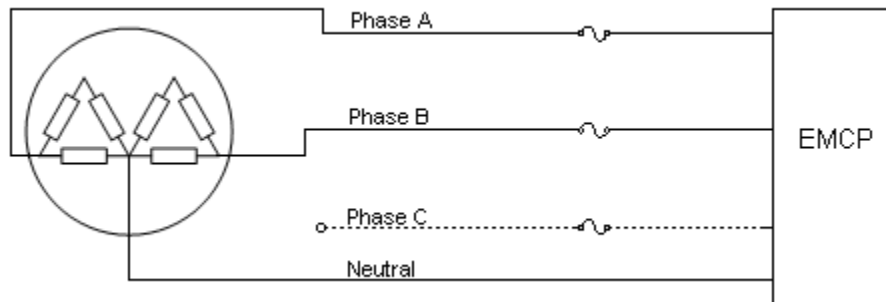


Figure 8: Single Phase Three Wire (L1-N-L2), Double Delta

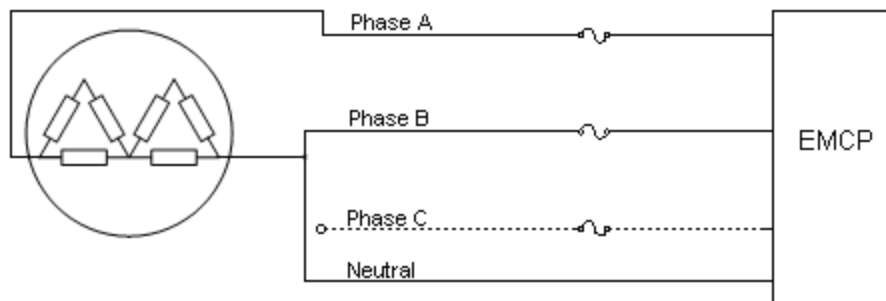


Figure 9: Single Phase Two Wire (L1-L2), Double Delta

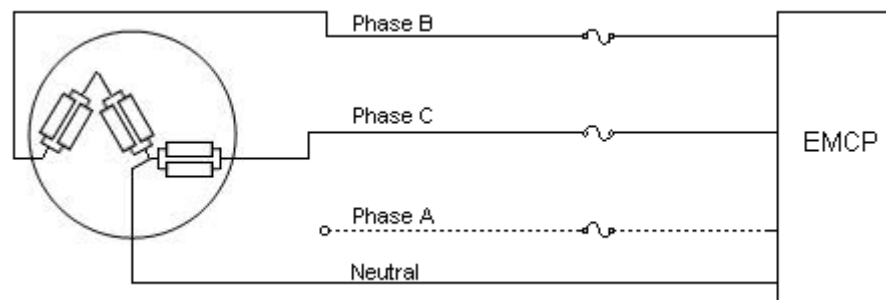


Figure 10: Single Phase Three Wire (L2-N-L3), Zig-

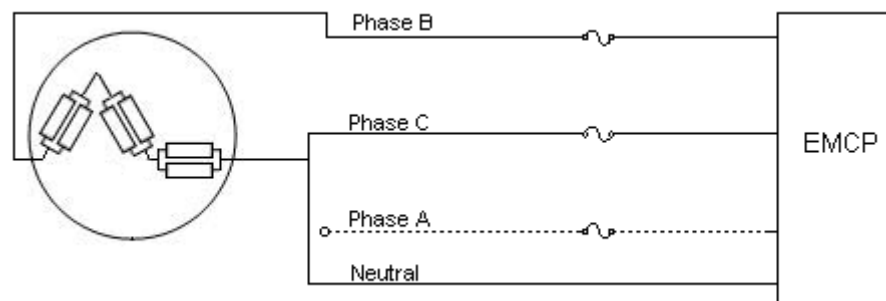


Figure 11: Single Phase Two Wire (L2-L3), Zig-Zag

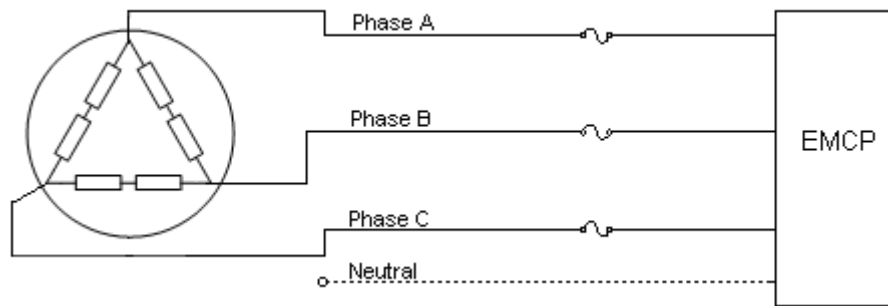


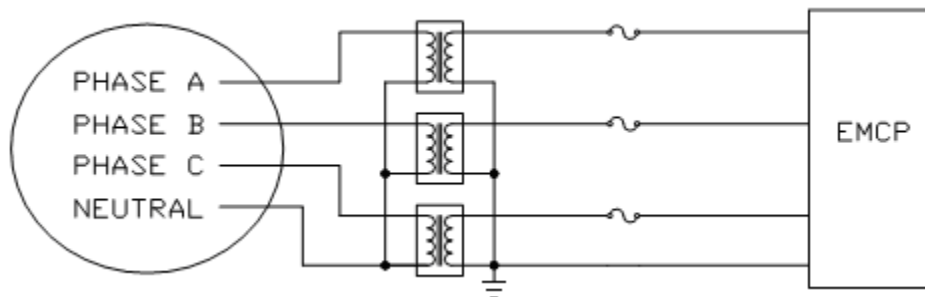
Figure 12: Three Phase Four Wire Delta(B-C-N-A) *FIX PICTURE*

3.9 TRANSFORMER CONNECTIONS

In order to monitor generator output voltages greater than 600 Volts nominal (grounded wye (star)), external potential transformers must be used.

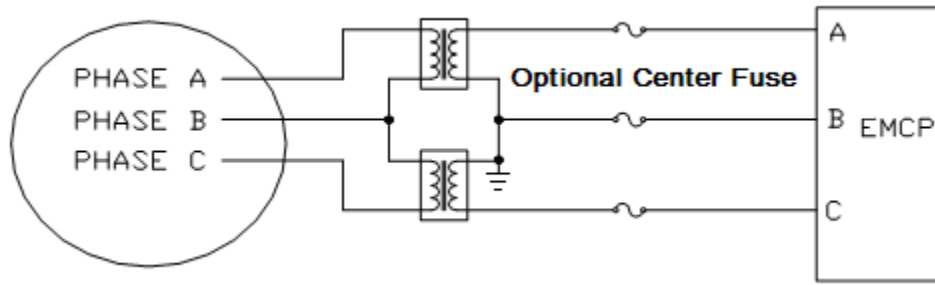
Note: The EMCP 4 must be programmed for the correct winding ratios when connecting external potential transformers. See Chapter 7, Setpoints for more information on how to program the winding ratios. If delta potential transformers are used on a wye (star) generator, the EMCP must be programmed for a delta generator.

Caution: The **WYE (STAR)** configuration of external potential transformers is preferred for 4-wire wye (star) generators because of the greater accuracy when loads are unbalanced. With the open delta configuration, some power parameters cannot be determined. These parameters are 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. See Table 1: Power Values Available by Generator Configuration.



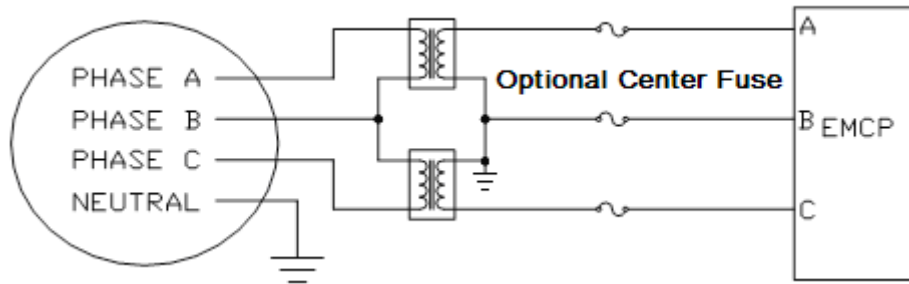
(PT) on the 4-Wire Wye (Star) Connected Generator

Figure 13: Wye (Star) Configuration of External Potential Transformers



(PT) on the 3-Wire Delta Connected Generator

Figure 14: Open Delta Configuration of External Potential Transformers



(PT) on the 4-Wire Wye (Star) Connected Generator

Figure 15: Open Delta Configuration of External Potential Transformers

Power Values Available by Generator Configuration							
Parameter	WYE (STAR)	3-WIRE DELTA	4-WIRE DELTA	2-WIRE 1-PHASE (L1-L2)	2-WIRE 1-PHASE (L2-L3)	3-WIRE 1-PHASE (L1-N-L2)	3-WIRE 1-PHASE (L2-N-L3)
Gen Freq	Available	Available	Available	Available	Available	Available	Available
$V_{L-L\text{ AVG}}$	Available	Available	Available	Available	Available	Available	Available
V_{A-B}	Available	Available	Available	Available	Not Available	Available	Not Available
V_{B-C}	Available	Available	Available	Not Available	Available	Not Available	Available
V_{C-A}	Available	Available	Available	Not Available	Not Available	Not Available	Not Available
$V_{L-N\text{ AVG}}$	Available	Available	Available	Not Available	Not Available	Available	Available
V_A	Available	Not Available	Available	Not Available	Not Available	Available	Not Available
V_B	Available	Not Available	Available	Not Available	Not Available	Available	Available
V_C	Available	Not Available	Available	Not Available	Not Available	Not Available	Available
I_{AVG}	Available	Available	Available	Available	Available	Available	Available
I_A	Available	Available	Available	Available	Not Available	Available	Not Available
I_B	Available	Available	Available	Available	Available	Available	Available
I_C	Available	Available	Available	Not Available	Available	Not Available	Available

Table 1: Power Values Available by Generator Configuration

Note: Accuracy of the potential and current transformers will affect the accuracy of the voltage and current readings.

3.10 WIRING REQUIREMENTS

When selecting the type of wire to use, consideration must be given to the wire voltage drop, (line loss), accuracy, communication error, and other requirements. See Table 2.

Component	Min 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).	
CAN (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.	
Engine Solenoids (Air Shutoff)	14	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			
RS-485 Annunciator	14 or 16 Or 18	Shielded twisted triad cable is recommended. 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).	Deutsch DT type of connectors are recommended.

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

Table 2: Wiring Requirements

3.11 SHIELDED AND COMMUNICATION WIRING

Shielded twisted pair cable is required for the magnetic speed sensor. CAN cable is required for Primary and Accessory CAN Data Links. 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. The shields should not be connected to the sheet metal. 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.

When the cable terminates at junction boxes, the shields must be connected to each other in order to maintain a continuous path. A continuous path must be maintained in the shield wire for sensors, whenever possible. Wire exposed beyond the shield should be as short as possible. The shield must be connected to battery negative as close to the controller as possible. Shields should be drained at one point only. When possible, this should be done at, or close to, the EMCP 4.

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 TYPES OF EMCP 4 EVENTS

The EMCP 4 has two lamps to annunciate events. The amber lamp indicates warning-type events, while the red lamp indicates shutdown-type events. The amber lamp also lights if a “Protect” lamp is being sent by a different module. ET2013B and later can be used to help identify what modules are sending different lamp statuses. The lamps flash when new events arrive, and remain flashing (often accompanied by an audible horn) until acknowledged by pressing the acknowledge button locally or remotely. Shutdown-type events do not clear until the user fixes the condition(s) that caused the shut down and “resets” the events. The EMCP 4 supports a very large number of events, and most events generated by the EMCP can be configured based on application needs. For information on viewing, resetting, and configuring events, see Chapter 5.

Note: The EMCP 4 will annunciate and display events from other modules, even if these events are not generated by the EMCP 4. These events are not logged in the EMCP itself, but are viewable from the individual module log located in the EMCP 4.

4.2 USING THE CAT SERVICE TOOL

Many of the features of the EMCP 4 system can be accessed via the Cat Service Tool. These features include viewing status data, monitoring optional modules, viewing and resetting events, and configuring setpoints.

Note: A minimum of the Cat ET Service Tool version 2010C is required to communicate properly with the EMCP 4. If an earlier version is used, the EMCP 4 will be grayed out. In order to have access to the latest setpoints, the latest version of the Cat ET service tool should always be used.

Throughout this document, instructions for accessing a feature both via the EMCP 4 display and via the Cat Service Tool will be given. However, the Cat Service Tool also offers other unique features that are useful for site commissioning, ECM retrofitting, or troubleshooting, such as the ability to log data to a file or graph data in real-time. Such features are not in the scope of this document. For more information on the Cat Service Tool, refer to the Cat Service Tool documentation and training.

Figure 16 outlines the available EMCP 4 features that are available within the Electronic Technician software.

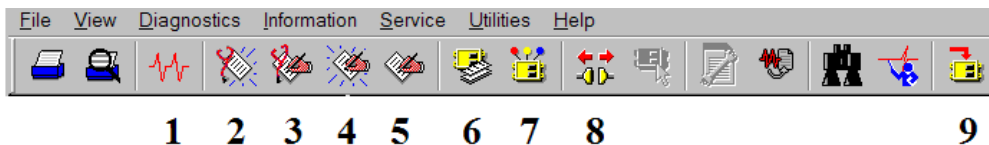


Figure 16: Electronic Technician EMCP 4 Features

1. Status Tool
2. Active Diagnostic Codes
3. Logged Diagnostic Codes
4. Active Event Codes
5. Logged Event Codes
6. ECM Summary
7. Configuration Tool
8. Connect/Disconnect
9. Winflash

When in the Status tool, buttons to Active Codes and Events are provided at the bottom of the screen.

CONNECTING TO THE EMCP 4 TO CONFIGURE SETPOINTS

In order to use the Cat Service Tool with the EMCP and configure setpoints, do the following:

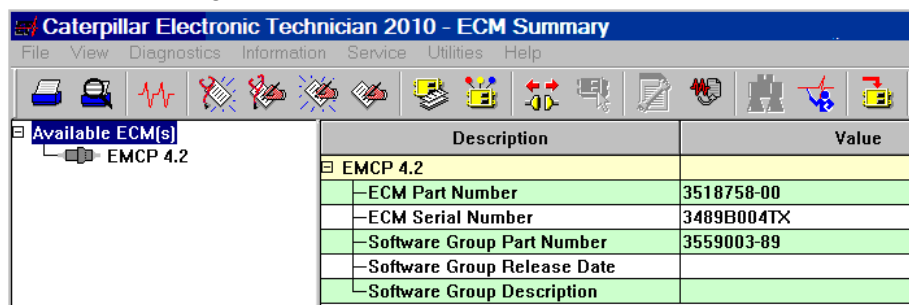
1. Connect the Service Tool to the PC and configure the port settings as appropriate.
2. Ensure the Service Tool is connected to the Primary Data Link (CAN 1).
3. Start the Electronic Technician software.



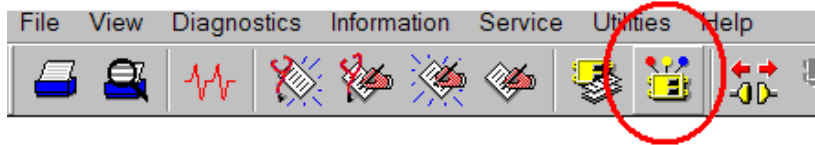
4. The software will search the data links.



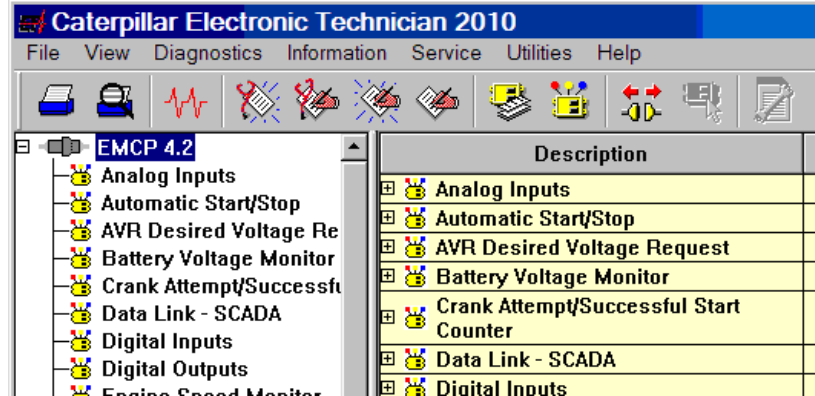
5. When the software finds the EMCP and connects to it, The ECM Summary screen will appear. If multiple devices are detected, always select the EMCP before continuing to be able to access special EMCP features with ET such as annunciator configuration and device lamp status.



6. To view configurable parameters within the EMCP 4, press the Configuration button.



7. The parameter groups will appear.



8. Selecting a group in the left pane will show all the parameters within that group in the right pane.

4.3 VIEWING SYSTEM PARAMETERS

Many generator and engine parameters are viewable in real time from both the Cat Service Tool, and the EMCP 4 display.

FROM THE CAT 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 Cat Service Tool help from the Help > Contents menu for more information on the Status Tool.

FROM THE EMCP 4 DISPLAY

Parameters are accessed (irrespective of the current screen position) by pressing the **AC**

OVERVIEW , **ENGINE OVERVIEW** , or **Main Menu**  buttons located below the screen. Detailed screens provide even more information by pressing the **SCROLL**

DOWN  button from each of the overview screens. For a description of the front view and navigation keys, refer to Appendix B.

The EMCP 4 parameters are organized with different levels of users in mind. These levels are as follows: View, Control, and Configure. Some of the parameters are accessible from multiple paths. For a complete menu structure, refer to Appendix A.

SUPPORTED PARAMETERS

Different versions of the EMCP 4 support different numbers of parameters. EMCP 4.2 supports multiple parameters not supported on the EMCP 4.1. 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 4 they may be available.

Parameters are displayed with units, some of which are configurable. For changing units or setting other user preferences see Chapter 4.4, Viewing and Adjusting Preferences.

Parameters that are not available to the EMCP 4 are shown as **** (four asterisks). This may indicate an incorrect software configuration, a wiring problem, or a problem with the sensor.

ENGINE OVERVIEW

The Engine Overview screens display various engine parameters. The following parameters are displayed on the Engine Overview screens:

ENGINE OVERVIEW SCREEN

- Engine Oil Pressure
- Engine Coolant Temperature
- Battery Voltage, as measured at the connector entering the EMCP 4
- 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)

34 Psi	188°F	24.8 V
1800 rPm		12.3 hrs
STOPPED		

ENGINE SCREEN 1

- Engine Oil Pressure
- Engine Coolant Temperature
- Engine Speed

OIL PRESSURE	34 Psi
COOLANT TEMP	188 °F
ENGINE SPEED	1800 rPm

ENGINE SCREEN 2

- Battery Voltage, as measured at the connector entering the EMCP 4
- Engine Hours
- Engine Fuel Level or Engine Oil Temperature via Analog input #3

BATT VOLTAGE	24.8 V
ENGINE HRS	12.3

ENGINE SCREEN 3 (EMCP 4.2 ONLY)

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

SERV:	489 HOURS
OR	164 DAYS

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)

TOTAL CRANKS	132
TOTAL STARTS	110

ENGINE SCREEN 5 (EMCP 4.2 ONLY)

- Cylinder #N Temperature (if temperature module is installed)



Press the **DOWN**  arrow to view the remaining cylinder temperatures.

CYLINDER 01	254 °F
CYLINDER 02	255 °F
CYLINDER 03	254 °F

ENGINE SCREEN 6 (EMCP 4.2 ONLY)

(if temperature module is installed)

- Temperature
- Left Exhaust Manifold
- Right Exhaust Manifold
- Intake Manifold
- Exhaust Temp
- Turbo 1 Compressor Inlet
- Turbo 2 Compressor Inlet
- Turbo 3 Compressor Inlet
- Turbo 4 Compressor Inlet
- Turbine 1 Inlet
- Turbine 1 Outlet
- Turbine 2 Inlet
- Turbine 2 Outlet
- Turbine 3 Inlet
- Turbine 3 Outlet
- Turbine 4 Inlet
- Turbine 4 Outlet



Press the **DOWN**  arrow to view the remaining temperatures.

LEFT EXH MAN	258°C
RIGHT EXH MAN	256°C
EXHAUST TEMP	301°C

ENGINE SCREEN 7 (EMCP 4.2 ONLY)
(if supported by Engine ECM)

- Engine Oil Temperature
- Engine Fuel Temperature

ENG OIL TEMP	168°C
ENG FUEL TEMP	157°C

ENGINE SCREEN 8 (EMCP 4.2 ONLY)
(if supported by Engine ECM)

- Engine Fuel Pressure
- Engine Crankcase Pressure
- Boost Pressure

ENG FUEL PRES	34kPA
ENG CRANK PRES	98kPA
BOOST PRES	24kPA

ENGINE SCREEN 9 (EMCP 4.2 ONLY)
(if supported by Engine ECM)

- Oil Filter Differential Pressure
- Fuel Filter Differential Pressure

OIL FLTR DIF PRES	7kPA
FUEL FLTR DIF PRES	8kPA

ENGINE SCREEN 10 (EMCP 4.2 ONLY)
(if supported by Engine ECM)

- Air Filter Differential Pressure

AIR FLTR DIF PRES	16kPA
-------------------	-------

ENGINE SCREEN 11 (EMCP 4.2 ONLY)
(if supported by Engine ECM)

- Total Fuel Consumption
- Instantaneous Fuel Consumption Rate

TOTAL FUEL USE	134gal
INST FUEL RATE	44gph

ENGINE SCREEN 12
(if supported by SCR or Engine ECM)

- SCR Tank Level Status

SCR TANK LEVEL STATUS	94%
--------------------------	-----

ENGINE SCREEN 13
(if supported by SCR or Engine ECM)

- SCR Tank Temperature

SCR TANK TEMPERATURE	102°C
-------------------------	-------

ENGINE SCREEN 14
(if supported by SCR or Engine ECM)

- SCR Air Assist Pressure

SCR AIR ASSIST PRESSURE	18kPA
----------------------------	-------

ENGINE SCREEN 15

(if supported by SCR or Engine ECM)

- Catalyst Temperature

CATALYST
TEMPERATURE
118°C

ENGINE SCREEN 16

(if supported by SCR or Engine ECM)

- SCR Exhaust Gas Differential Pressure

SCR EXHAUST GAS
DIFFERENTIAL PRESSURE
4kPA

ENGINE SCREEN 17

- (if supported by SCR or Engine ECM) SCR System Status

SCR SYSTEM
STATUS
NORMAL

Engine Screen 18

(if supported by SCR or Engine ECM)

- Diesel Exhaust Fluid Dosing Temperature

DEF DOSING
TEMPERATURE
101°C

ENGINE SCREEN 19

- (if supported by SCR or Engine ECM) Total Diesel Exhaust Fluid Used

TOTAL DIESEL EXHAUST
FLUID USED
140.2 gal

ENGINE SCREEN 20

(if supported by SCR or Engine ECM)

- Time Since Last Inducement

TIME SINCE
LAST INDUCEMENT
9.0 HOURS

ENGINE SCREEN 21

(if supported by SCR or Engine ECM)

- Time Remaining Until Inducement

TIME REMAINING
UNTIL INDUCEMENT
3.0 HOURS

AC OVERVIEW

The AC Overview screens display various generator parameters. The following parameters are displayed on the AC Overview screens:

AC OVERVIEW SCREEN

- Average Line-Line AC Voltage
- Average Current
- AC Frequency
- Power Factor (EMCP 4.2 Only)
- Power Factor Lead/Lag status (EMCP 4.2 Only)
- Total Generator Real Power – kW (EMCP 4.2 Only)
- Percent Real Power as a percentage of Generator Rated Power (EMCP 4.2 Only)

AVG:	480 V	L-L	586 A
	60.0 Hz	0.87	LAGGING
TOTAL kW	404	67%	

GENERATOR SCREEN 1

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

L-L	V	479	480	480
	A	587	586	586
	60.0 Hz			

GENERATOR SCREEN 2

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

L-N	V	277	278	277
	A	587	586	586
	60.0 Hz			

GENERATOR SCREEN 3 (EMCP 4.2 ONLY)

- Phase Generator Real Power – kW
- Phase Generator Apparent Power – kVA
- Phase Generator Reactive Power – kVAr

kW	135	136	135
kVA	142	142	142
kVAr	45	44	45

GENERATOR SCREEN 4 (EMCP 4.2 ONLY)

- Phase Generator Real Power – kW
- Phase Generator Apparent Power – kVA
- Power Factor

kW	135	136	135
kVA	142	142	142
P.F.	0.95	0.95	0.95

GENERATOR SCREEN 5 (EMCP 4.2 ONLY)

- Total Generator Real Power – kW
- Total Generator Apparent Power – kVA
- Total Generator Reactive Power – kVAr

TOTAL kW	404	67%
TOTAL kVA	426	67%
TOTAL kVAr	134	67%

GENERATOR SCREEN 6 (EMCP 4.2 ONLY)

- Generator Real Energy produced since last meter reset
- Generator Reactive Energy produced since last meter reset

kWh	5629
kVArh	1602

GENERATOR SCREEN 7

- Average Line-Line AC Voltage
- Average Line-Neutral AC Voltage
- Power Factor (EMCP 4.2 Only)
- Power Factor Lead/Lag status (EMCP 4.2 Only)

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

GENERATOR SCREEN 8 (EMCP 4.2 ONLY)

- Rear Bearing Temperature (if temperature module is installed)
- Front Bearing Temperature (if temperature module is installed)

BEARING TEMPERATURES	
REAR	122° F
FRONT	110° F

GENERATOR SCREEN 9 (EMCP 4.2 ONLY)

- Generator Phase A Winding Temperature (if temperature module is installed)
- Generator Phase B Winding Temperature (if temperature module is installed)
- Generator Phase C Winding Temperature (if temperature module is installed)

WINDING TEMPERATURES		
A	B	C
87°F	87°F	86°F

GENERATOR SCREEN 10 (EMCP 4.2 WITH CDVR ONLY)

- Generator Excitation Field Voltage
- Generator Excitation Field Current

GEN EXCIT VOLTS	63.2V
GEN EXCIT CURRENT	9.8A

4.4 VIEWING AND ADJUSTING PREFERENCES

The EMCP 4 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 4.2 only), and displayed language (to select between the customer language and Technician English).

Note: These preferences do not affect operation of the EMCP 4, the values in the SCADA Communications (Modbus) or the data as viewed in the Cat Service Tool. They only affect how the text and data is converted and displayed on the EMCP 4 display.

SETTING THE PREFERENCES USING THE EMCP 4 DISPLAY

On the EMCP 4 display, the Preferences menu is located at the bottom of the Main Menu.

Scroll **DOWN**  to the desired Preference.

Press the **OK KEY** .

Use the Arrow keys to adjust the Preference as described below.

For any preference, press the **OK KEY**  to

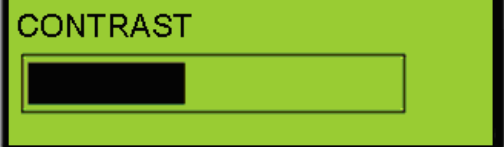
accept the change (or **ESCAPE KEY**  to reject the change) and return to the Preferences menu.



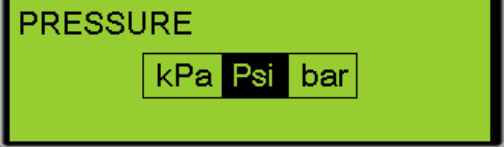
MAIN MENU
SOFTWARE INFO
PREFERENCES



PREFERENCES
CONTRAST
PRESSURES



CONTRAST



PRESSURE

kPa **Psi** bar

PREFERENCES

- CONTRAST** This determines the darkness of the pixels on the display. A minimum contrast setting (reached by pressing and holding the down or left arrow) effectively blanks the screen, and a maximum contrast setting (reached by pressing and holding the up or right arrow) effectively darkens the entire screen. To change the contrast if the screen is unreadable due to a misconfiguration or ambient conditions, see **CHANGING THE EMCP 4 CONTRAST WHEN THE DISPLAY IS UNREADABLE**.
- 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 up or down arrows, or the Function keys.
- 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. Select the desired unit with the up or down arrows.
- VOLUME**
(EMCP 4.2 only) This allows volume parameters (such as Fuel Volume) to be shown in Liters, Imperial Gallons, or US Gallons. Select the desired unit with the up or down arrows.
- LAMP TEST** When this selection is highlighted, pressing and holding the **OK KEY**  will darken all pixels on the screen and illuminate all LED's on the face of the controller.
- 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). Select the desired language with the up or down arrows. To change the language to Technician English, regardless of the current screen, and without needing to read the text, see **CHANGING THE EMCP 4 DISPLAY TO TECHNICIAN ENGLISH**.

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

CHANGING THE EMCP 4 CONTRAST WHEN THE DISPLAY IS UNREADABLE

1. Press the **MAIN MENU**  key
2. Scroll **DOWN**  until scrolling stops
3. Press the **OK KEY**  (this will take you into the Preferences Menu)
4. Press the **OK KEY**  again (this will take you into the Contrast selection)
5. Press and hold either **LEFT ARROW**  or **RIGHT ARROW**  until the text and graphics become visible
6. Press the **OK KEY**  to accept the adjustment

CHANGING THE EMCP 4 DISPLAY TO TECHNICIAN ENGLISH

1. Press the **MAIN MENU**  key
2. Scroll **DOWN**  until the scrolling stops
3. Press the **OK KEY**  (this will take you into the Preferences Menu)
4. Press the **DOWN ARROW**  key until scrolling stops
5. Press the **OK KEY**  (this will take you into the Language selection)
6. Press the **UP ARROW**  key until the scrolling stops
7. Press the **OK KEY**  to select **TECHNICIAN ENGLISH**

The EMCP 4 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 THE EMCP 4 DISPLAY TO THE PRIMARY LANGUAGE

1. Press the **MAIN MENU**  key
2. Scroll **DOWN**  until the scrolling stops
3. Press the **OK KEY**  (this will take you into the Preferences Menu)
4. Press the **DOWN ARROW**  until the scrolling stops
5. Press the **OK KEY**  (this will take you into the language selection)
6. Press the **DOWN**  arrow to select the customer language
7. Press the **OK KEY**  to change to the customer language

The EMCP 4 language setting is changed back to the customer language.

SETTING THE PREFERENCES USING THE SERVICE TOOL

Only the preferences for units can be configured using the Cat Service Tool. They are located in the Configuration Tool. Select Display Preferences from the left panel.

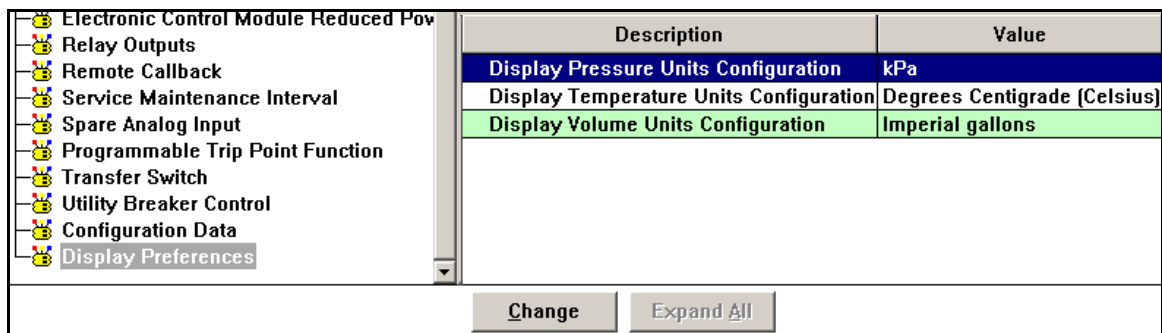


Figure 17: Display Preferences

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 some setpoints (such as Low Engine Oil Pressure Event Threshold via Datalink) to be shown in either kPa, psi, or bar.
- 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 Liters, Imperial Gallons, or US Gallons.
(EMCP 4.2 ONLY)

4.5 CONFIGURING TIME/DATE (EMCP 4.2 ONLY)

The EMCP 4.2 has an internal Real Time clock that is used for time-stamping events and Programmable Cycle Timer (Chapter 13). The timestamps for the last date and time an event has occurred and the first date and time the event has occurred are viewed by selecting a module in the Event Log and pressing the OK key, followed by the **DOWN**

ARROW  key. See Figure 18.

SPN 175	FMI 15	SPN 175	FMI 15
LAST HRS	33.6	FIRST HRS	33.6
01/01/10	11:23:27	28/02/10	16:21:13

Figure 18: Event Details Screens

CHANGING THE TIME/DATE

The EMCP 4.2 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 4 display; it cannot be done using the Cat 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:

At MAIN MENU scroll **DOWN**  to CONFIGURE.

Press the **OK KEY** .

Scroll **DOWN**  to TIME/DATE.

Press the **OK KEY** .

To begin editing the time, press the **OK KEY**  while the current time is selected.

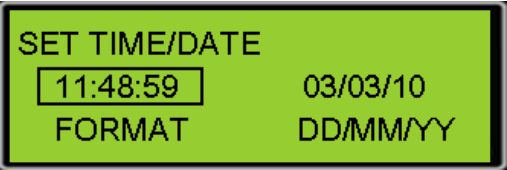
Press the **OK KEY**  again to enter the editor.



MAIN MENU
CONTROL
CONFIGURE



CONFIGURE
RESET COUNTERS
TIME/DATE



SET TIME/DATE
11:48:59 03/03/10
FORMAT DD/MM/YY



SET TIME
1 1 : 4 8 : 5 9

Select a digit using the **LEFT ARROW**  or **RIGHT ARROW** .

To change the selected digit use the **UP ARROW**  or **DOWN ARROW** .

To accept changes, press the **OK KEY** . To reject changes, press the **ESCAPE KEY** .

TO CHANGE THE DATE FROM THIS POINT

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

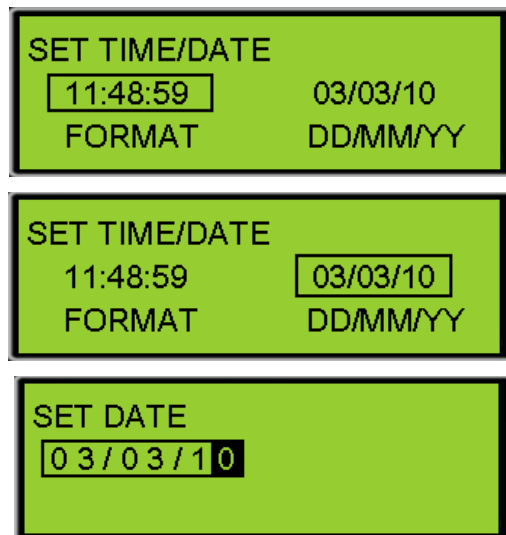
Press the **RIGHT ARROW**  key to put the box around the date.

Press the **OK KEY**  again to enter the editor.

Select a digit using the **LEFT ARROW**  or **RIGHT ARROW** .

To change the selected digit use the **UP ARROW**  or **DOWN ARROW** .

To accept changes, press the **OK KEY** . To reject changes, press the **ESCAPE KEY** .

**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 4.2 display; it cannot be done using the Cat Service Tool.

Note: This preference does not affect operation of the EMCP 4 or the data as viewed in the Cat Service Tool. It only affects how the date is displayed on the EMCP 4 display and the format of the event time stamps.

To change the date format, do the following:

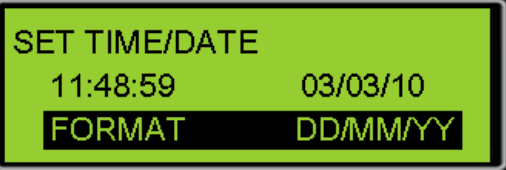
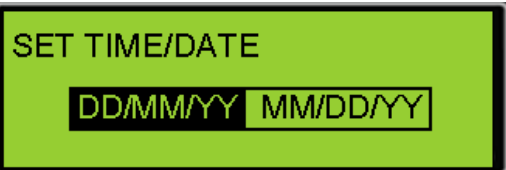
At MAIN MENU scroll **DOWN**  to **CONFIGURE**.
Press the **OK KEY** .

SCROLL DOWN  to **TIME/DATE**.
Press the **OK KEY** .

To begin editing the date, press the **OK KEY**  while the current date is selected.

Select the format using the
LEFT ARROW  or **RIGHT ARROW** , then press
the **OK KEY**  to accept, or the **ESCAPE KEY**  to reject, the change.



4.6 ADJUSTING GENERATOR SET PARAMETERS

On many gensets, the engine speed, generator output voltage, and idle/rated status can be adjusted from the display of the EMCP 4. This ability is dependent upon the engine interface strategy and input/output configuration.

GENERATOR OUTPUT VOLTAGE

If the genset is equipped with a Cat Digital Voltage Regulator (Cat DVR) or the Integrated Voltage Regulator (IVR), then the generator output voltage setpoint can be adjusted from the display of the EMCP 4. When using the CDVR, the CDVR must be programmed to allow this control. In order for the **VOLTAGE ADJUST** to work via CAN, 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 4 will **NOT WORK**.

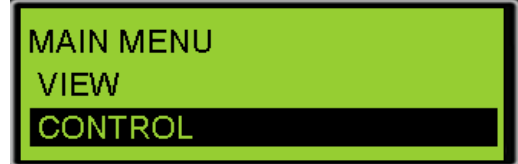
ENGINE SPEED

If the genset is equipped with an ADEM A3 or A4 governor, then the engine speed setpoint can be adjusted from the display of the EMCP 4, provided the A3 or A4 is programmed to allow this control. In order for the **SPEED ADJUST** to work via CAN, the **DESIRED THROTTLE INPUT CONFIGURATION** setpoint in the A3 or A4 must be programmed for **CAN INPUT**. If that setpoint is set to **PWM**, the **SPEED CONTROL** from the EMCP 4 will **NOT WORK**.

PROGRAMMING THE GENERATOR OUTPUT VOLTAGE AND ENGINE SPEED

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

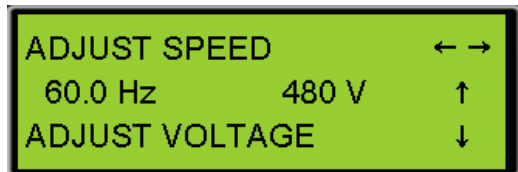
Press the **OK KEY**



From the **CONTROL MENU**, select **VOLT/Hz CONTROL**.



Press the **OK KEY**



The speed and voltage adjust screen will be displayed.

To adjust the generator voltage from this screen:

Press the **DOWN ARROW KEY**  to **DECREASE** the generator voltage.

Press the **UP ARROW KEY**  to **INCREASE** the generator voltage.

To adjust the engine speed from this screen:

Press the **LEFT ARROW KEY**  to **DECREASE** the engine speed.

Press the **RIGHT ARROW KEY**  to **INCREASE** the engine speed.

The EMCP 4 will broadcast a desired engine speed bias based on the adjustment that is made. When the engine speed is adjusted, then that value will remain until either it is adjusted again or until the control is power-cycled. Unlike the setpoints or preferences

(i.e. contrast), any changes to this screen take effect immediately. The **OK KEY**



and **ESCAPE KEY**  do not serve to accept or cancel changes.

IDLE/RATED

The EMCP 4.1 and EMCP 4.2 both have the ability to be placed into Idle mode via the display, a Discrete Input, or through the SCADA Data Link. With some genset systems, the engine ECM may also send the EMCP into Idle mode when the engine ECM is operating in Idle mode. Idle mode will disable Under Speed, Under Voltage, and Under Frequency protections in the EMCP 4. It will also use a different set of oil pressure thresholds.

Note: The Engine Forced Idle Feature Enable Status parameter must be set to “Enabled” within Cat ET prior to seeing this menu option on the display. This setpoint is under the Automatic Start/Stop submenu in Cat ET.

When the EMCP 4 is placed in Idle mode, a programmable output may be programmed and wired to signal that it is operating in Idle. In some wiring configurations, the EMCP will also send a signal via the Primary CAN Data Link to the ADEM.

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

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

Press the **OK KEY**



MAIN MENU
VIEW
CONTROL

From the **CONTROL MENU** select **IDLE/RATED**.

Press the **OK KEY**



CONTROL
VOLT/Hz CONTROL
IDLE/RATED

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

Press the **OK KEY**



IDLE/RATED
RUN AT RATED

Press the **UP ARROW**  or **DOWN ARROW**  to change the state.

Press the **OK KEY**



IDLE/RATED
RUN AT RATED
RUN AT IDLE

ENGINE SENSOR VERSUS DATA LINK

The Engine Oil Pressure and Engine Coolant Temperature setpoints need special care when programming. These can be configured as either **SENSOR** or **DATA LINK**.

When **SENSOR** is configured, the physical sensor is connected directly to the EMCP 4. In this configuration, Analog Inputs are configured with the desired setpoints for the rated speed warnings and shutdowns. The idle setpoints are still configured under the Engine Oil Pressure Monitor.

When **DATA LINK** is configured, the physical sensors are connected to the engine ECM. The engine ECM is configured with setpoints to protect the engine. Sensor values may also be communicated to the EMCP over the data link. The EMCP allows for redundant setpoints to be assigned based on this information seen from the engine.

TO CONFIGURE THE CONTROLLER AS SENSOR OR DATA LINK USING THE DISPLAY:

At MAIN MENU scroll DOWN  to CONFIGURE.

Press the OK KEY .

SCROLL DOWN  to ALL SETPOINTS.

Press the OK KEY .

SCROLL DOWN  to ENG MONITOR/PROTECT.

Press the OK KEY .

SCROLL DOWN  to ENG COOL TEMP MON OR ENG OIL PRES MON.

Press the OK KEY .

Note: Level 3 password is required.

Press the OK KEY .

To change the selection use the UP ARROW 
or DOWN ARROW .

Press the OK KEY .

MAIN MENU
CONTROL
CONFIGURE

CONFIGURE
INPUTS & OUTPUTS
ALL SETPOINTS

SETPOINTS
CONTROL
ENG MONITOR/PROTECT

ENG MONITOR/PROTECT
ENG COOL TEMP MON
ENG OIL PRES MON

ENGINE OIL PRESSURE
SENSOR CONFIGURATION
SENSOR

TO CONFIGURE THE CONTROLLER AS SENSOR OR DATA LINK USING CAT ET:

1. Connect to the EMCP 4 using the Cat Service Tool as stated in Chapter 4.2.
2. Select Automatic Start/Stop on the left.



3. Double click the Engine Coolant Temperature Sensor Configuration setpoint to change this value from the drop down menu. Click the OK button to program.

The screenshot shows a dialog box titled "Change Parameter Value". It contains the following fields and controls:

- Parameter Name:** Engine Coolant Temperature Sensor Configuration
- Current Value:** Sensor
- New Value:** A dropdown menu with three options: "Data Link" (highlighted in blue), "Data Link", and "Sensor".
- Text:** "Please select one of the listed values for this parameter."
- Buttons:** "OK" and "Cancel" at the bottom right.

4. Double click the Engine Oil Pressure Sensor Configuration setpoint to change this value from the drop down menu. Click the OK button to program.

The screenshot shows a dialog box titled "Change Parameter Value". It contains the following fields and controls:

- Parameter Name:** Engine Oil Pressure Sensor Configuration
- Current Value:** Sensor
- New Value:** A dropdown menu with three options: "Data Link" (highlighted in blue), "Data Link", and "Sensor".
- Text:** "Please select one of the listed values for this parameter."
- Buttons:** "OK" and "Cancel" at the bottom right.

ENGINE OIL PRESSURE

The Engine Oil Pressure setpoints need special care when programming. The first step is to set the configuration as either SENSOR or DATA LINK.

When SENSOR is configured, the physical sensor is connected directly to the EMCP 4. In this configuration, Analog Input #1 (normally used for Oil Pressure Sensor) is configured with the desired setpoints for the rated speed Oil Pressure warnings and shutdowns. The idle speed step and idle oil pressure setpoints are still configured under the Engine Oil Pressure Monitor.

When DATA LINK is configured, the physical sensor is connected to the engine ECM. The engine ECM is configured with setpoints to protect the engine. Sensor values may also be communicated to the EMCP over the data link. The EMCP allows for redundant setpoints to be assigned based on this information seen from the engine.

SENSOR CONFIGURATION

In SENSOR configuration, Analog Input #1 contains the parameters for warnings and shutdowns for High and Low OIL PRESSURE. Security Level 3 is required to program Analog Input #1.

TO CONFIGURE ANALOG INPUT #1 FOR ENGINE OIL PRESSURE:

AT THE MAIN MENU, scroll down  to CONFIGURE.

Press the OK KEY .

SCROLL DOWN  to INPUTS & OUTPUTS.

Press the OK KEY .

SCROLL DOWN  to ANALOG INPUTS.

Press the OK KEY .

Alternately, access to THE INPUTS & OUTPUTS submenu is accessible from ALL SETPOINTS.

Select the ANALOG INPUT #1.

Press the OK KEY .

Press the OK KEY  to highlight the current configuration (DISABLED, RESISTIVE, OR VOLTAGE).

Scroll DOWN  to RESISTIVE .

Press the OK KEY .

Scroll DOWN  to DATA IDENTIFICATION

Press the OK KEY  to change the current DATA IDENTIFICATION.

Select the DATA IDENTIFICATION to ENG OIL PRES.

Press the OK KEY .

MAIN MENU
CONTROL
CONFIGURE

INPUTS & OUTPUTS
DIGITAL INPUTS
RELAY OUTPUTS

INPUTS & OUTPUTS
DIGITAL OUTPUTS
ANALOG INPUTS

ANALOG INPUTS
ANALOG INPUT #1
ANALOG INPUT #2

ANALOG INPUT #1
USAGE TYPE:
DISABLED

ANALOG INPUT #1
USAGE TYPE:
RESISTIVE

ANALOG INPUT #1
DATA IDENTIFICATION:
DATA LINK - SCADA

ANALOG INPUT #1
DATA IDENTIFICATION:
ENG OIL PRES

Scroll **DOWN**  to configure the remaining setpoints for Analog Input #1:

- Map Selection Number
- Low Warning Threshold
- Low Warning Delay
- Low Warning Event Response
- Low S/D Threshold
- Low S/D Delay
- Low S/D Event Response
- Shared Supply Voltage

In addition to the setpoints for high and low Oil Pressure available in Analog Input #1, setpoints for LOW IDLE LOW OIL PRESSURE and STEP SPEED are also available in the ENG MONITOR/PROTECT menu.

TO CONFIGURE THESE SETPOINTS:

At MAIN MENU scroll **DOWN**  to CONFIGURE.

Press the OK KEY .

SCROLL **DOWN**  to ALL SETPOINTS.

Press the OK KEY .

SCROLL **DOWN**  to ENG MONITOR/PROTECT.

Press the OK KEY .

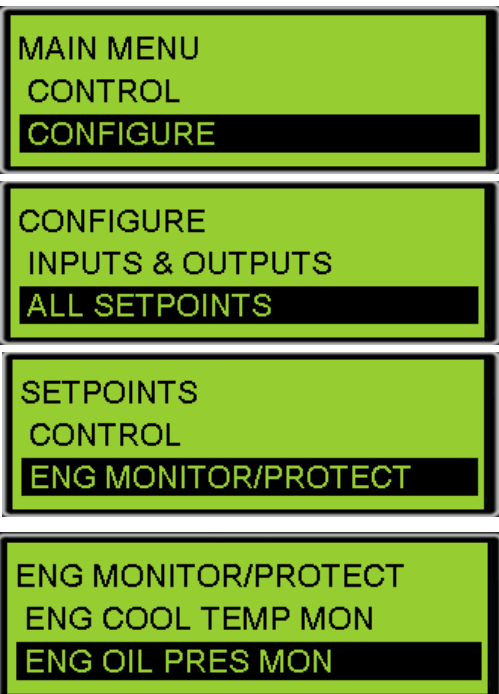
SCROLL **DOWN**  to ENG OIL PRES MON.

Press the OK KEY .

Note: Level 3 password is required.

Scroll **DOWN**  to configure the remaining setpoints for Engine Oil Pressure Monitor:

- Low Eng Oil Pressure Warning Threshold
- Low Idle Low Eng Oil Pres Warn Threshold
- Low Eng Oil Pressure Warning Delay Time
- Low Eng Oil Pressure Shutdown Threshold
- Low Idle Low Eng Oil Pres S/D Threshold
- Low Eng Oil Pressure Shutdown Delay Time
- Low Engine Oil Pressure Step Speed



Note: All DATA LINK OIL PRESSURE setpoints in this menu are inactive when in SENSOR configuration. The Low Idle setpoints are still active regardless of SENSOR or DATA LINK. Setpoints labeled as DATA LINK to refer to the fact they are only active when the DATA LINK configuration is chosen.

DATA LINK

The OIL PRESSURE setpoints when in the DATA LINK configuration are redundant to the primary protection provided by the engine ECM. If these protections are not programmed to match those in the ADEM and an event occurs, check the Event Logs to determine which module generated the event.

ENGINE COOLANT TEMPERATURE

The Engine Coolant Temperature setpoints need special care when programming. The first step is to set the configuration as either SENSOR or DATA LINK.

When SENSOR is configured, the physical sensor is connected directly to the EMCP. In this configuration, Analog Input #2 (normally used for Coolant Temperature) is configured with the desired setpoints for Coolant Temperature warnings and shutdowns.

When DATA LINK is configured, the physical sensor is connected to the engine ECM. The engine ECM is configured with setpoints to protect the engine. Sensor values may also be communicated to the EMCP over the data link. The EMCP allows for redundant setpoints to be assigned based on this information seen from the engine.

SENSOR CONFIGURATION

In SENSOR configuration, Analog Input #2 contains the configurations for alarms and shutdowns for High and Low COOLANT TEMPERATURE. Security Level 3 is required to program Analog Input #2.

TO CONFIGURE ANALOG INPUT #2 FOR ENGINE COOLANT TEMPERATURE:

AT THE MAIN MENU, scroll down  to CONFIGURE

Press the OK KEY 

SCROLL DOWN  to INPUTS & OUTPUTS

Press the OK KEY 

SCROLL DOWN  to ANALOG INPUTS

Press the OK KEY 

Alternately, access to THE INPUTS & OUTPUTS submenu is accessible from ALL SETPOINTS.

Select the ANALOG INPUT #2

Press the OK KEY 

MAIN MENU
CONTROL
CONFIGURE

INPUTS & OUTPUTS
DIGITAL INPUTS
RELAY OUTPUTS

INPUTS & OUTPUTS
DIGITAL OUTPUTS
ANALOG INPUTS

ANALOG INPUTS
ANALOG INPUT #1
ANALOG INPUT #2

Press the **OK KEY**  to highlight the current configuration (**DISABLED, RESISTIVE, OR VOLTAGE**).

Scroll **DOWN**  to select the appropriate sensor

Press the **OK KEY** 

Scroll **DOWN**  to **DATA IDENTIFICATION**

Press the **OK KEY**  to change the current **DATA IDENTIFICATION**.

Select the **ENG COOLANT TEMP**

Press the **OK KEY** 

ANALOG INPUT #2
USAGE TYPE:
DISABLED

ANALOG INPUT #2
USAGE TYPE:
RESISTIVE

ANALOG INPUT #2
DATA IDENTIFICATION:
DATA LINK - SCADA

ANALOG INPUT #2
DATA IDENTIFICATION:
ENG COOLANT TEMP

Scroll **DOWN**  to configure the remaining setpoints for Analog Input #2:

- Map Selection Number
- High Warning Threshold
- High Warning Delay
- High Warning Event Response
- High Warning Threshold
- Low Warning Delay
- Low Warning Event Response
- High S/D Threshold
- High S/D Delay
- High S/D Event Response
- Shared Supply Voltage

Note: All COOLANT TEMP setpoints in the ENG MONITOR/PROTECT menu are inactive when in SENSOR configuration. They are labeled as DATA LINK to refer to the fact they are only active when the DATA LINK configuration is chosen.

DATA LINK

The COOLANT TEMPERATURE setpoints when in the DATA LINK configuration are redundant to the primary protection provided by the engine ECM. If these protections are not programmed to match those in the ADEM and an event occurs, check the Event Logs to determine which module generated the event.

4.7 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 19, Stopping The Engine. There are several ways the generator set can be started from the control panel.

To **START** the engine:

1. In **MANUAL OPERATION**, press the **RUN KEY** 
- or
2. Activate a Digital Input programmed for ECS in Run
- or
3. Place the control in **AUTO** mode then,
4. The engine can be started **THREE DIFFERENT WAYS**:
 - a: Activate the **REMOTE START INPUT**
 - b: Activate a **REMOTE INITIATE** over the MODBUS data link (EMCP 4.2 only)
 - c: Configure a **PROGRAMMABLE CYCLE TIMER** (EMCP 4.2 only). See Chapter 13.

When the control panel initiates a start command on an engine, the EMCP 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 4 will activate the Relay Output programmed to activate the starter motor magnetic switch, and the Relay Output programmed to activate the fuel enable circuit.

On electronic engines with ADEM™ A3 or newer engine ECMs using Common Engine Interface, the start command and fuel enable signals may be sent from the EMCP 4 to the engine ECM via the PRIMARY CAN 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 are not needed on those engines and can be configured for other uses.

The Starter Motor Relay 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 4 Crank setpoints number of cranks, crank duration, and crank terminate speed are not used on engines 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.

Note: If a Digital Input is programmed for ECS in Auto, or Run, or Stop, and a maintained switch latches that input to make it active, the front panel buttons will not have any effect.

EMCP 4 REMOTE START

The EMCP 4 has the ability to accept a remote start signal. If this signal is activated, the EMCP will send an Engine Start request to the engine controller. If the Remote Start signal is removed, the EMCP will send a Stop request signal to the engine controller. A momentary signal will not keep the engine running.

This signal should be wired into pin 55. This input will be logically active when pulled down to battery negative.

STOPPING THE ENGINE

Once the engine is started, the engine can be stopped by pressing the **STOP KEY**  on the control panel, or activating a Digital Input programmed for ECS in Stop. 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 START INPUT**
2. The **REMOTE START COMMAND** over the Modbus data link (EMCP 4.2 only).
3. The **PROGRAMMABLE CYCLE TIMER** (EMCP 4.2 only). See Chapter 13

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 ECMs using Common Engine Interface(CEI), the cooldown timer in the EMCP 4 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 on the EMCP can be overridden by pressing and holding the **STOP**

 **KEY** for approximately 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 **OK 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, the Discrete or Relay Output programmed for fuel injection will be deactivated (by default, Relay Output #2 will deactivate, but this may be programmed differently). The **STOP** command will also be sent over the PRIMARY CAN data link for those engines that require it. The engine will come to a stop.

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

If the EMCP 4 detects a condition where an engine or generator parameter exceeds programmed event thresholds for a programmed amount of time, or another **SHUTDOWN EVENT** occurs, then the EMCP 4 will attempt to shut the engine down.

Note: Event behavior is determined by setpoints called **EVENT RESPONSE CONFIGURATIONS**. If a shutdown-type event's **EVENT RESPONSE CONFIGURATION** is disabled or not set to shutdown, it may not shut the engine down. Appropriate default values are pre-configured in the factory. Modify **EVENT RESPONSE CONFIGURATIONS** at your own risk! See Chapter 5.

Note: If a Digital Input is programmed for ECS in Auto, or Run, or Stop, and a maintaining switch latches that input to make it active, the front panel buttons will not have any effect.

Depending on how a specific **EVENT RESPONSE CONFIGURATION** is programmed, the EMCP 4 will either put the engine in **COOLDOWN**, followed by a shutdown (**SOFT SHUTDOWN**) or shut the engine down immediately (**HARD SHUTDOWN**). See Figure 19.

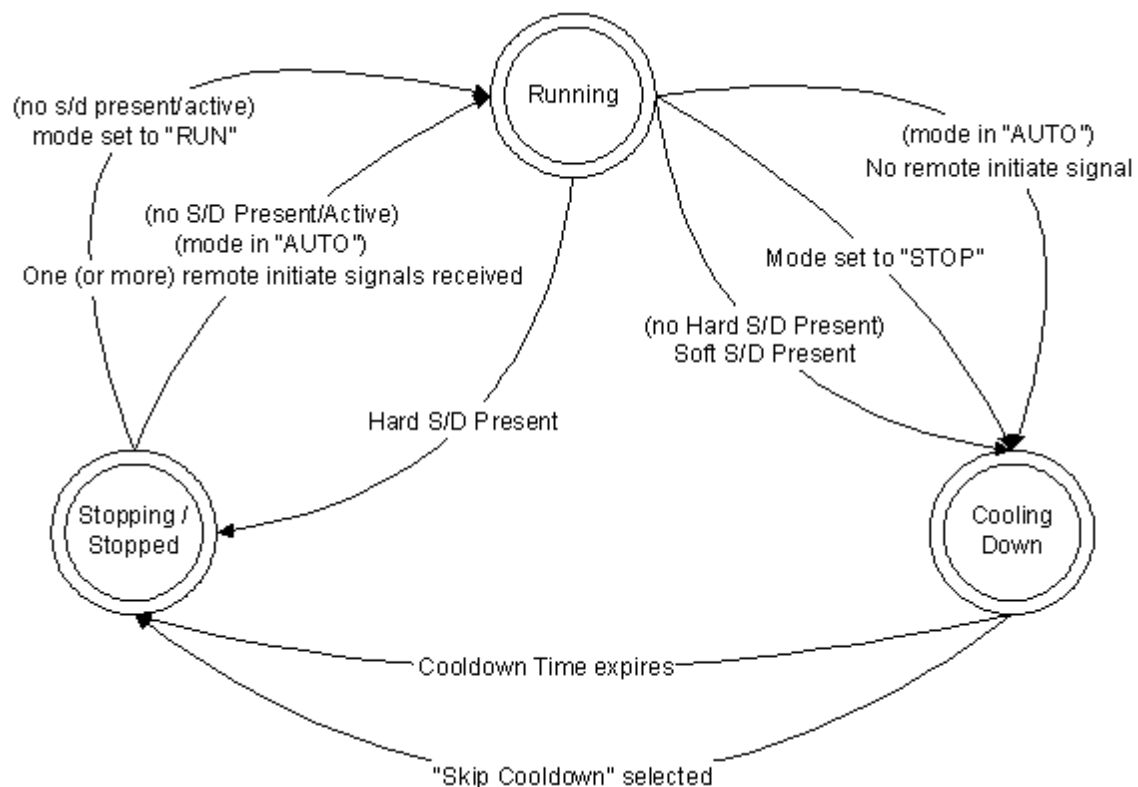


Figure 19: Stopping the Engine

EMERGENCY STOP

The EMCP 4 Emergency Stop input is configurable as Active High, or Active Low. The active state may be configured within the EMCP 4 display or within Cat ET.

TO CONFIGURE THE E-STOP ACTIVE STATE CONFIGURATION FROM THE DISPLAY, DO THE FOLLOWING:

At MAIN MENU scroll DOWN  to CONFIGURE.

Press the OK KEY .

MAIN MENU
CONTROL
CONFIGURE

SCROLL DOWN  to ALL SETPOINTS.

Press the OK KEY .

CONFIGURE
INPUTS & OUTPUTS
ALL SETPOINTS

SCROLL DOWN  to CONTROL.

Press the OK KEY .

SETPOINTS
CONTROL
ENG MONITOR/PROTECT

SCROLL DOWN  to AUTO START/STOP.

Press the OK KEY .

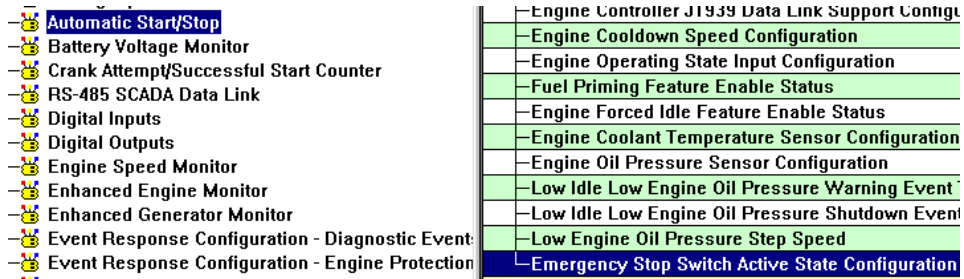
CONTROL
AUTO START/STOP
FUEL TRANSFER

SCROLL DOWN  to EMERGENCY STOP INPUT ACTIVE STATE CONFIG.

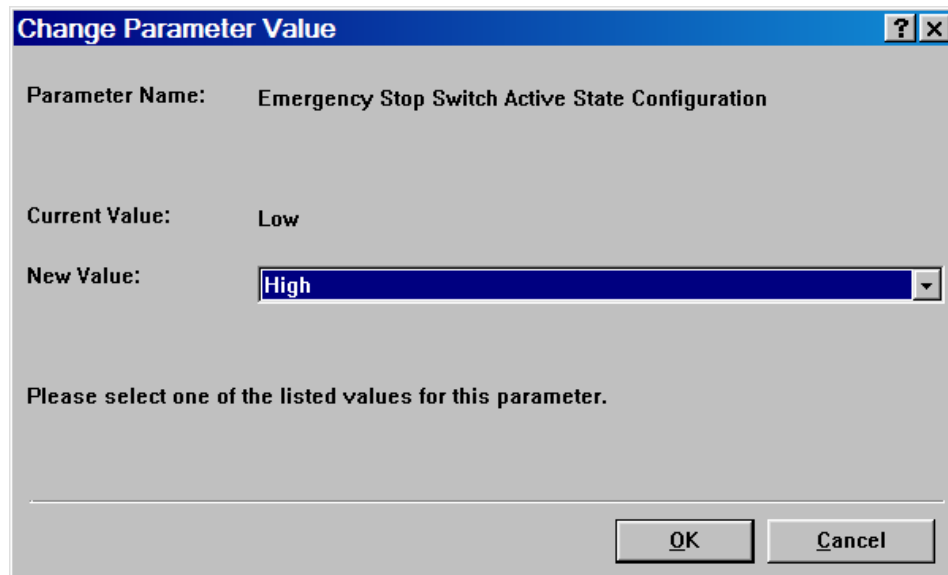
EMERGENCY STOP INPUT
ACTIVE STATE CONFIG
LOW

TO CHANGE THE E-STOP ACTIVE STATE CONFIGURATION WITH ET, DO THE FOLLOWING:

1. Connect to the EMCP 4 using the Cat Service Tool as stated in Chapter 4.2.
2. Select Automatic Start/Stop on the left.



3. Double click Emergency Stop Switch Input Configuration on the right to select a new value.

**4.8 ENGINE SETPOINT VERIFICATION**

The engine setpoint verification procedure verifies that the EMCP 4 operates correctly when a **LOW OIL PRESSURE** or **HIGH COOLANT TEMPERATURE** event occurs. The engine setpoint verification procedure also verifies that the EMCP 4 operates correctly when an **ENGINE OVERSPEED** event occurs.

On an **ENGINE OVERSPEED** event, the EMCP 4 will shut the engine down.

LOW OIL PRESSURE and **HIGH COOLANT TEMPERATURE** each have two events, **WARNING** and **SHUTDOWN**. The EMCP 4 will issue a **WARNING** whenever the warning threshold is reached and a **SHUTDOWN** whenever the shutdown threshold is reached. This verification procedure will modify configuration setpoints used in normal operation. The steps below outline how to perform the **LOW OIL PRESSURE SHUTDOWN** and **HIGH COOLANT TEMPERATURE SHUTDOWN PROCEDURE**. A similar process can be used for **LOW OIL PRESSURE WARNING** and **HIGH COOLANT TEMPERATURE WARNING**, along with **LOW IDLE LOW OIL PRESSURE**.

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 from the display requires a level 3 password. For details on changing security levels refer to Chapter 6.

The Security Level only affects changing parameters from the EMCP 4. Changing parameters with the Cat 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 the 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 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. Determine whether the controller is set for SENSOR or DATA LINK, refer to Chapter 4.6.

If SENSOR is selected, perform steps 3-5 in the CONFIGURE→INPUTS & OUTPUTS→ANALOG INPUTS configuration for ANALOG INPUT#1 setpoints.

If DATA LINK is selected, perform steps 3-5 in the CONFIGURE→ALL SETPOINTS→ENG MONITOR/PROTECT→ENG OIL PRES MON setpoints.

3. 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).
4. 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.
5. 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. Determine whether the controller is set for SENSOR or DATA LINK, refer to Chapter 4.6.

If SENSOR is selected, perform steps 3-5 in the CONFIGURE→INPUTS & OUTPUTS→ANALOG INPUTS configuration for ANALOG INPUT#2 setpoints.

If DATA LINK is selected, perform steps 3-5 in the CONFIGURE→ALL SETPOINTS→ENG MONITOR/PROTECT→ENG COOL TEMP MON setpoints.

3. 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).
4. View the event by going to the Genset Control event log.
5. Reset the event. Refer to Handling Events for more information about how to view and reset the event.
6. Return setpoint value for High Engine Coolant Temperature Shutdown Event Threshold to the original value.

4.9 ENGINE OPERATING HOURS

One of the features of the EMCP 4 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 Voltage.

UPDATING ENGINE OPERATING HOURS

For applications where a new EMCP 4 is fitted to a generator set that was previously in operation, the EMCP 4 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 4 display; it cannot be done using the Cat Service Tool. In order to update engine hours, **LEVEL 3 ACCESS** is required. Refer to Chapter 6, Security.

UPDATING ENGINE HOURS

At MAIN MENU SCROLL

SCROLL DOWN  to CONFIGUREPress the OK KEY Scroll DOWN  to ENGINE OPERATING HOURSPress OK KEY 

(if pressing OK has no effect, then Level 3 access has not been obtained)

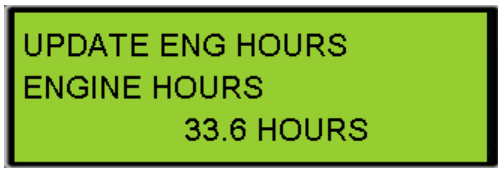
Current **ENGINE HOURS** are displayed.Press the OK KEY  to change the hours.To edit the **ENGINE HOURS**, Select a digit using theLEFT ARROW  or RIGHT ARROW 

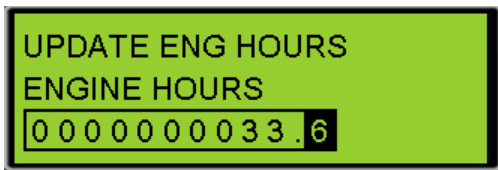
To change the selected digit use the UP ARROW

 or DOWN ARROW To accept changes, press the OK KEY . To reject changes, press the ESCAPE KEY .Again, press the OK KEY  to confirm, or theESCAPE KEY  to reject the changes.

 MAIN MENU
CONTROL
CONFIGURE


 CONFIGURE
ALL SETPOINTS
ENG OPERATE HRS  3


 UPDATE ENG HOURS
ENGINE HOURS
33.6 HOURS


 UPDATE ENG HOURS
ENGINE HOURS
0000000033.6


 UPDATE HRS 33.6
OK TO UPDATE
↶ TO CANCEL

5 HANDLING EVENTS

The EMCP 4 shows previous and current events from both the EMCP and external modules. These events are organized into logs for each physical module the EMCP 4 is receiving EVENT messages from.

The logs include:

GENSET CONTROL	Events for the EMCP 4 GSC
ENGINE CONTROL	Events for a Primary CAN Data Link-compatible engine ECM
DIGITAL AVR	Events for the Cat Digital Voltage Regulator (Cat DVR)
THERMOCOUPLE	Events for the Thermocouple Module
EXTERNAL I/O	Events for the Discrete Input/Output (DIO) module
RTD MODULE	Events for the Resistive Temperature Device (RTD) module
SCR MODULE	Events for Engine Aftertreatment systems

The Genset Control Log stores events generated by the EMCP 4. Any other event is stored within the module that generated the event. Even if the EMCP annunciates an event, it does not mean that the EMCP logs that event. It may be within another module's log.

Each log is visible only if the module is connected to the appropriate data link, either the Primary data link or the Accessory data link, and is communicating with the EMCP 4.



The list of Event Logs can be viewed by pressing the Event Log hotkey **EVENT LOG** or via the View Submenu. Select the log you wish to view and press OK to view the events.

The EMCP 4 supports more than one instance of some of the above modules. (See Chapter 17, for the number of modules supported by each of the EMCP models). Those modules are uniquely identified with a number at the end of the log name.

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

An event in the EMCP 4 Genset Control Log can be in one of three states; **PRESENT**, **ACTIVE**, or **INACTIVE**.

PRESENT	This state is only applicable to the Genset Control Log. PRESENT means that the condition that caused the event is still present. The condition needs to be addressed before the event can be reset. Note: This state only applies to Genset Control events. Other modules will not have Present in logs.
ACTIVE	The event was previously in a “Present” state, but it is no longer present. It has been latched by the event system and needs to be reset before the engine can be restarted. Within the Genset Control Log, the condition that caused the event is still affecting the system, but may be reset. (See Chapter 5.3 through 5.6 on how to Reset Events). Warning type events automatically reset when the condition that caused the event is resolved and will never be Active. Within any log other than the Genset Control Log, the condition that caused the event is affecting the system. The event may, or may not, be resettable. If the Reset All command fails to reset the event, then this event is still occurring and must be resolved before the event can be reset. Note: Many events go from Present to Active when the engine is shutdown and may reoccur once the engine starts running again. Further action may be required to resolve the issue.
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.

5.1 CONFIGURING EVENT RESPONSES FOR EMCP 4 GENERATED EVENTS

The category of event, as well as other behavior when an event occurs, can be configured via a group of EMCP 4 setpoints called **EVENT RESPONSE CONFIGURATIONS**. An example of an event response configuration is **LOW ENGINE LOW OIL PRESSURE WARNING EVENT RESPONSE CONFIGURATION**. This setpoint determines what actions the EMCP 4 takes when it receives an event.

Note: Event Response Configuration is only valid for the EMCP 4, not any other modules.

Each **EVENT RESPONSE CONFIGURATION** type setpoint can either be viewed or edited. By default, VIEW is highlighted. These setpoints can only be edited when the ECS (Engine Control Switch) is in the Stop mode.

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

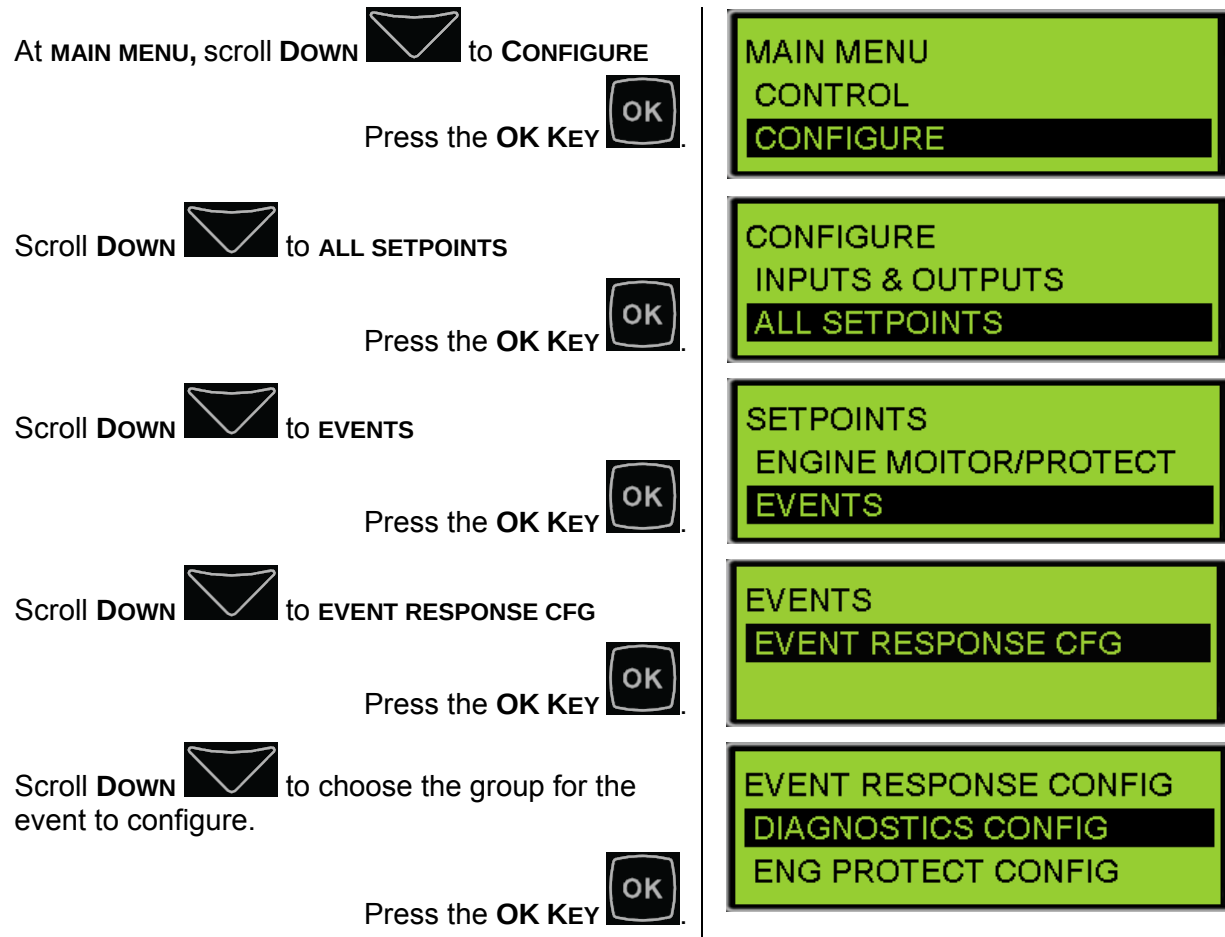
WARNING	Creates a Warning event in the event log and lights the amber LED. The engine will not shut down. A Warning event will reset by itself (i.e. it will go from the "Present" state to the "Inactive" state) as soon as the condition that caused it goes away.
AUDIBLE ALERT	Determines whether this event will also trigger an audible horn. If so, the event activates any relays that are programmed for Horn Control (see Chapter 10 Relay Outputs or Chapter 10 Digital Outputs). If no relay is programmed for Horn Control, no action will be taken; the EMCP 4 does not have an internal horn. Audible Alert can only be programmed if either a 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 has expired (see Chapter 4.5, Starting and Stopping the Engine).
HARD SHUTDOWN	Creates a Shutdown event in the event log, shuts the engine down immediately and lights the red LED.
BREAKER #1 TRIP	Activates a Breaker #1 Trip, which can be programmed for a Relay Output or Digital Output for external use. Breaker #1 usually refers to the Generator circuit breaker.
BREAKER #2 TRIP	Activates a Breaker #2 Trip, which can be programmed for a Digital Output or Relay Output for external use. Breaker #2 may refer to a second circuit breaker.
FAULT PROTECTION TIMER ENABLED	Suppresses the event unless the engine is running and the Fault Protection Timer has expired (this prevents nuisance events during startup, or ones that are not relevant when the engine is stopped).
ACTIVE ONLY	Creates an Active Only event in the event log. Active Only events are for informational purposes only. They typically do not light the Amber LED or behave like a Warning (although many events can be configured to do so). When the condition goes away, the event disappears from 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. Likewise, events cannot be generated for any and all conditions. For example, a Low Engine Coolant Temperature Shutdown is meaningless and cannot be generated.

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 4 display.



The group name should help find the setpoint. However, a list of setpoints in each group, or submenu is given in Table 3.

Diagnostics Config	Engine Protection Config	Generator Protection Config	Custom Event Config	Other System Config
- Accessory Data Link* - Engine Speed - Primary Data Link - SCADA Data Link* - Battery Charger Fail - Eng Cont Not Responding - RS485-Annunciator Data Link* - Analog Inputs	Pressures - Engine Oil - Gas Pressure Temperatures - Engine Coolant - Engine Oil - Exhaust Levels - Engine Coolant - Engine Oil - Fuel - Ext Fuel Tank Others - Air Damper Closed - Unexpected Engine Shutdown - Overspeed - Underspeed - Emergency Stop - Fail to Start - Fuel Leak - Service Maintenance Interval - Engine Inlet Manifold Charge Combustion - Remote E-Stop	- Generator Rear Bearing Temperature - Generator Overcurrent - Generator Over Frequency - Generator Under Frequency - Reverse Power - Generator Over Voltage - Generator Under Voltage - Earth Fault - Generator Winding Temperature #1 - Generator High Power - Reverse Reactive Power - kW Relay Trip #1 - kW Relay Trip # 2	- Digital Input Custom Events - Analog Input Custom Events - Aux #1 Event Inputs - Aux #2 Event Inputs	- Battery Voltage - Battery Charging System Voltage - Generator Breaker Open - Generator Breaker Closed - Engine in Cooldown - Speed-Frequency Mismatch - Not in Auto - Earth Leakage - EPS Supplying Load - Battery Cranking Voltage Event System - Engine Running Lamp Conditions*

*EMCP 4.2 only

Table 3: Event Response Configuration Setpoints

EXAMPLE:Select **ENGINE PROTECTION CONFIG**Press the **OK KEY**Select **PRESSURES**Press the **OK KEY**

To edit a setpoint, press the **RIGHT ARROW** key to highlight **EDIT**.



This brings up a list of event response configuration setpoints. Use the Up or Down arrows to scroll through the list.

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 the **OK KEY** to edit the setpoint.



Use the **LEFT ARROW** and **RIGHT ARROW** to toggle between checked and unchecked, and use



the **UP ARROW** and **DOWN ARROW** to move between the responses.



EVENT RESPONSE CONFIG
DIAGNOSTICS CONFIG
ENG PROTECT CONFIG

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).

DIAGNOSTICS CONFIG
PRESSURES
TEMPERATURES

LOW ENGINE OIL PRES
WARNING CONFIG
VIEW EDIT

Here you can edit individual responses, as described above.

☒ WARNING
☐ AUDIBLE ALERT
☐ SOFT SHUTDOWN

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

5.3 RESETTING INDIVIDUAL ACTIVE EVENTS FOR THE EMCP 4

There are three ways to reset events. One way, described in this chapter, which applies to the EMCP 4 GSC only (the “Genset Control” log), is to reset individual Active events by navigating to the desired event in the event log, described below.

The second way, which applies to all modules other than the EMCP 4, is to reset all Active events in that module’s event log by navigating to one of the Active events in that event log (see Chapter 5.4).

The third way is an approach that resets all Active events for all modules (see Chapter 5.5). With any of these methods, you must be in **STOP** mode.

To reset individual events on the EMCP 4, start by navigating to the event log:

At **MAIN MENU** Select **VIEW** by pressing the

OK KEY .

Alternately, press the **EVENT LOG BUTTON** to access the **EVENT LOG**.

Select **EVENT LOGS** by pressing the **OK KEY**

.

Scroll up  or down  to select the **GENSET CONTROL LOG**

Press the **OK KEY** .

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

Generally, events are ordered by the status of the event; **PRESENT** events are listed first, followed by **ACTIVE** events, and finally the **INACTIVE** events. Within each status, the events are listed with the most recent first.

Press the **OK KEY**  to enable the reset feature.

Press the **OK KEY**  to reset the event. Notice that the event changes from Active to Inactive.

MAIN MENU

VIEW

CONTROL

VIEW

EVENT LOGS

ENGINE OVERVIEW

ACTIVE EVENTS

1

GENSET CONTROL

1

In this example image, there is one **PRESENT** or **ACTIVE** event under Genset Control #1.

CUSTOM EVENT #2 CON

EXISTS

2/13

ACTIVE

OCC 15

SPN 702

FMI 31

ACTIVE

RESET

NUM OCCURRENCES

8

SPN 702

FMI 31

INACTIVE

NUM OCCURRENCES

8

5.4 RESETTING ALL ACTIVE EVENTS FOR A SINGLE MODULE

The second way to reset events, described in this chapter, which applies to all modules other than the EMCP 4, is to reset all of the module's Active events by navigating to one of the Active events in the event log. This method doesn't apply to the EMCP 4 GENSET CONTROL log. For information on resetting events on the EMCP 4, see chapters 5.3 or 5.5.

With any method, you must be in **STOP** mode. A key difference between the EMCP 4 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 module's Active events on any individual module except the EMCP 4 (listed as **GENSET CONTROL** in the event log), start by navigating to the event log.

At MAIN MENU scroll DOWN  to VIEW by pressing the OK KEY .

Select EVENT LOGS by pressing the OK KEY .

Scroll UP  or DOWN  to select the desired log and

Press OK KEY .

Press OK KEY  to view the first event details.

Pressing the OK KEY  will allow an option to RESET all events in the selected module.

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

MAIN MENU
VIEW
CONTROL

VIEW
EVENT LOGS
ENGINE OVERVIEW

ACTIVE EVENTS	4
GENSET CONTROL	2
EXTERNAL I/O #1	2

LOW FUEL LEVEL	
SHUTDOWN	1/2
ACTIVE	OCC 44

SPN 96	FMI 1
ACTIVE	RESET MOD
NUM OCCURRENCES	2

SPN	FMI
NUM OCCURRENCES	

Note: Modules other than the EMCP 4 cannot display events as **PRESENT**.

If pressing **OK 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 ACTIVE EVENTS FOR ALL MODULES

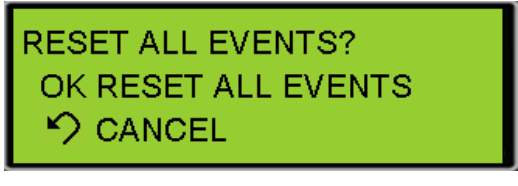
The third way to reset events, described in this chapter, is a shortcut that resets all Active events for all modules. With any method, you must be in **STOP** mode.

Once all of 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 **RESET KEY** .
A confirmation prompt will appear.



RESET ALL EVENTS?
OK RESET ALL EVENTS
↶ CANCEL

Pressing the **OK KEY**  will continue and **RESET** all events on all modules.

Pressing the **ESCAPE KEY**  will **CANCEL** the reset operation.

The controller will display which events were reset, and which ones were not.

Note: Reset All Events will not reset Present events! For example, if the E-Stop switch is pressed and an **EMERGENCY STOP 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 PRIMARY CAN DATA LINK SUPPORT

The EMCP 4 has the ability to reset all events for electronic engines with no PRIMARY CAN support by means of a Relay Output. A number of conditions must be satisfied in order for this to work.

- FIRST:** One of the Outputs must be configured as a Command/Status for **ECU FAULT RESET**. See Chapter 10.
- SECOND:** The corresponding 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:



Pressing the **RESET ALL 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. This will only active the ECU FAULT RESET OUTPUT if the EMCP has a warning or fault. This warning or fault can be triggered by using a custom event on a digital input that is wired to the fault alarm of the ECU.

5.7 TROUBLESHOOTING RESETTING EVENTS

There are common reasons for the EMCP 4 not allowing events to be reset. First of all, in order to reset any event, the EMCP 4 must be in STOP mode. In order to reset engine ECM events, the engine speed must also be zero.

SERVICE MAINTENANCE INTERVAL WARNING and **NOT IN AUTO WARNING** are explained more fully below.

NOT IN AUTO WARNING

This event is Present whenever the control is in either RUN or STOP. As a result, it cannot be reset in STOP (since the event is present). The event will reset when the



control is returned to **AUTO**. This event can be disabled by modifying the GENERATOR CONTROL NOT IN AUTOMATIC WARNING EVENT RESPONSE CONFIGURATION setpoint. See Chapter 7 for instructions on editing that setpoint.

SERVICE MAINTENANCE INTERVAL (EMCP 4.2 ONLY)

If a **SERVICE MAINTENANCE INTERVAL WARNING** is **PRESENT**, it **cannot** be reset. The warning is PRESENT because one of the countdown timers 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 (typical is 180 calendar days and 500 engine hours). This timer must be reset from the display; it cannot be reset by using the Service Tool alone. This warning can only be disabled by using the Event Response Configuration. See Chapter 5.2.

Note: This warning does not appear on the face of the EMCP 4 as a flashing LED unless configured to do so within Cat ET under Event Response Configuration – Engine Protection Events.

TO VIEW THE TIMER SETTINGS ON THE DISPLAY:

At MAIN MENU scroll **DOWN**  to **CONFIGURE**

Press the **OK KEY** 

Scroll **DOWN**  to **RESET COUNTER**

Press the **OK KEY** 

Scroll **DOWN**  until you reach
SERVICE MAINTENANCE INTERVAL

Press the **OK KEY** 

The **SERVICE MAINTENANCE INTERVAL HOURS** is displayed.

Scroll **DOWN**  to view the
SERVICE MAINTENANCE INTERVAL DAYS

Press the **OK KEY** 

Scroll **DOWN**  to view the
PASSWORD REQUIRED TO RESET THE SERVICE MAINTENANCE INTERVAL.

The security level required to reset the service maintenance level is shown as a level 2, but the security level required to change the level is level 3. The required security level can be changed by using the Service Tool.



MAIN MENU
CONTROL
CONFIGURE



CONFIGURE
ENG OPERATING HRS
RESET COUNTERS



ENG MONITOR/PROTECT
ENHANCED ENGINE MON
SERV MAINT INTERVAL



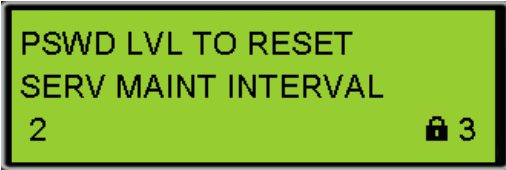
SERVICE MAINTENANCE
INTERVAL HOURS
500 HOURS 



SERVICE MAINTENANCE
INTERVAL HOURS
500 HOURS 



SERVICE MAINTENANCE
INTERVAL DAYS
180 DAYS 



PSWD LVL TO RESET
SERV MAINT INTERVAL
2  3

TO RESET THE TIMER ON THE DISPLAY:

At MAIN MENU scroll DOWN  to CONFIGURE

Press the OK KEY .

Scroll DOWN  to RESET COUNTERS

Press the OK KEY .

Scroll DOWN  to SERV MAINT INTERVAL

Press the OK KEY .

RESET SERV INTVL? is highlighted. To RESET the service interval press the OK KEY .

A confirmation prompt will appear. Pressing the

OK KEY  will continue and RESET the service maintenance interval. Pressing the ESCAPE KEY



will CANCEL the reset operation.

The new Service intervals will be displayed.

MAIN MENU
CONTROL
CONFIGURE

CONFIGURE
RESET COUNTERS
TIME/DATE

RESET COUNTER
RESET START COUNTER
SERV MAINT INTERVAL

SERV: 482 HOURS
OR 175 DAYS
RESET SERV INTVL?

RESET SERV INTVL?
OK RESET INTERVAL
↶ CANCEL

SERV: 500 HOURS
OR 180 DAYS
RESET SERV INTVL?

TO ADJUST THE TIMER SETTINGS FROM CAT ET, DO THE FOLLOWING:

1. Connect to the EMCP 4 using the Cat Service Tool as stated in Chapter 4.2.
2. Select Service Maintenance Interval on the left.

Generator Over/Under Voltage	Service Maintenance Interval	
Generator Reverse Power	Maintenance Level 1 Cycle Interval Hours	500 hours
Programmable Cycle Timer	Maintenance Level 1 Cycle Interval Days	180
Electronic Control Module Rec	Customer Password Security Level to Reset Service Maintenance Interval	0-No Security
Relay Outputs		
Service Maintenance Interval		
KW Relay Setpoints		
DIO Inputs		
DIO Outputs		

3. Double click Maintenance Level 1 Cycle Interval Hours on the right to enter a new interval.

Change Parameter Value [?] [X]

Parameter Name: Maintenance Level 1 Cycle Interval Hours

Current Value: 500 hours

New Value:

[OK] [Cancel]

4. Double click Maintenance Level 1 Cycle Interval Days on the right to enter a new interval.

Change Parameter Value [?] [X]

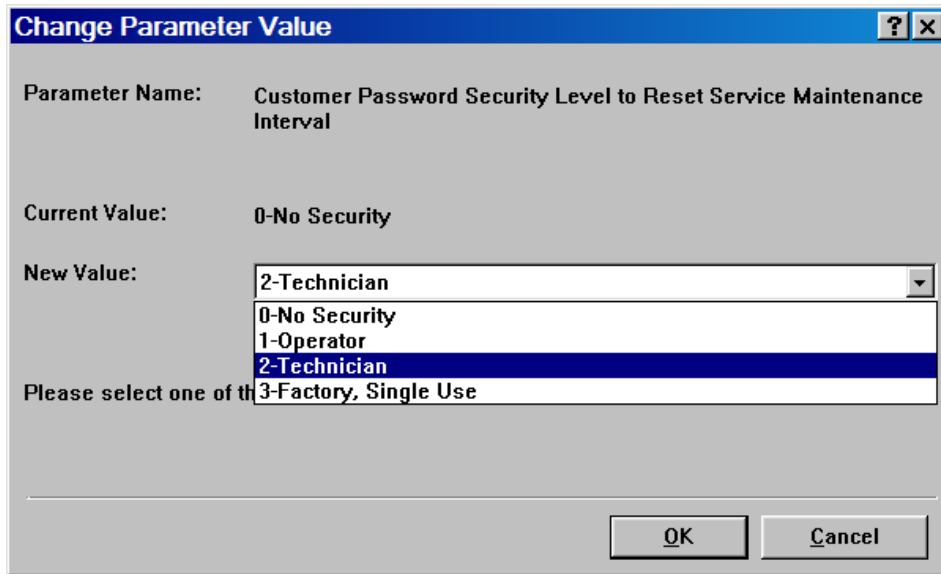
Parameter Name: Maintenance Level 1 Cycle Interval Days

Current Value: 180

New Value:

[OK] [Cancel]

5. Double click Customer Password Security Level to Reset Service Maintenance Interval on the right to enter a new security level.



The image shows a Windows-style dialog box titled "Change Parameter Value". It has a blue title bar with a question mark icon and a close button. The dialog contains the following fields and controls:

- Parameter Name:** Customer Password Security Level to Reset Service Maintenance Interval
- Current Value:** 0-No Security
- New Value:** A dropdown menu with the following options:
 - 2-Technician (selected)
 - 0-No Security
 - 1-Operator
 - 2-Technician
 - 3-Factory, Single Use
- Please select one of the following:** (text label)
- Buttons:** OK and Cancel

Caution: Be sure to change the password level 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 4: **LEVEL 0**, **LEVEL 1**, **LEVEL 2**, **LEVEL 3**, and **SERVICE TOOL**. 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.

Note: These are optional levels of security; by default these passwords are disabled, and the default access level is LEVEL 2 from Parts Service.

LEVEL 3 ACCESS is password protected at the factory, and requires contacting the Cat **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 Cat 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 4. Access of the EMCP 4 remotely via the Cat Service Tool or via the SCADA data link is not affected by the security level on the EMCP 4 display.

Changing parameters with the Cat Service Tool does not require passwords, since the Service Tool already has the highest level of access.

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 4. However, the passwords themselves may differ. Furthermore, the EMCP 4 and the SCADA data link may be at different levels of access at any given time. For more information about SCADA security see Chapter 18.

Level 1 and Level 2 passwords are usually **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 4 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 EMCP 4 will start at Level 0 on power up. When the Level 1 password is entered, the EMCP 4 will move up to Level 2 access. If neither a level 1, nor a level 2 password has been defined, the EMCP 4 will always be at least at a Level 2 access.

THE SECURITY MENU

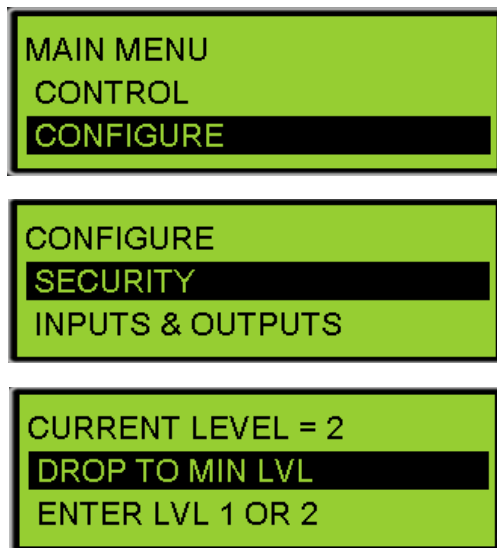
To get to the security menu:

At MAIN MENU scroll DOWN  to Configure

Press the OK KEY .

At SECURITY, press the OK 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 4 spaces. In each space a numbers from 0 through 9 can be entered. The password can be from 1 to 4 digits and is entirely user defined. Enter the password for either level 1 or level 2 if either of those passwords have been defined. Use the UP

ARROW  or DOWN ARROW  to change the value of any highlighted digit. Use the

LEFT ARROW  or RIGHT ARROW  to navigate between digits.

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 Cat Dealer TC with this number. The TC will reply with another 16 digit number. **Note:** Level 3 seed key and response will change based on various pieces of information. It is valid only when generated, and will be different in the future for that specific controller.

Press the **OK KEY**  from the **PHONE IN WITH** screen, and a password entry screen will be displayed. Enter the password that was supplied by the TC in the same manner as the other types of passwords.

Press the **OK KEY**  to confirm, or **ESCAPE KEY**  to reject the change. Pressing the **OK KEY**  after entering the number will set the current level to 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 4 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 4 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 **OK 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 4 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 4 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 **OK KEY** and the control will go back to the **SECURITY SCREEN** and the level 2 password will be set.

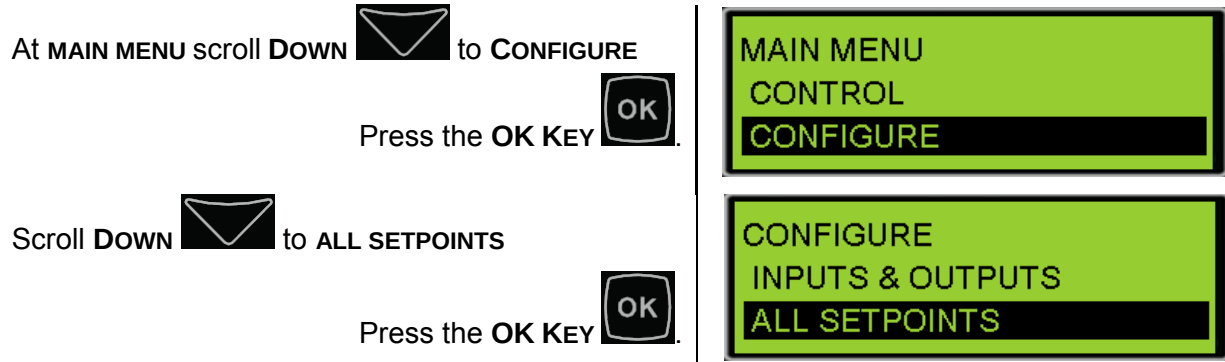
Selecting **CHANGE SCADA PSWD** will allow for the SCADA password to be changed.

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.

7 SETPOINTS

The EMCP 4.1 and 4.2 have a variety of setpoints that can be programmed or adjusted. These setpoints can be adjusted via the display, or via the Cat Service Tool. In order to program the setpoints via the display, go through the following menu options:



All of the setpoints on EMCP 4 can be accessed through this menu. However, setpoints related to input and output configuration can also be accessed through the **INPUTS AND OUTPUTS** menu under **CONFIGURE**. It is recommended to use the latter to configure inputs and outputs. For more information on configuring inputs and outputs, see Chapter 8 through 10.

7.1 CONFIGURING SETPOINTS

Setpoints can be one of four different types: **NUMERICAL ENTRY**, **SELECTION**, **SUSPECT PARAMETER NUMBER**, or **EVENT RESPONSE**. Each type is configured differently. For configuring any setpoint via the display, the user must first have the proper security access. See Chapter 6 for more information on security.

NUMERICAL ENTRY setpoints are parameters like time delays, thresholds, etc. For these setpoints the display will show the current value.

To change the value of a **NUMERICAL ENTRY** type setpoint:

1. Press the **OK KEY**  when the setpoint is highlighted. 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. Digits will wrap around. Therefore, pressing up when 9 is shown will change it to 0, or pressing down when 0 is shown will change it to 9.
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 **OK KEY**  to save the value.

Tip: You can quickly select the largest possible value for the setpoint by pressing the

LEFT  arrow key until the leftmost digit is shown, and then pressing the **UP**  arrow key until the value stops changing. Similarly you can select the smallest possible

value by pressing the **LEFT**  arrow key until the leftmost digit is shown, and then pressing and holding **DOWN**  arrow key until the value stops changing.

SELECTION type setpoints, such as Generator Configuration, or Active State, have options that are not numerical. For these setpoints, the display will show the current setting.

To change the value of a **SELECTION** type setpoint:

1. Press the **OK KEY**  when the setpoint is highlighted. The current setting of the setpoint will be shown.
2. Use the **UP**  or **DOWN**  arrow keys to scroll through the options that are available for that setpoint. Scroll quickly by holding the key.
3. When the desired option is displayed, press the **OK KEY**  to save the setting.

SUSPECT PARAMETER NUMBER type setpoints are similar to **SELECTION** type setpoints, but the selections are grouped into four groups:

1. Pressures
2. Temperatures
3. Levels
4. Others

Any selection with units that are not pressure, temperature, or percent will be in the "Others" group. This group also contains Custom Parameters and Custom Events. Suspect parameter numbers indicating status (like Gen Breaker Open) will also be here.

To change the value of a **SUSPECT PARAMETER NUMBER** type setpoint:

1. Press the **OK KEY**  when the setpoint is highlighted. Notice here that the setpoint value is not shown. Instead, the first group name, PRESSURE, is shown.
2. Use the **UP**  or **DOWN**  arrow keys to scroll through the four groups: PRESSURE, TEMPERATURE, LEVEL, OTHERS.
3. When the desired option is displayed, press the **OK KEY**  to see the suspect parameter numbers (by name) in that group.
4. Use the **UP**  or **DOWN**  arrow keys to scroll through the suspect parameter numbers (by name) until the desired one is selected.
5. Press the **OK KEY**  to save the setting. Alternately, press the **BACK**  key to return to the group selection: PRESSURE, TEMPERATURE, LEVEL, OTHERS.

EVENT RESPONSE CONFIGURATION type setpoints are a little different from the previously discussed setpoints. Each setpoint configures one or more actions that occur when the event occurs. See Chapter 5.1 for more information.

7.2 SETPOINTS ON THE EMCP 4 DISPLAY

The setpoints in the EMCP 4 are organized into multiple submenus. See Appendix A and the appropriate sections of this document for more information.

7.3 SETPOINTS ON THE CAT SERVICE TOOL

EMCP 4 setpoints can be configured using the Cat Service Tool (ET). To access setpoints, see Chapter 4.2.

If a value is changed from the EMCP display, Cat ET will not refresh the setpoint automatically. Press the “Config Tool” icon to refresh the list.

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 4.1 and 4.2 have different numbers of setpoints. The categories shown here match those in ET version 2013B. Older versions may have less, and newer versions may have more.

Note: Any setpoint with a value given as Unavailable is not applicable to that level of EMCP 4.

SETPOINT CATEGORIES

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

ANALOG INPUTS

Setpoints related to Analog Inputs. See Chapter 9.

AUTOMATIC START/STOP

Setpoints related to starting and stopping the generator set, as well as engine configuration.

BATTERY VOLTAGE MONITOR

Setpoints related to monitoring battery voltage from the battery power input to the EMCP 4.

CRANK ATTEMPT/SUCCESSFUL START COUNTER

Setpoint related to crank/start counters.

DATA LINK: RS-485 SCADA (EMCP 4.2 ONLY)

Setpoints related to SCADA (Modbus) data link communications. See Chapter 18.

DIGITAL INPUTS

Setpoints related to Digital Inputs. See Chapter 8.

DIGITAL OUTPUTS

Setpoints related to the polarity of Digital Outputs. See Chapter 10.

ENGINE COOLANT TEMPERATURE MONITOR

Setpoints related to monitoring engine coolant temperature.

ENGINE OIL PRESSURE MONITOR

Setpoints related to monitoring engine oil pressure.

ENGINE SPEED MONITOR

Setpoints related to monitoring engine speed using the Magnetic Pick-Up (MPU) input.

ENHANCED ENGINE MONITOR

Setpoints related engine cylinder temperature monitoring via the optional Thermocouple module. Applies to EMCP 4.2 only.

ENHANCED GENERATOR MONITOR

Setpoints related to generator bearing and winding temperature monitoring via the optional RTD module. Applies to EMCP 4.2 only.

EVENT RESPONSE CONFIGURATION - DIAGNOSTIC EVENTS

Setpoints used to configure the EMCP 4 response to diagnostic events. See Chapter 5.7.

EVENT RESPONSE CONFIGURATION - ENGINE PROTECTION EVENTS

Setpoints used to configure the EMCP 4 response to engine protection events.
See Chapter 5.

EVENT RESPONSE CONFIGURATION - GENERATOR PROTECTION EVENTS

Setpoints used to configure the EMCP 4 response to generator protection events.
See Chapter 5.

EVENT RESPONSE CONFIGURATION - OTHER SYSTEM EVENTS

Setpoints used to configure the EMCP 4 response to events that do not fit into the category of diagnostics, engine protection, or generator protection. See Chapter 5.

EVENT RESPONSE CONFIGURATION – CUSTOM EVENTS

Setpoints used to configure the EMCP 4 response to custom events. See Chapter 5.

EVENT SYSTEM (EMCP 4.2 ONLY)

Setpoints used to configure the Engine Running Conditions for the Engine Run Lamp on the RS-485 Annunciator. See Chapter 17.

FUEL TRANSFER

Setpoints related to fuel transfer feature.

GENERATOR AC MONITOR

Setpoints related to generator configuration (for EMCP 4 calculation and reporting).

GENERATOR AC POWER MONITOR (EMCP 4.2 ONLY)

Setpoints related to generator power monitoring.

GENERATOR CURRENT MONITORING (EMCP 4.2 ONLY)

Setpoints related to generator AC overcurrent monitoring.

GENERATOR OVER/UNDER FREQUENCY

Setpoints related to generator overfrequency and underfrequency monitoring.

GENERATOR OVER/UNDER VOLTAGE

Setpoints related to generator AC overvoltage and undervoltage monitoring.

GENERATOR REVERSE POWER (EMCP 4.2 ONLY)

Setpoints related to generator AC reverse power monitoring.

INTEGRATED VOLTAGE REGULATOR

Setpoints related to configuring the Integrated Voltage Regulator (if installed). See Chapter 19.

PROGRAMMABLE CYCLE TIMER (EMCP 4.2 ONLY)

Setpoints related to configuring Programmable Cycle Timers. See Chapter 13.

ELECTRONIC CONTROL MODULE REDUCED POWER MODE

Setpoints related to a power-saving mode of the EMCP 4 called Reduced Power Mode. See Chapter 14.

RELAY OUTPUTS

Setpoints related to Relay Outputs. See Chapter 10.

SERVICE MAINTENANCE INTERVAL

Setpoints related to configuring and resetting the timers used to indicate a service needed warning. See Chapter 5.7.

KW RELAY SETPOINTS

Setpoints related to configuring the behavior of the Trip Point function, which is used to indicate that the generator is approaching overload.

CONFIGURATION DATA

Contains the Engine Serial Number setpoint, which is read-only.

DISPLAY PREFERENCES

Setpoints determining the units used on the EMCP 4 display. Note that this does not affect the data as viewed on the Cat Service Tool. See Chapter 4.4.

8 DIGITAL INPUTS

The EMCP 4.1 and 4.2 have six user-programmable Digital Inputs. The user programmable Digital Inputs are referenced to Battery (-) and will see a change in state at ~3VDC with a 1VDC hysteresis. The Digital Inputs seen on the display that are labeled “A” and “B” are reserved for E-Stop and Remote Start.

The programming of the Digital Inputs starts by selecting a “Usage Type”. The rest of the programming is dependent upon what Usage Type is selected. Programming Digital Inputs from the EMCP display requires Level 2 security access. Figure 20 summarizes the paths possible for Programming a Digital Input.

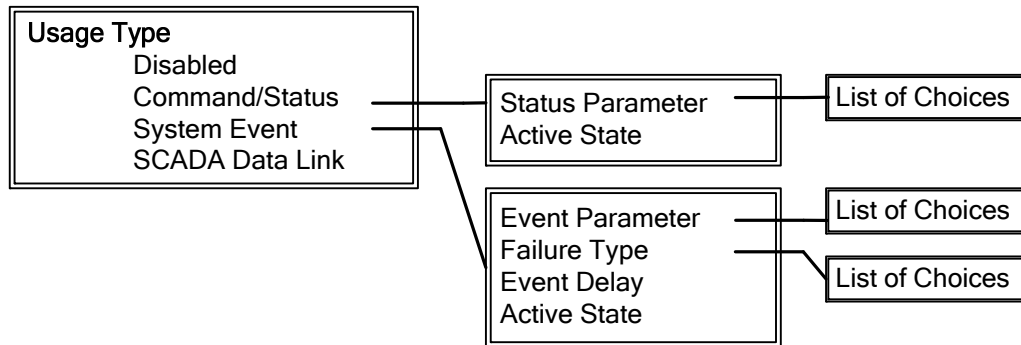


Figure 20: Digital Input Programming Paths

The Usage Type of **DISABLED** is used to completely disable the input. No status will be shown, and no action will be taken by the EMCP 4.

The Usage Type of **COMMAND/STATUS** is used to make certain system conditions be known by the EMCP 4; an example of a Command/Status parameter is the Idle Mode command.

The Usage Type of **SYSTEM EVENT** is used to inform the EMCP 4 of system conditions that require the EMCP 4 to trigger an event.

The Usage Type of **SCADA DATA LINK** is used to bring in digital input to the EMCP 4 specifically for use by the SCADA data link. EMCP 4 will not take any action or trigger any events on such an input.

The Digital Inputs of the EMCP 4 are tied to an internal pull-up resistor inside the controller. Therefore, if a Digital Input is **UNCONNECTED**, the Digital Input will sit at a **PHYSICAL HIGH** state. See Figure 21. Note that a Digital Input wired to battery positive will always remain Active if programmed for Active High, and will always remain Inactive if programmed for Active Low.

A battery negative input should be switched to each EMCP 4 Digital Input for proper operation.

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

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

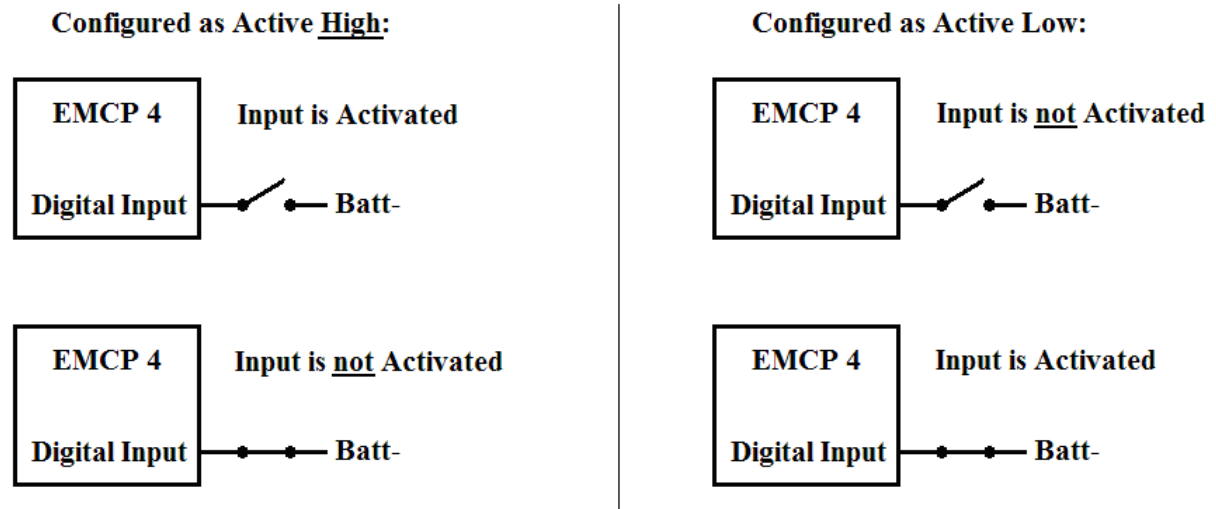


Figure 20: Valid States of Digital Input Wiring and Configuration

Note: Improper configuration of these inputs can cause a false event to be triggered, or cause an event to not be triggered when desired.

Note: If more than one Digital Input is configured for the same physical quantity (i.e. the setpoint Digital Input Data Identification matches between two Digital Inputs), then the higher numbered Digital Input value will have priority. For example, if both Digital Input #4 and Digital Input #5 are configured for ECS in Run but Digital Input #4 is activated with Digital Input #5 left inactive, then Digital Input #4 will be ignored.

8.1 PROGRAMMING DIGITAL INPUTS USING THE DISPLAY

The steps to configure the Digital Inputs for each of the Usage Types are described below.

VIEWING THE CURRENT DIGITAL INPUT STATUS

To view the current status of a Digital Input, go through the following menu options:

AT THE MAIN MENU, scroll DOWN  TO VIEW

Press the OK KEY 

Scroll DOWN  to I/O STATUS

Press the OK KEY 

Press the OK KEY  to access DIGITAL INPUTS.

The status of all Digital Inputs is shown.

A dash under an input number (or letter) indicates an input that is programmed, but inactive. A large "X" under an input number (or letter) indicates an input that is disabled. A number (or letter) under an input number (or letter) indicates an input that is programmed and active.

With the LEFT ARROW  or RIGHT ARROW , select the DIGITAL INPUT that you want to view, then press the OK KEY .

The programmed Usage Type of the selected Digital Input is shown.

Scroll DOWN  to view the remaining parameters for this input:

- Event Name
- Usage Type
- Delay Time (System Event only)
- Physical State
- Logical State
- Active State

MAIN MENU

VIEW

CONTROL

VIEW

AC OVERVIEW

I/O STATUS

I/O STATUS

DIGITAL INPUTS

RELAY OUTPUTS

DIGITAL INPUTS

1	2	3	4	5	6	A	B
X	-	X	X	X	X	-	-

DIGITAL INPUT #2

FUEL LEVEL

LOW WARNING

DIGITAL INPUT #2

PHYSICAL:

+V

DIGITAL INPUT #2

LOGICAL:

INACTIVE

CONFIGURING DIGITAL INPUTS FOR STATUS PARAMETERS

Command or Status parameters are used to control specific functions within the control system or to make certain conditions within the system be known. To configure a Digital Input as a Command or Status Parameter, go through the following menu options:

AT THE MAIN MENU, scroll DOWN  TO CONFIGURE

MAIN MENU
CONTROL
CONFIGURE

Press the OK KEY 

Scroll DOWN  to INPUTS & OUTPUTS

INPUTS & OUTPUTS
DIGITAL INPUTS
RELAY OUTPUTS

Press the OK KEY 

Alternately, access to the INPUTS & OUTPUTS submenu is accessible from ALL SETPOINTS.

Press the OK KEY  to access DIGITAL INPUTS.

DIGITAL INPUTS
INPUT #1
INPUT #2

Select the DIGITAL INPUT that you want to program

Press the OK KEY 

DIGITAL INPUT #1
USAGE TYPE
DISABLED

Press the OK KEY  to highlight the current configuration (DISABLED, COMMAND/STATUS, SYSTEM EVENT, OR SCADA).

DIGITAL INPUT #1
USAGE TYPE
DISABLED

Scroll DOWN  to STATUS

Press the OK KEY 

DIGITAL INPUT #1
USAGE TYPE
COMMAND/STATUS

Scroll DOWN  to STATUS PARAMETER

Press the OK KEY  to highlight the current STATUS PARAMETER.

DIGITAL INPUT #1
STATUS PARAMETER:
ECS IN STOP

Select the **STATUS PARAMETER** that you want to program

Press the **OK KEY**



DIGITAL INPUT #1
STATUS PARAMETER:
RAISE VOLTAGE

Scroll **DOWN**  to **ACTIVE STATE**

Press the **OK KEY**  to highlight the current **ACTIVE STATE**.

DIGITAL INPUT #1
ACTIVE STATE
LOW

Select the **ACTIVE STATE** that you want to program and

Press the **OK KEY**



DIGITAL INPUT #1
ACTIVE STATE
HIGH

Any Digital Input can be configured for any one of the Command/Status parameters in Table 4:

ECS in Run*	Nominal Voltage Selection is Low***
ECS in Auto*	Auto Load Fuel
ECS in Stop*	Auto Unload Fuel***
Idle Mode Command	Start Aid Timer Bypass
Inhibit Cooldown	Fuel Priming Command
Raise Voltage	Inhibit Reactive Droop Compensation**
Lower Voltage	Inhibit Line Drop Compensation**
Raise Speed	Enable Power Factor Control Command**
Lower Speed	Disable Generator Excitation**
Nominal Frequency Selection is Low***	
*If a Digital Input is programmed for ECS in Auto, or Run, or Stop, and a maintained switch latches that input to make it active, the front panel buttons will not have any effect. ** Only available with Integrated Voltage Regulator *** Not available with Standard software	

Table 4: Digital Input Command/Status Options

DIGITAL INPUT COMMAND/STATUS DESCRIPTIONS

Below is a brief description of the purpose of each command/status digital input option:

ECS IN RUN

- When activated, has the same effect as pressing the “Run” button (puts the EMCP in RUN mode and runs the generator at rated voltage and speed). While this input is Logically Active, the ECS can’t be changed from RUN.

ECS IN AUTO

- When activated, has the same effect as pressing the “Auto” button (puts the EMCP in AUTO mode). While this input is Logically Active, the ECS can’t be changed from AUTO.

ECS IN STOP

- When activated, has the same effect as pressing the “Stop” button (puts the EMCP in STOP mode). While this input is Logically Active, the ECS can’t be changed from STOP.

IDLE MODE COMMAND

- When activated, attempts to force the engine to run at idle speed when the engine is running. This action will also disable various protective functions including functions such as underspeed, undervoltage and under-frequency

INHIBIT COOLDOWN

- While activated, prevents the engine from entering cooldown and keeps the EMCP in pre-cooldown state. Must be de-activated before the engine will completely stop. A hard shutdown will still stop the engine even if Inhibit Cooldown is in place.

RAISE VOLTAGE

- When activated, raises generator voltage level by 0.5% of rated. If the input is maintained, after 0.5 seconds generator voltage level increases by 0.5% every 400ms (approximate). Typically used for external voltage biasing and/or external paralleling control.

LOWER VOLTAGE

- When activated, lowers generator voltage level by 0.5% of rated. If the input is maintained, after 0.5 seconds generator voltage level decreases by 0.5% every 400ms (approximate). Typically used for external voltage biasing and/or external paralleling control.

RAISE SPEED

- When activated, raises engine speed by 0.5% of rated. If the input is maintained, after 0.5 seconds engine speed increases by 0.5% every 400ms (approximate). Typically used for external speed biasing and/or external paralleling control.

LOWER SPEED

- When activated, lowers engine speed by 0.5% of rated. If the input is maintained, after 0.5 seconds engine speed decreases by 0.5% every 400ms (approximate). Typically used for external speed biasing and/or external paralleling control.

NOMINAL FREQUENCY SELECTION IS LOW

- When activated, selects low frequency ratings group #3 or #4. If an input is not mapped to a digital input, it is assumed to be a logical "0". When used in conjunction with Nominal Voltage Selection is Low the following ratings groups can be selected:

Programmable Digital Input "Nominal Frequency is Low" Logical Status	Programmable Digital Input "Nominal Voltage is Low" Logical Status	Ratings Group Selected
0 (high frequency)	0 (high voltage)	Group #1
0 (high frequency)	1 (low voltage)	Group #2
1 (low frequency)	0 (high voltage)	Group #3
1 (low frequency)	1 (low voltage)	Group #4

(Not available on standard software)

NOMINAL VOLTAGE SELECTION IS LOW

- When activated, selects low voltage ratings group #2 or #4. If an input is not mapped to a digital input, it is assumed to be a logical "0". When used in conjunction with Nominal Frequency Selection is Low the following ratings groups can be selected:

Programmable Digital Input "Nominal Frequency is Low" Logical Status	Programmable Digital Input "Nominal Voltage is Low" Logical Status	Ratings Group Selected
0 (high frequency)	0 (high voltage)	Group #1
0 (high frequency)	1 (low voltage)	Group #2
1 (low frequency)	0 (high voltage)	Group #3
1 (low frequency)	1 (low voltage)	Group #4

(Not available on standard software)

AUTO LOAD FUEL

- When activated, initiates the automatic fuel transfer in feature (if enabled). Typically used in conjunction with programmable digital outputs and analog input to control loading fuel.

AUTO UNLOAD FUEL

- When activated, initiates the automatic fuel transfer out feature (if enabled). Typically used in conjunction with programmable digital outputs and analog input to control unloading fuel. (Not available on standard software)

START AID TIMER BYPASS

- When activated, bypasses any remaining Start Aid Activation time and allows the set to proceed directly to cranking.

FUEL PRIMING COMMAND

- When activated, initiates fuel priming pump (if enabled). If Engine Operating State is configured for Hardwired, EMCP controls the fuel priming pump using fuel control relay output. If Engine Operating State is configured for CAN Input, EMCP communicates fuel priming command to engine ECM.

INHIBIT REACTIVE DROOP COMPENSATION

- When activated, reactive droop compensation bias (if configured) is removed from generator voltage output. (Only available with Integrated Voltage Regulator).

INHIBIT LINE DROP COMPENSATION

- When activated, line drop compensation bias (if configured) is removed from generator voltage output. (Only available with Integrated Voltage Regulator).

ENABLE POWER FACTOR CONTROL COMMAND

- When activated, voltage regulator control is performed in order to control power factor to a desired level. (Only available with Integrated Voltage Regulator).

DISABLE GENERATOR EXCITATION COMMAND

- When activated, generator excitation command is forced to zero and generator voltage output will only consist of residual voltage. (Only available with Integrated Voltage Regulator).

CONFIGURING DIGITAL INPUTS FOR SYSTEM EVENTS

System Events are used to know when specific conditions are reached and to alert the control system of warning or shutdown conditions. To configure a Digital Input as a System Event, go through the following menu options:

AT THE MAIN MENU, scroll down  to CONFIGURE

Press the OK KEY 

SCROLL DOWN  to INPUTS & OUTPUTS

Press the OK KEY 

Alternately, access to THE INPUTS & OUTPUTS submenu is accessible from ALL SETPOINTS.

Press the OK KEY  to access DIGITAL INPUTS.

Select the DIGITAL INPUT that you want to program and

Press the OK KEY 

Press the OK KEY  to highlight the current configuration (DISABLED, STATUS, SYSTEM EVENT, OR SCADA).

Scroll DOWN  to SYSTEM EVENT

Press the OK KEY 

Scroll DOWN  to EVENT PARAMETER

Press the OK KEY  to edit the current STATUS PARAMETER.

Select the type of EVENT PARAMETER that you want to program (Pressures, Temperatures, Levels, or Others)

Press the OK KEY 

MAIN MENU
CONTROL
CONFIGURE

INPUTS & OUTPUTS
DIGITAL INPUTS
RELAY OUTPUTS

DIGITAL INPUTS
INPUT #1
INPUT #2

DIGITAL INPUT #1
USAGE TYPE
DISABLED

DIGITAL INPUT #1
USAGE TYPE
DISABLED

DIGITAL INPUT #1
USAGE TYPE
SYSTEM EVENT

DIGITAL INPUT #1
EVENT PARAMETER:
PRESSURES

DIGITAL INPUT #1
EVENT PARAMETER:
LEVELS

Select the **EVENT PARAMETER** that you want to program

Press the **OK KEY**



Scroll **DOWN**  to **FAILURE TYPE**

Press the **OK KEY**  to edit the current **FAILURE TYPE**.

Select the **FAILURE TYPE** that you want to program

Press the **OK KEY**



Scroll **DOWN**  to **EVENT DELAY**

Press the **OK KEY**  to highlight the current **EVENT DELAY**.

Select the **EVENT DELAY** that you want

Press the **OK KEY**



Scroll **DOWN**  to **ACTIVE STATE**

Press the **OK KEY**  to highlight the current **ACTIVE STATE**.

Select the **ACTIVE STATE** that you want to program and

Press the **OK KEY**



DIGITAL INPUT #1
EVENT PARAMETER:
ENG COOLANT LVL

DIGITAL INPUT #1
FAILURE TYPE:
HIGH SHUTDOWN

DIGITAL INPUT #1
FAILURE TYPE:
LOW SHUTDOWN

DIGITAL INPUT #1
EVENT DELAY:
10 SECONDS

DIGITAL INPUT #1
EVENT DELAY:
0 1 0

DIGITAL INPUT #1
ACTIVE STATE
LOW

DIGITAL INPUT #1
ACTIVE STATE
HIGH

Any Digital Input can be configured for any one of the System Event parameters in Table 5:

Pressures Engine Oil Pressure Gas Pressure	Others Custom Event* Air Damper Closed Battery Charger Failure Fuel Leak Earth Fault Earth Leakage Battery Charging System Voltage Generator Breaker Closed Generator Breaker Open Generator Current Generator Real Power Inlet Manifold Charge Combustion EPS Supply Load (EMCP 4.2 only) Emergency Stop Switch (Remote)
Temperatures Engine Coolant Temperature Engine Oil Temperature Exhaust Temp Generator Rear Bearing Temperature Generator Winding #1 Temperature	
Levels Engine Coolant Level Engine Oil Level Fuel Level External Tank Fuel Level	

Table 5: Digital Input System Events

***Note:** Digital Input s configured for Custom Event SPNs (701-718) are shared between the EMCP and DIO Modules. Therefore ONLY one Custom Event SPN-FMI can be used between the two modules. SPN701 (Digital Input #1 Custom Event) may also be used in the Configuration of “Engine Running”.

CONFIGURING DIGITAL INPUTS FOR SCADA DATA LINK

When a Digital Input is configured for SCADA Data Link, the state of the input will be placed into the appropriate MODBUS register only. No alarms or warnings will be generated by the EMCP. To configure a Digital Input for SCADA Data Link, go through the following menu options:

AT THE MAIN MENU, scroll down  TO CONFIGURE

Press OK KEY 

SCROLL DOWN  to inputs & outputs

Press OK KEY 

Alternately, access to THE INPUTS & OUTPUTS submenu is accessible from ALL SETPOINTS.

Press OK KEY  to access DIGITAL INPUTS

Select the DIGITAL INPUT that you want to program

Press the OK KEY 

Press the OK KEY  to highlight the current configuration (DISABLED, STATUS, SYSTEM EVENT, OR SCADA).

Scroll DOWN  to SCADA DATA LINK

Press the OK KEY 

Scroll DOWN  to ACTIVE STATE

Press the OK KEY  to highlight the current ACTIVE STATE.

Select the ACTIVE STATE that you want to program

Press the OK KEY 

MAIN MENU
CONTROL
CONFIGURE

INPUTS & OUTPUTS
DIGITAL INPUTS
RELAY OUTPUTS

DIGITAL INPUTS
INPUT #1
INPUT #2

DIGITAL INPUT #1
USAGE TYPE
DISABLED

DIGITAL INPUT #1
USAGE TYPE
DISABLED

DIGITAL INPUT #1
USAGE TYPE:
SCADA DATALINK

DIGITAL INPUT #1
ACTIVE STATE
LOW

DIGITAL INPUT #1
ACTIVE STATE
HIGH

For information on reading the status of Digital Inputs via MODBUS, please refer to the SCADA documentation.

DISABLING DIGITAL INPUTS

To disable a Digital Input, go through the following menu options:

AT THE MAIN MENU, scroll down  TO CONFIGURE

MAIN MENU
CONTROL
CONFIGURE

Press the OK KEY 

SCROLL DOWN  TO INPUTS & OUTPUTS

INPUTS & OUTPUTS
DIGITAL INPUTS
RELAY OUTPUTS

Press the OK KEY 

Alternately, access to THE INPUTS & OUTPUTS submenu is accessible from ALL SETPOINTS.

Press the OK KEY  to access DIGITAL INPUTS.

DIGITAL INPUTS
INPUT #1
INPUT #2

Select the DIGITAL INPUT that you want to program

Press the OK KEY 

DIGITAL INPUT #1
USAGE TYPE
DISABLED

Press the OK KEY  to highlight the current configuration (DISABLED, STATUS, SYSTEM EVENT, OR SCADA).

DIGITAL INPUT #1
USAGE TYPE
DISABLED

Scroll DOWN  TO DISABLED

Press the OK KEY 

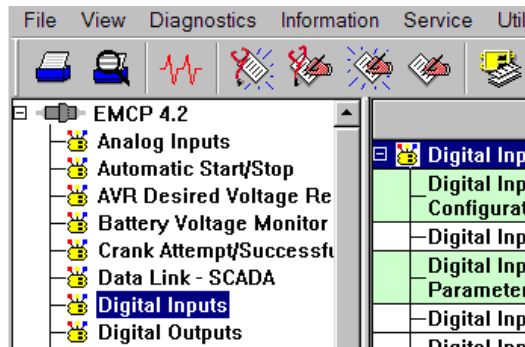
DIGITAL INPUT #1
USAGE TYPE
DISABLED

Note: If a Digital Input is set to **Disabled**, then any faults or events on that input will not be broadcast or annunciated on the network.

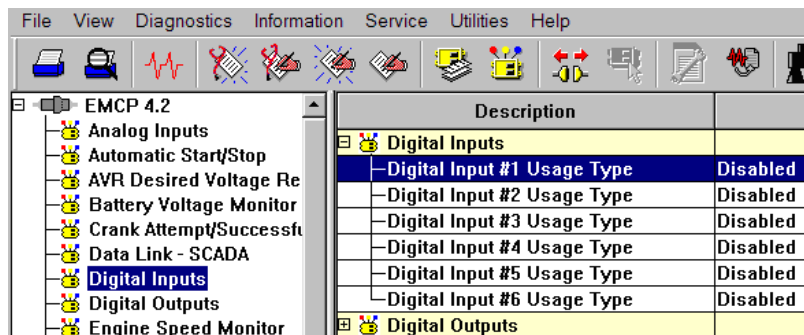
8.2 PROGRAMMING DIGITAL INPUTS USING THE CAT SERVICE TOOL

The EMCP 4 Digital Inputs can be configured using the Cat Service Tool. The key to programming them is to program the setpoints related to each input in order from top to bottom. To program an input, do the following steps:

1. Connect to the EMCP 4 using the Cat Service Tool as stated in Chapter 4.2.
2. Select Digital Inputs on the left.



3. Determine which input is to be configured. For example, all of the setpoints for Digital Input #1 have the text "#1" in their name.



4. Next follow the steps below according to which Usage Type is desired.

CONFIGURING DIGITAL INPUTS FOR STATUS PARAMETER

1. Double click the Digital Input #N Usage type to change this value to Command/Status Parameter from the drop down menu. Click the OK button to program.

The dialog box titled "Change Parameter Value" shows the following information:

- Parameter Name:** Digital Input #1 Usage Type
- Current Value:** Command/Status Parameter
- New Value:** A dropdown menu is open, showing the following options: System Event, **Command/Status Parameter** (highlighted), Data Link, Disabled, and System Event.
- Please select one of the**
- Buttons:** OK and Cancel.

2. The Digital Input #N Command/Status Parameter Data Identification and Active State Configuration parameters will now be visible in the right pane.

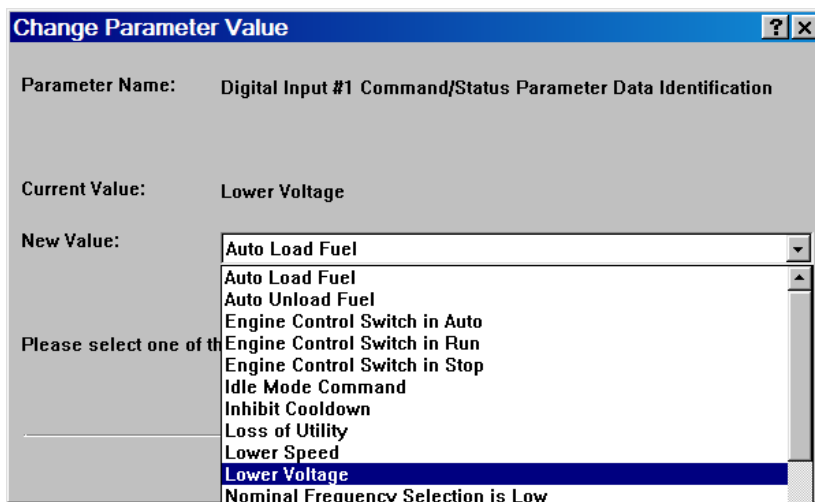
Description		Value
Digital Inputs		
Digital Input #1 Active State Configuration		High
Digital Input #1 Usage Type		Command/Status Parameter
Digital Input #1 Command/Status Parameter Data Identification		Lower Voltage

3. Configure the Active State Configuration setpoint according to your wiring – either active High or active Low. Click the OK button to program.

The dialog box titled "Change Parameter Value" shows the following information:

- Parameter Name:** Digital Input #1 Active State Configuration
- Current Value:** High
- New Value:** A dropdown menu is open, showing the following options: High, **High** (highlighted), and Low.
- Please select one of the listed values for this parameter.**
- Buttons:** OK and Cancel.

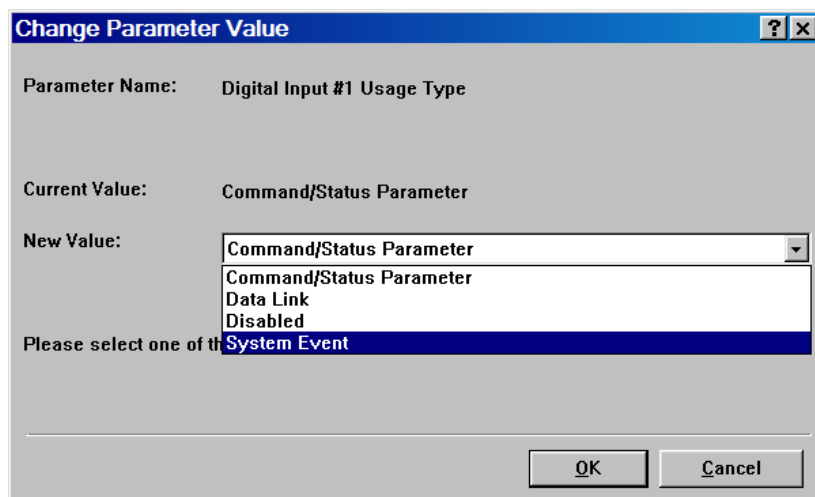
4. Double click the Configure the Command/Status Parameter Data Identification setpoint to change this value from the drop down menu. Click the OK button to program.



See Table 4 in Chapter 8.1 for a complete list of possible Status Parameter Data Identifications.

CONFIGURING DIGITAL INPUTS FOR SYSTEM EVENTS

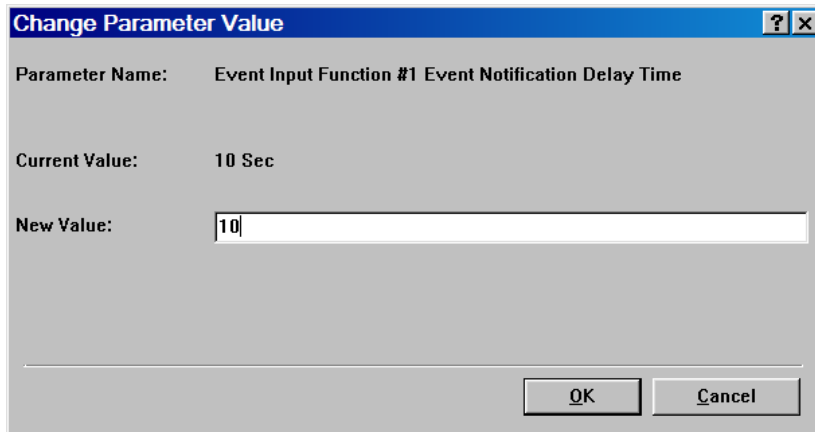
1. Double click the Digital Input #N Usage type to change this value to System Event from the drop down menu. Click the OK button to program.



2. The Event Input Function #N Event Notification Delay Time, Suspect Parameter Number (SPN), Failure Mode Identifier (FMI) and Active State Configuration parameters will now be visible in the right pane.

Description		Value
 Digital Inputs		
	Digital Input #1 Active State Configuration	High
	Digital Input #1 Usage Type	System Event
	Event Input Function #1 Event Notification Delay Time	10 Sec
	Event Input Function #1 Suspect Parameter Number	Custom Event
	Event Input Function #1 Failure Mode Identifier	Condition Exists

3. Double click the Event Input Function #N Event Notification Delay Time setpoint to change this value. Click the OK button to program.



Change Parameter Value

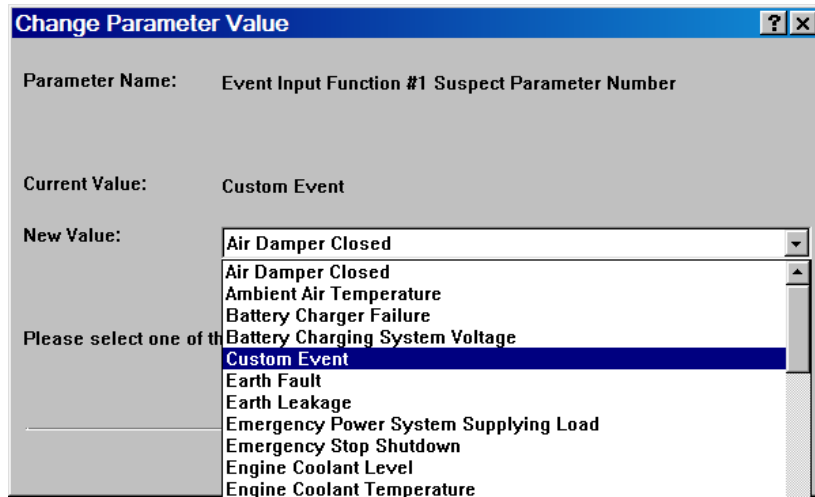
Parameter Name: Event Input Function #1 Event Notification Delay Time

Current Value: 10 Sec

New Value:

OK Cancel

4. Double click the Event Input Function #N Suspect Parameter Number (SPN) setpoint to change this value from the drop down menu. Click the OK button to program.



Change Parameter Value

Parameter Name: Event Input Function #1 Suspect Parameter Number

Current Value: Custom Event

New Value:

Please select one of the following:

- Air Damper Closed
- Ambient Air Temperature
- Battery Charger Failure
- Battery Charging System Voltage
- Custom Event**
- Earth Fault
- Earth Leakage
- Emergency Power System Supplying Load
- Emergency Stop Shutdown
- Engine Coolant Level
- Engine Coolant Temperature

- Double click the Event Input Function #N Failure Mode Identifier (FMI) setpoint to change this value from the drop down menu. Click the OK button to program.

The screenshot shows a dialog box titled "Change Parameter Value". The "Parameter Name" is "Event Input Function #1 Failure Mode Identifier". The "Current Value" is "Condition Exists". The "New Value" is selected from a dropdown menu. The dropdown list is open, showing the following options: "Condition Exists" (highlighted), "High Shutdown", "High Warning", "Low Shutdown", "Low Warning", and "Special Instructions". Below the dropdown, the text "Please select one of the" is visible. At the bottom right, there are "OK" and "Cancel" buttons.

- Configure the Active State Configuration setpoint according to your wiring – either active High or active Low. Click the OK button to program.

The screenshot shows a dialog box titled "Change Parameter Value". The "Parameter Name" is "Digital Input #1 Active State Configuration". The "Current Value" is "High". The "New Value" is selected from a dropdown menu. The dropdown list is open, showing the following options: "High" (highlighted), "High", and "Low". Below the dropdown, the text "Please select one of the listed values for this parameter." is visible. At the bottom right, there are "OK" and "Cancel" buttons.

- Once the input is set with an SPN and FMI, the Event Response Configuration may have to be checked. For information on Event Response Configurations and how to program them, see Chapter 5.2.

Not all SPN and FMI combinations are valid. Table 6 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 4. The EMCP 4 may not give the option of an invalid FMI for a given SPN. In Cat ET, there is no restriction on the SPN/FMI combination. An invalid combination in Cat ET will result in an “Out of Range” error.

Category	Suspect Parameter Number	Failure Mode Identifier Valid Options				
		High Shutdown	Low Shutdown	High Warning	Low Warning	Status
Pressures	Engine Oil Pressure		y		y	y*
	Gas Pressure	y	y	y	y	
Temperatures	Engine Coolant Temperature	y		y	y	
	Engine Oil Temperature	y	y	y	y	y*
	Exhaust Temperature	y		y	y	
	Generator Rear Bearing Temperature	y	y	y	y	
	Generator Winding #1 Temperature	y		y		
Levels	Engine Coolant Level	y	y	y	y	
	Engine Oil Level	y	y	y	y	
	Fuel Level	y	y	y	y	
	External Tank Fuel Level	y	y	y	y	
Others	Air Damper Closed					y
	Battery Charging System Voltage				y	
	Battery Charger Failure					y
	Custom Event (see note below)					y
	Earth Fault					y
	Earth Leakage					y
	Emergency Stop Switch					y**
	EPS Supply Load					y
	Fuel Leak					y
	Gen Breaker Closed					y
	Gen Breaker Open					y
	Generator Current	y	y	y	y	
	Generator Real Power		y	y	y	
	Inlet Manifold Charge					
	Combustion					y

Table 6: Event Input Function SPN and FMI Options

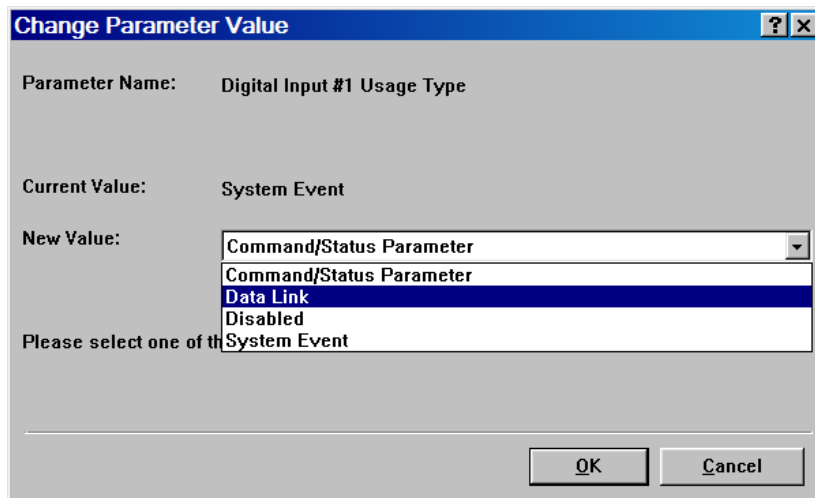
*This status is FMI 14 (Special Instruction), not FMI 31 (Condition Exists).

** This status is FMI 14(Special Instruction), not FMI 31 (Condition Exists). This gives a means to differentiate between a Remote Emergency Stop and Emergency Stop.

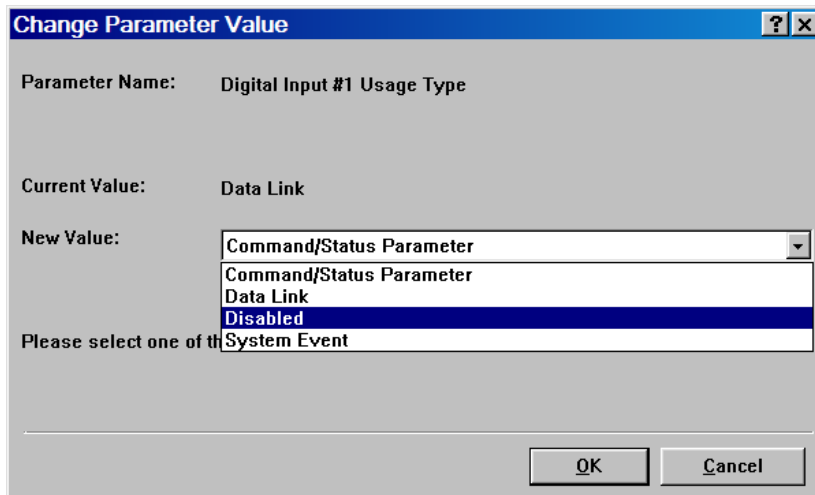
Note: For Custom Events, each input can only trigger the custom event number that matches the Digital Input number (Digital Input #1 can only activate Custom Event #1, etc).

CONFIGURING DIGITAL INPUTS FOR SCADA DATA LINK

1. Double click the Digital Input #N Usage type to change this value to Data Link from the drop down menu. Click the OK button to program.

**DISABLING DIGITAL INPUTS**

1. Double click the Digital Input #N Usage type to change this value to Disabled from the drop down menu. Click the OK button to program.



9 ANALOG INPUTS

The EMCP 4.1 and 4.2 support three 2-wire (plus shield) Analog Inputs. None of these inputs are dedicated to specific functions. These are individually selectable as either Voltage or Resistive Sender inputs for interface to senders, customer signals, etc. The modes of operation are described below:

- Voltage mode: 0-5 Volts with software-selectable sub-ranges (see Table 9 in Chapter 9.3). The input impedance is a minimum of 10k Ohms and a maximum of 1M Ohms. The Analog Input return signals must be tied to battery negative external to the controller.
- Resistive Sender (VDO typemtr) Mode: 5-2000 Ohms with software-selectable nonlinear maps. Accuracy is 1% or 0.5 Ohms accuracy, whichever is worse. The Analog Input return signals must be tied to battery negative external to the controller.

The Analog Inputs have a 5V common non-isolated power supply capable of supplying up to 100mA of current, and has overload protection. This supply is to be used to provide power to sensors if required by the source power pin and Analog Input returns. The negative side of this supply is battery negative.

See Electrical Connections Chapter 3.5 for illustrations on how to connect the sensors to the control.

Analog Inputs programmed to monitor pressures should be wired to sensors that read gauge, not absolute pressure, unless absolute pressure is desired.

For Analog Inputs, the data range can be positive or negative, but Event thresholds are only positive. Therefore, to prevent nuisance alarms for low warnings, disable the Event Response Configuration if data is acceptable to be negative (see Chapter 5.2).

The first and second Analog Inputs are configured by default for non-electronic engines to monitor engine oil pressure and engine coolant temperature, respectively, and are protected by Level 3 security. The third Analog Input is protected at Level 2 security. For help on programming the Level 3 password prior to running this procedure, see Chapter 6, Security. Alternately, the Cat Service Tool can be used to program these setpoints.

Note: If the Analog Inputs are set to **DISABLED**, then any sensor faults or events will not be broadcast or annunciated on the network.

Note: If more than one Analog Input is configured for the same physical quantity (i.e. the setpoint Analog Input Data Identification matches between two Analog Inputs), then the higher numbered Analog Input value will be displayed on the Engine Overview screen. For example, if both Analog Input #2 and Analog Input #3 are configured for oil temperature, but the sensor is connected only to Analog Input #2 (and Analog Input #3 is left open), a display of **** diagnostic will result. The Engine Overview screen will display the value from Analog Input #3. Warnings and Shutdowns will be monitored for both Analog Inputs. **When troubleshooting inputs, always make sure to check for configuration conflicts!**

The Analog Inputs are often not 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 may be 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 4, 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 sensor values on the Engine Overview screen on the EMCP 4 display will show **** (asterisks).

Note: Improper configuration of these inputs can cause a false event to be triggered, or cause an event to not be triggered when desired. If a user disables an input without including other external protection, or disables the annunciation of an enabled input, detection will not be available. If a spare input is enabled, but not wired to a sensor, a false event may occur.

The programming of the Analog Inputs starts by selecting a “Usage Type”. The rest of the programming is dependent upon what Usage Type is selected. Figure 22 summarizes the paths possible for Programming an Analog Input.

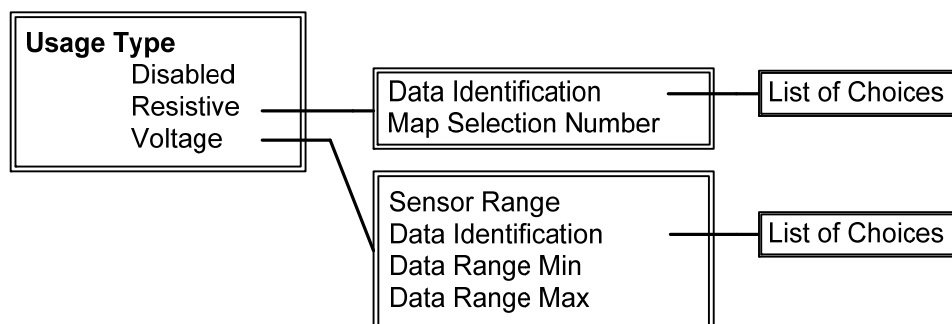


Figure 22: Analog Input Programming Paths

9.1 PROGRAMMING ANALOG INPUTS USING THE DISPLAY

The steps to configure the Analog Inputs for each of the Usage Types are described below. Level 3 security is required for Analog Inputs #1 and #2. Level 2 security is required for Analog Input #3.

VIEWING THE CURRENT ANALOG INPUT STATUS

To view the current status of an Analog Input, go through the following menu options:

AT THE MAIN MENU, scroll DOWN  TO VIEW

Press the OK KEY 

Scroll DOWN  TO I/O STATUS

Press the OK KEY 

Scroll DOWN  TO ANALOG INPUTS

Press the OK KEY 

Scroll DOWN  TO choose the ANALOG INPUT desired.

Press the OK KEY 

The programmed Data Identification of the selected Analog Input is shown.

Scroll DOWN  TO view the remaining parameters for this input (including the actual value seen on the input).

MAIN MENU

VIEW

CONTROL

VIEW

AC OVERVIEW

I/O STATUS

I/O STATUS

DIGITAL OUTPUTS

ANALOG INPUTS

ANALOG INPUTS

INPUT #1

INPUT #2

ANALOG INPUT #1

DATA IDENTIFICATION

CUSTOM PARAM

CONFIGURING ANALOG INPUTS FOR RESISTIVE MODE

To configure an Analog Input for Resistive Mode, go through the following menu options:

AT THE MAIN MENU, scroll down  to **CONFIGURE**

Press the **OK KEY** 

SCROLL DOWN  to **INPUTS & OUTPUTS**

Press the **OK KEY** 

SCROLL DOWN  to **ANALOG INPUTS**

Press the **OK KEY** 

Alternately, access to **THE INPUTS & OUTPUTS** submenu is accessible from **ALL SETPOINTS**.

Select the **ANALOG INPUT** that you want to program

Press the **OK KEY** 

Press the **OK KEY**  to highlight the current configuration (**DISABLED, RESISTIVE, OR VOLTAGE**).

Scroll DOWN  to **RESISTIVE**

Press the **OK KEY** 

Scroll DOWN  to **DATA IDENTIFICATION**

Press the **OK KEY**  to change the current **DATA IDENTIFICATION**.

Select the **DATA IDENTIFICATION** that you want to program

Press the **OK KEY** 

MAIN MENU
CONTROL
CONFIGURE

INPUTS & OUTPUTS
DIGITAL INPUTS
RELAY OUTPUTS

INPUTS & OUTPUTS
DIGITAL OUTPUTS
ANALOG INPUTS

ANALOG INPUTS
INPUT #2
INPUT #3

ANALOG INPUT #3
USAGE TYPE:
DISABLED

ANALOG INPUT #3
USAGE TYPE:
RESISTIVE

ANALOG INPUT #3
DATA IDENTIFICATION:
DATA LINK - SCADA

ANALOG INPUT #3
DATA IDENTIFICATION:
ENG OIL PRES

Scroll DOWN  to **MAP SELECTION NUMBER**

Press the **OK KEY**  to change the current **MAP SELECTION NUMBER**.

Select the **MAP SELECTION NUMBER** that you want to program

Press the **OK KEY** .

ANALOG INPUT #3
MAP SELECTION NUMBER:
3

ANALOG INPUT #3
MAP SELECTION NUMBER:
03

The Data Identification will remain the same when switching between Resistive or Voltage.

Any Analog Input can be configured for any one of the Data Identification parameters in Table 7:

Engine Oil Pres	Custom Parameters
Eng Coolant Temp	Data Link – SCADA (EMCP 4.2 only)
Engine Oil Temp	Engine Speed Control
Engine Fuel Level	Generator Voltage Control
Ext Tank Fuel Level	

Table 7: Analog Input Data Identifications

The Sensor Codes correspond to sensor maps as defined in Chapter 9.3.

CONFIGURING ANALOG INPUTS FOR VOLTAGE MODE

To configure an Analog Input for Voltage Mode, go through the following menu options:

AT THE MAIN MENU, scroll down  to CONFIGURE

Press the OK KEY 

SCROLL DOWN  to INPUTS & OUTPUTS

Press the OK KEY 

SCROLL DOWN  to ANALOG INPUTS

Press the OK KEY 

Alternately, access to THE INPUTS & OUTPUTS submenu is accessible from ALL SETPOINTS.
Select the **ANALOG INPUT** that you want to program

Press the OK KEY 

Press the OK KEY  to highlight the current configuration (**DISABLED**, **RESISTIVE**, OR **VOLTAGE**).

Scroll DOWN  to **VOLTAGE**

Press the OK KEY 

Scroll DOWN  to **SENSOR RANGE**

Press the OK KEY  to change the current **SENSOR RANGE**.

Select the **SENSOR RANGE** that you want to program

Press the OK KEY 

MAIN MENU
CONTROL
CONFIGURE

INPUTS & OUTPUTS
DIGITAL INPUTS
RELAY OUTPUTS

INPUTS & OUTPUTS
DIGITAL OUTPUTS
ANALOG INPUTS

ANALOG INPUTS
INPUT #2
INPUT #3

ANALOG INPUT #3
USAGE TYPE:
DISABLED

ANALOG INPUT #3
USAGE TYPE:
VOLTAGE

ANALOG INPUT #3
SENSOR RANGE:

ANALOG INPUT #3
SENSOR RANGE:
0 TO 5 V

Scroll **DOWN**  to **DATA IDENTIFICATION**

Press the **OK KEY**  to change the current **DATA IDENTIFICATION**.

Select the **STATUS PARAMETER** that you want to program

Press the **OK KEY** 

Scroll **DOWN**  to **DATA RANGE MIN**

Press the **OK KEY**  to change the current **DATA RANGE MIN**.

Select the **DATA RANGE MIN** that you want to program

Press the **OK KEY** 

For Analog Inputs, the data range can be positive or negative, but Event thresholds are only positive. Therefore, to prevent nuisance alarms for low warnings, disable the Event Response Configuration if data is acceptable to be negative (see Chapter 5.2).

Scroll **DOWN**  to **DATA RANGE MAX**

Press the **OK KEY**  to change the current **DATA RANGE MAX**.

Select the **DATA RANGE MAX** that you want to program

Press the **OK KEY** 

ANALOG INPUT #3
DATA IDENTIFICATION:
ENG COOLANT TEMP

ANALOG INPUT #3
DATA IDENTIFICATION:
ENGINE OIL TEMP

ANALOG INPUT #3
DATA RANGE MIN:
-0.00° C

ANALOG INPUT #3
DATA RANGE MIN:
- 0 0 0 0 0 . 0 0

ANALOG INPUT #3
DATA RANGE MAX:
100.00° C

ANALOG INPUT #3
DATA RANGE MAX:
+ 0 0 1 0 0 . 0 0

The Data Identification list is the same whether Signal Type is Resistive or Voltage.

Any Analog Input can be configured for any one of the Data Identification parameters in Table 7.

DISABLING ANALOG INPUTS

To Disable an Analog Input, go through the following menu options:

AT THE MAIN MENU, scroll down  to CONFIGURE

Press the OK KEY 

SCROLL DOWN  to INPUTS & OUTPUTS

Press the OK KEY 

SCROLL DOWN  to ANALOG INPUTS

Press the OK KEY 

Alternately, access to THE INPUTS & OUTPUTS submenu is accessible from ALL SETPOINTS.

Select the ANALOG INPUT that you want to program

Press the OK KEY 

Press the OK KEY  to highlight the current configuration (DISABLED, RESISTIVE, OR VOLTAGE).

Scroll DOWN  to DISABLED

Press the OK KEY 

MAIN MENU
CONTROL
CONFIGURE

INPUTS & OUTPUTS
DIGITAL INPUTS
RELAY OUTPUTS

INPUTS & OUTPUTS
DIGITAL OUTPUTS
ANALOG INPUTS

ANALOG INPUTS
INPUT #2
INPUT #3

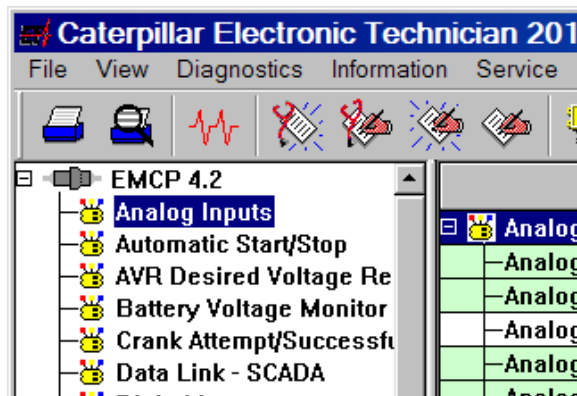
ANALOG INPUT #3
USAGE TYPE:
DISABLED

ANALOG INPUT #3
USAGE TYPE:
DISABLED

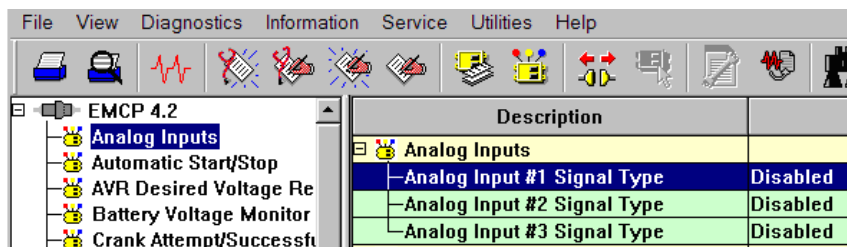
9.2 PROGRAMMING ANALOG INPUTS USING THE CAT SERVICE TOOL

The EMCP 4 Analog Inputs can be configured using the Cat Service Tool. The key to programming them is to program the setpoints related to each input in order from top to bottom. To program an Analog Input, do the following steps:

1. Connect to the EMCP 4 using the Cat Service Tool as stated in Chapter 4.2.
2. Select Analog Inputs on the left.



3. Determine which input is to be configured. For example, all of the setpoints for Analog Input #1 have the text “#1” in their name.



4. Next follow the steps below according to which Usage Type is desired.

CONFIGURING ANALOG INPUTS FOR RESISTIVE MODE

The EMCP 4 supports resistive sender maps, which are nonlinear maps representing the transfer function of the resistive sender. Once an Analog Input is configured as a Resistive input type, a map must be selected.

1. Double click the Analog Input #N Usage type to change this value to Resistive Sender from the drop down menu. Click the OK button to program.

The dialog box titled "Change Parameter Value" shows the parameter "Analog Input #1 Signal Type". The current value is "Disabled". The new value dropdown menu is open, showing options: "Disabled", "Resistive Sender" (highlighted), and "Voltage". A message at the bottom says "Please select one of the listed values for this parameter." Buttons for "OK" and "Cancel" are at the bottom right.

2. The Analog Input #N Configuration Code and Data Identification parameters will now be visible in the right pane.

Description	Value
Analog Inputs	
—Analog Input #1 Signal Type	Resistive Sender
—Analog Input #1 Configuration Code	Map #3
—Analog Input #1 Data Identification	Data Link Only

3. Double click the Configuration Code setpoint to change this value from the drop down menu. Click the OK button to program.

The dialog box titled "Change Parameter Value" shows the parameter "Analog Input #1 Configuration Code". The current value is "Map #3". The new value dropdown menu is open, showing options: "Map #1" (highlighted), "Map #2", "Map #3", "Map #4", "Map #5", "Map #6", and "Map #7". A message at the bottom says "Please select one of the listed values for this parameter." Buttons for "OK" and "Cancel" are at the bottom right.

4. Double click the Data Identification setpoint to change this value from the drop down menu. Click the OK button to program.

Change Parameter Value

Parameter Name: Analog Input #1 Data Identification

Current Value: Custom Parameter

New Value:
 Custom Parameter
Data Link Only
 Desired Engine Speed Command
 Engine Coolant Temperature
 Engine Fuel Level
 Engine Oil Pressure
 Engine Oil Temperature
 External Tank Fuel Level

Please select one of the

OK Cancel

Based on whether or not the selected option supports events, the list of setpoints shown will adjust accordingly. If the selected option does not support events, then the configuration is complete.

5. If the selected option does support events, then continue and configure the event thresholds and delays. The Analog Input #N Threshold and Delay Time parameters will now be visible in the right pane.

Description	Value
Analog Inputs	
—Analog Input #1 Signal Type	Resistive Sender
—Analog Input #1 Configuration Code	Map #1
—Analog Input #1 Data Identification	Custom Parameter
—Analog Input #1 High Warning Event Threshold	80
—Analog Input #1 High Warning Event Delay Time	0 Sec
—Analog Input #1 High Shutdown Event Threshold	84
—Analog Input #1 High Shutdown Event Delay Time	0 Sec
—Analog Input #1 Low Warning Event Threshold	20
—Analog Input #1 Low Warning Event Delay Time	0 Sec
—Analog Input #1 Low Shutdown Event Threshold	16
—Analog Input #1 Low Shutdown Event Delay Time	0 Sec

Table 8 lists the options and which, if any, events they support. Not all SPN and FMI combinations are valid. Table 8 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 4. The EMCP 4 may not give the option of an invalid FMI for a given SPN. In Cat ET, there is no restriction on the SPN/FMI combination. An invalid combination in Cat ET will result in an “Out of Range” error.

Suspect Parameter Number	Failure Mode Identifier Valid Options			
	High Shutdown	Low Shutdown	High Warning	Low Warning
Engine Oil Pressure		y		y
Engine Coolant Temperature	y		y	y
Engine Oil Temperature	y	y	y	y
Fuel Level	y	y	y	y
External Tank Fuel Level	y	y	y	y
Gen Volt Control				
Custom Event (see note below)	y	y	y	y
Data Link Only				
Desired Engine Speed Command				

Table 8: Event Input Function SPN and FMI Options

Note: For Custom Events, each input can only trigger the custom event number that matches the Analog Input number (Analog Input #1 can only activate Custom Event #1, etc.).

- Configure each of these setpoints by double clicking each one and typing a new value. Click the OK button to program.

Change Parameter Value [?] [X]

Parameter Name: Analog Input #1 High Warning Event Delay Time

Current Value: 0 Sec

New Value:

[OK] [Cancel]

Note: The units for the event thresholds are not shown. For pressures, the units are always kPa. For temperatures, they are always degrees Celsius. For levels, they are always percent. For the custom parameter type, they are unitless. The range for custom parameters is defined by the selected sensor map if programmed for resistive.

CONFIGURING ANALOG INPUTS FOR VOLTAGE MODE

The EMCP 4 supports linear voltage senders, which are senders whose output voltage varies linearly with the change in a physical measurement. Once the Analog Input is configured as a Voltage Input type, the linear mapping must be defined by entering the sensor voltage range and the corresponding minimum and maximum physical measurement range.

1. Double click the Analog Input #N Usage type to change this value to Voltage from the drop down menu. Click the OK button to program.

2. The Analog Input #N Signal Range, Data Identification, and Minimum and Maximum Data Range parameters will now be visible in the right pane.

Description	Value
Analog Inputs	
—Analog Input #1 Signal Type	Voltage
—Analog Input #1 Signal Range	0 to 5 V
—Analog Input #1 Data Identification	Data Link Only
—Analog Input #1 Minimum Data Range	0.060
—Analog Input #1 Maximum Data Range	0.100

3. Double click the Signal Range setpoint to change this value from the drop down menu to match the range supported by your sensor (or the next larger range). See Chapter 9.3 for what to do if the desired sensor's range is not supported. Click the OK button to program.

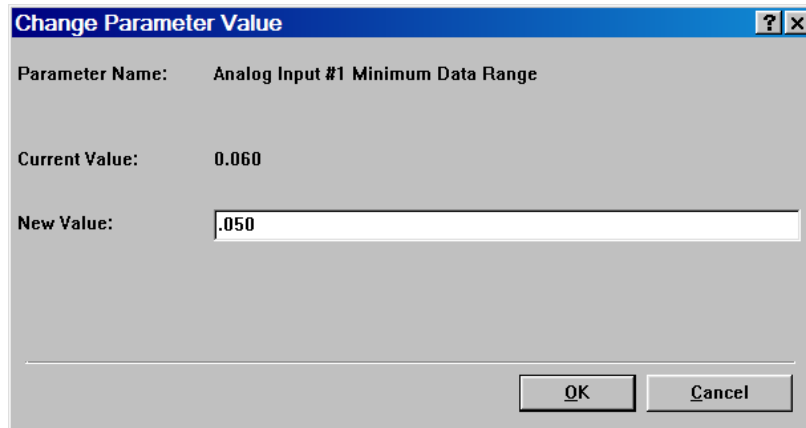
The screenshot shows a dialog box titled "Change Parameter Value". The "Parameter Name" is "Analog Input #1 Signal Range". The "Current Value" is "0 to 5 V". The "New Value" is a dropdown menu with the following options: "0 to 5 V", "0.5 to 4.5 V", and "1 to 5 V". The "0 to 5 V" option is currently selected. Below the dropdown, it says "Please select one of the listed values for this parameter." At the bottom right, there are "OK" and "Cancel" buttons.

4. Double click the Data Identification setpoint to change this value from the drop down menu. Click the OK button to program.

The screenshot shows a dialog box titled "Change Parameter Value". The "Parameter Name" is "Analog Input #1 Data Identification". The "Current Value" is "Custom Parameter". The "New Value" is a dropdown menu with the following options: "Custom Parameter", "Custom Parameter", "Data Link Only", "Desired Engine Speed Command", "Engine Coolant Temperature", "Engine Fuel Level", "Engine Oil Pressure", "Engine Oil Temperature", and "External Tank Fuel Level". The "Data Link Only" option is currently selected. Below the dropdown, it says "Please select one of the listed values for this parameter." At the bottom right, there are "OK" and "Cancel" buttons.

5. Based on whether or not the selected option supports events, the list of setpoints shown will adjust accordingly. Table 8 lists the options and which, if any, events they support.

6. Configure each of the Minimum and Maximum Data Range setpoints by double clicking each setpoint and typing a new value. Click the OK button to program.



The dialog box titled "Change Parameter Value" has a blue header bar with a question mark icon and a close button. It contains the following fields:

- Parameter Name:** Analog Input #1 Minimum Data Range
- Current Value:** 0.060
- New Value:** .050 (text input field)

At the bottom right, there are two buttons: "OK" and "Cancel".

For Analog Inputs, the data range can be positive or negative, but Event thresholds are only positive. Therefore, to prevent nuisance alarms for low warnings, disable the Event Response Configuration if data is acceptable to be negative (see Chapter 5.2).

7. If the selected Data Identification does support events, then continue and configure the event thresholds and delays. The Analog Input #N Threshold and Delay Time parameters will be visible in the right pane.

Description		Value
 Analog Inputs		
— Analog Input #1 Signal Type		Voltage
— Analog Input #1 Signal Range		0 to 5 V
— Analog Input #1 Data Identification		Custom Parameter
— Analog Input #1 Minimum Data Range		0.060
— Analog Input #1 Maximum Data Range		0.100
— Analog Input #1 High Warning Event Threshold		80
— Analog Input #1 High Warning Event Delay Time		0 Sec
— Analog Input #1 High Shutdown Event Threshold		84
— Analog Input #1 High Shutdown Event Delay Time		0 Sec
— Analog Input #1 Low Warning Event Threshold		20
— Analog Input #1 Low Warning Event Delay Time		0 Sec
— Analog Input #1 Low Shutdown Event Threshold		16
— Analog Input #1 Low Shutdown Event Delay Time		0 Sec

8. Configure each of these setpoints by double clicking each one and typing a new value. Click the OK button to program.

A screenshot of a 'Change Parameter Value' dialog box. The title bar is blue with a question mark icon and a close button. The dialog has a light gray background. It contains three labels: 'Parameter Name:' followed by 'Analog Input #1 High Warning Event Delay Time', 'Current Value:' followed by '0 Sec', and 'New Value:' followed by a text input field containing the number '5'. At the bottom right, there are two buttons: 'OK' and 'Cancel'.

Note: The units for the event thresholds are not shown. For pressures, the units are always kPa. For temperatures, they are always degrees Celsius. For levels, they are always percent. For the custom parameter type, they are unitless. The range for custom parameters is defined by the selected sensor map.

DISABLING ANALOG INPUTS

1. Double click the Analog Input #N Usage type to change this value to Disabled from the drop down menu. Click the OK button to program.

A screenshot of a 'Change Parameter Value' dialog box. The title bar is blue with a question mark icon and a close button. The dialog has a light gray background. It contains three labels: 'Parameter Name:' followed by 'Analog Input #1 Signal Type', 'Current Value:' followed by 'Resistive Sender', and 'New Value:' followed by a drop-down menu showing 'Disabled'. Below the drop-down menu, there is a text prompt: 'Please select one of the listed values for this parameter.' At the bottom right, there are two buttons: 'OK' and 'Cancel'.

Note: If the Analog Inputs are set to Disabled, then any sensor faults or events will not be broadcast or annunciated on the network.

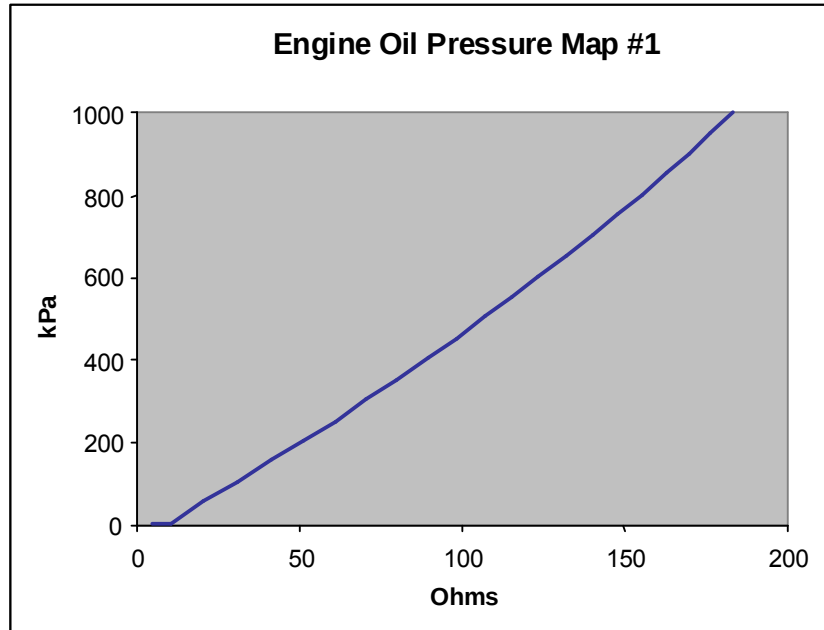
9.3 ANALOG INPUT MAPS

Resistive senders can use nonlinear sensor maps. These maps are not available for Voltage or Current modes. Maps are predefined in the software flash file, and can be selected by the customer. The Analog Inputs are capable of reading resistance from ~5 ohms.

The following maps are predefined:

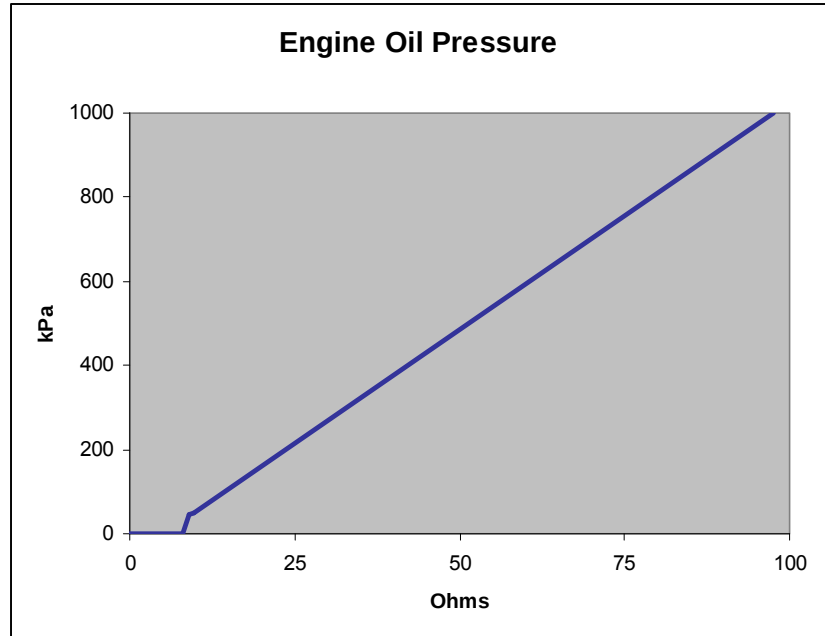
Analog Input Map #1
Engine Oil Pressure
Map #1

Ohms	kPa
5.1	0
10.2	0
20.9	50
31.3	100
41.6	150
51.6	200
61.3	250
70.9	300
80.4	350
89.5	400
98.6	450
107.3	500
115.9	550
124.3	600
132.5	650
140.5	700
148.2	750
155.8	800
163.1	850
170.2	900
177.2	950
183.9	1000



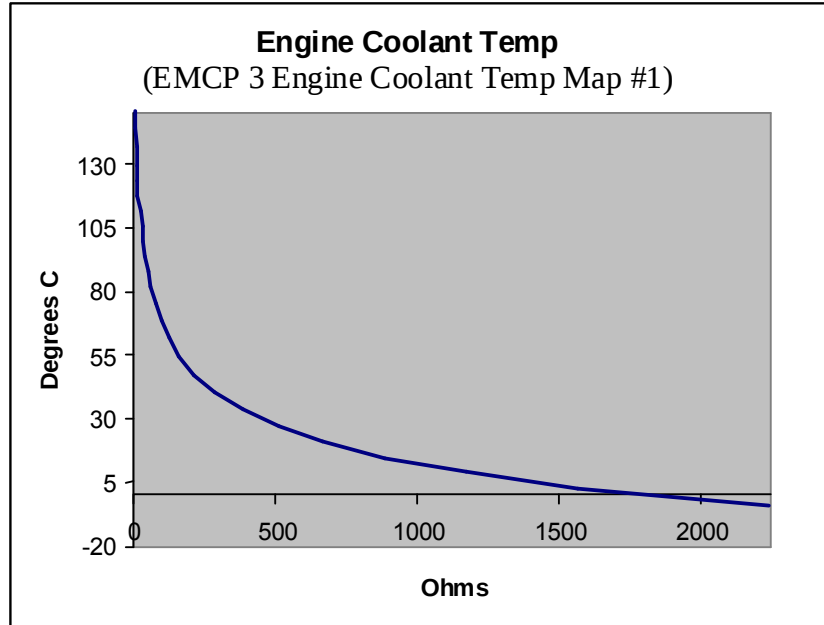
Analog Input Map #2**Engine Oil Pressure**

Ohms	kPa
0	0
8	0
9	45
9.8	50
97.5	1000



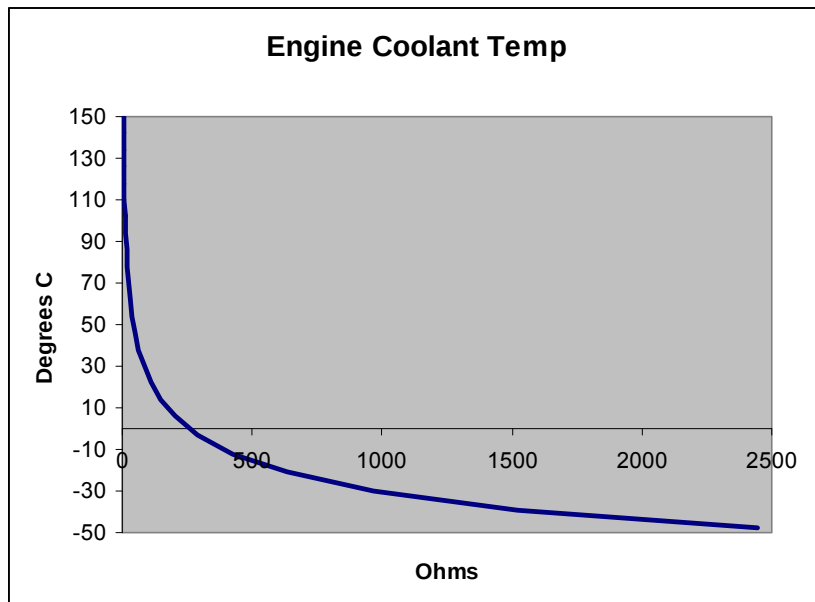
Analog Input Map #3**Engine Coolant Temp.
Map #1**

Ohms	Degrees C
11.0	150
12.8	143
15.0	136
17.9	129
20.8	123
24.2	117
28.4	111
33.4	105
39.6	99
46.9	93
56.1	87
67.9	81
82.4	75
103.6	68
129.6	61
168.0	54
221.9	47
291.5	40
387.5	33
520.6	26
677.0	20
890.6	14
1182.9	8
1575.6	2
2249.4	-5



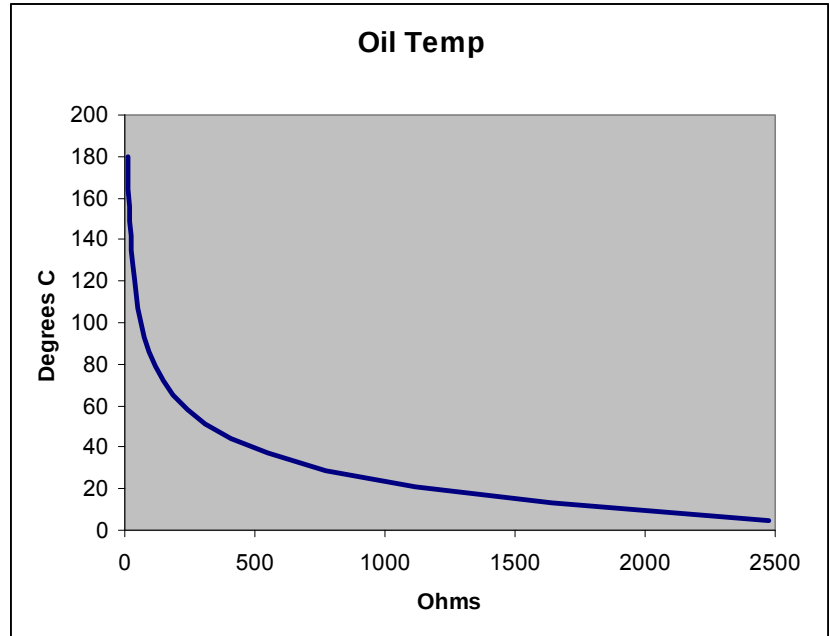
Analog Input Map #4
Engine Coolant Temp.
Map #2

Ohms	Degrees C
2442	-48
1518	-39
968.9	-30
633.6	-21
423.9	-12
289.7	-3
201.9	6
148.8	14
111.2	22
84.2	30
64.5	38
50	46
39.2	54
31	62
24.8	70
20	78
16.3	86
13.3	94
11.0	102
9.18	110
7.7	118
6.5	126
5.5	134
4.7	142
4.1	150



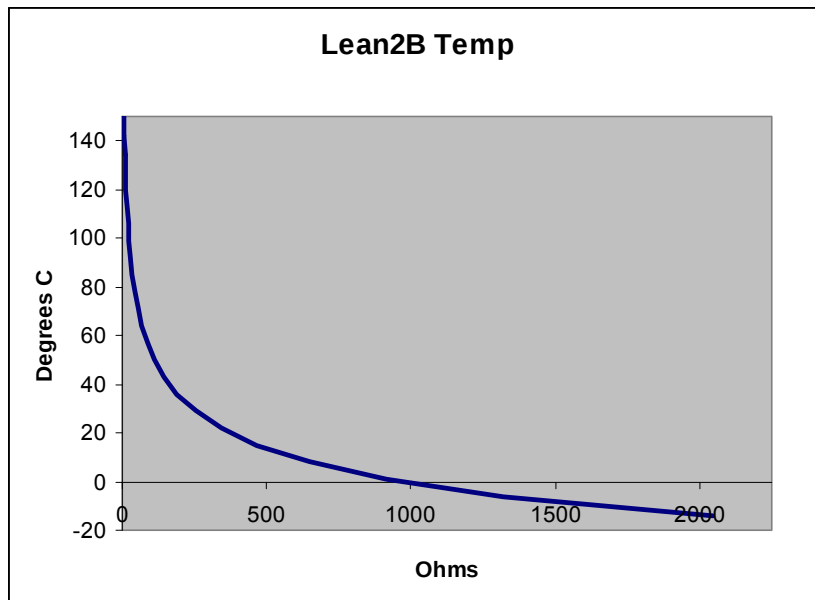
Analog Input Map #5**Oil Temp**

Ohms	Degrees C
10.2	180
11.9	172
13.9	164
16.4	156
19.0	149
22.0	142
25.7	135
30.2	128
35.6	121
42.5	114
51.2	107
61.9	100
75.8	93
93.6	86
115.6	79
145.2	72
184.7	65
238.0	58
309.9	51
408.7	44
546.6	37
773.7	29
1114.9	21
1640.3	13
2473.6	5



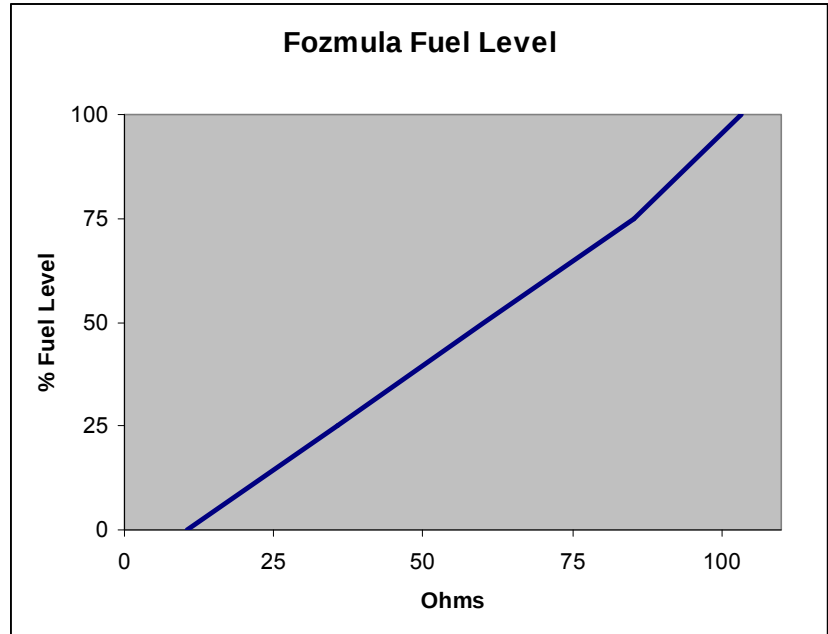
**Analog Input Map #6
Engine Coolant Temp
Map #3**

Ohms	Degrees C
6.9	150
8.2	142
9.8	134
11.6	127
13.8	120
16.3	113
19.6	106
23.8	99
28.8	92
35.4	85
43.7	78
54.5	71
68.5	64
87.1	57
111.8	50
145.1	43
190.5	36
253.4	29
341.5	22
467.0	15
648.8	8
916.6	1
1318.5	-6
2046.6	-14

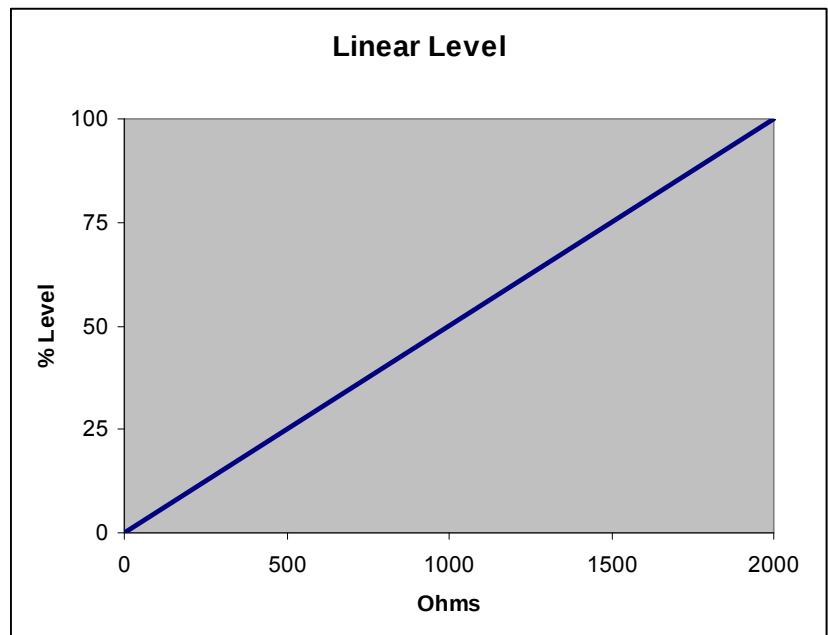


Analog Input Map #7**Fozmula Fuel Level**

Ohms	%
10.5	0
35.6	25
60.2	50
85.2	75
103.2	100

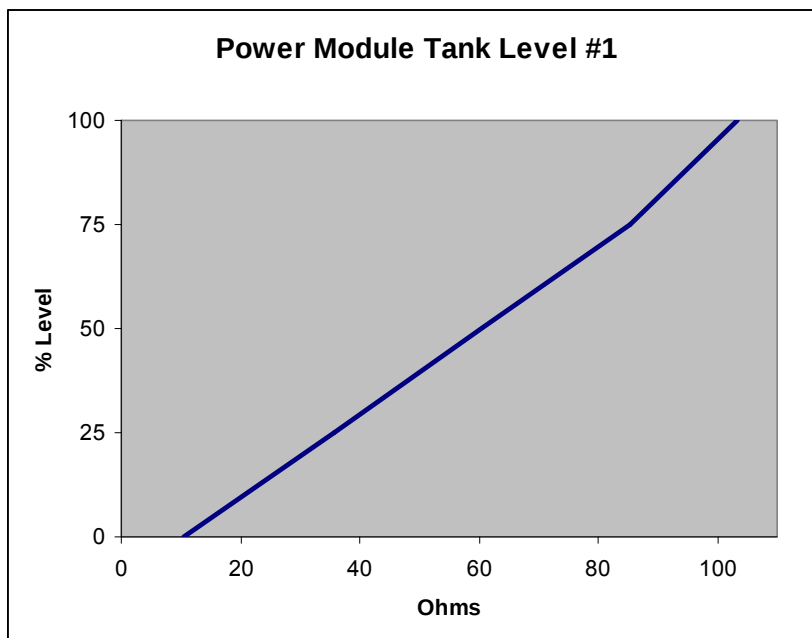
**Analog Input Map #8****Linear Level**

Ohms	%
0	0
2000	100

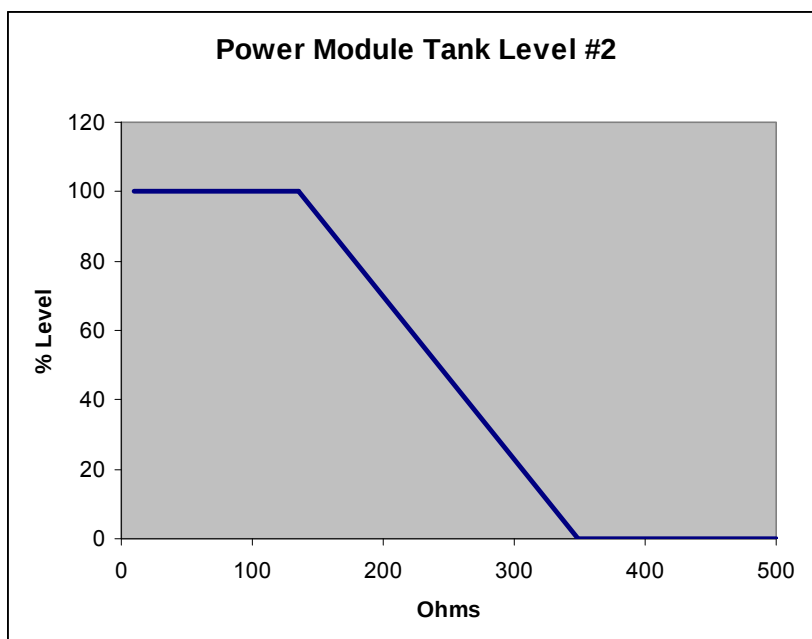


Analog Input Map #9**Power Module Tank
Level #1**

Ohms	%
10.5	0
35.6	25
60.2	50
85.2	75
103.2	100

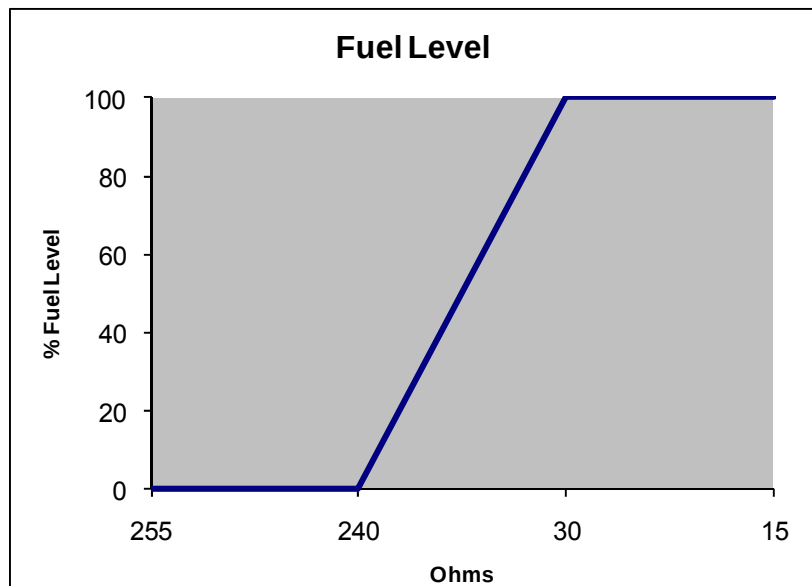
**Analog Input Map #10****Power Module Tank
Level #2**

Ohms	%
10	100
135	100
348.2	0
500	0



Analog Input Map #11

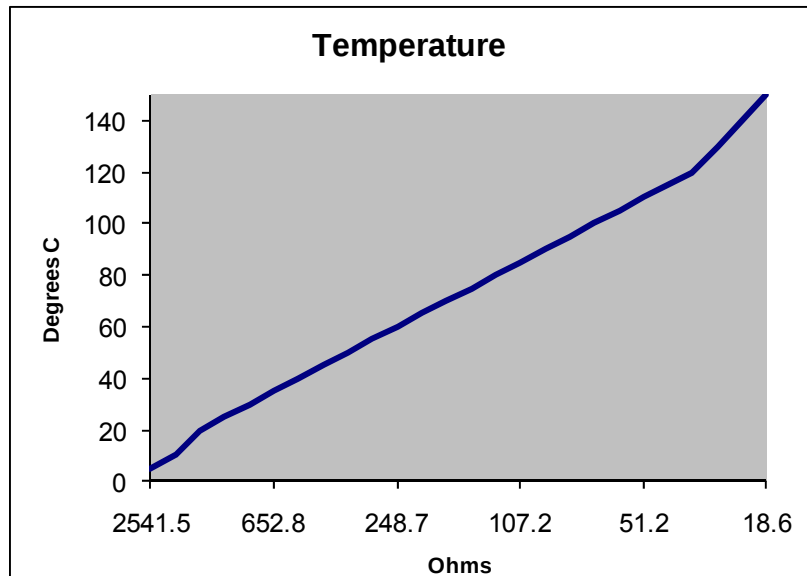
Fuel Level	
Ohms	%
255	0
240	0
30	100
15	100



Analog Input Map #12**Temperature**

Useful for temperatures based on CAT sensor part number 256-6453. (EMCP Only supports down to 10 degrees C).

Ohms	Degrees C
2541.5	5
1991.4	10
1249.5	20
1000	25
805.5	30
652.8	35
532.3	40
436.6	45
360	50
298.4	55
248.7	60
208.2	65
175.2	70
148.1	75
125.7	80
107.2	85
91.7	90
78.8	95
68	100
58.9	105
51.2	110
44.6	115
39	120
30.1	130
23.6	140
18.6	150



For EMCP 4.1 and 4.2, voltage senders can be configured within the ranges in Table 9:

<u>Voltage Sender Ranges</u>
0 to 5V
1 to 5V
0.5 to 4.5V

Table 9: Analog Input Ranges

Analog Input data ranges can be defined with positive and negative values, but Event thresholds are only programmable as positive values. Therefore, to prevent nuisance alarms for low warnings when using negative numbers for data ranges, the Event Response Configuration can be disabled, if input data is acceptable to be negative.

WARNINGS AND SHUTDOWNS

Each of these inputs can be configured to have **HIGH WARNINGS**, **LOW WARNINGS**, **HIGH SHUTDOWNS** and **LOW SHUTDOWNS** with configurable thresholds. Any value below the bottom point on the map or above the highest point on the map will raise a corresponding diagnostic event. Also, all of the events associated with the Analog Inputs have programmable time delays. Low Idle Oil Pressure setpoints are also available under the Engine Oil Monitor area. Information on how to program these thresholds and time delays can be found in Chapter 7, Setpoints.

UNSUPPORTED ANALOG INPUT SENSOR RANGES

There may be Voltage sensors available that use ranges not explicitly supported by the EMCP 4. Depending on the situation, there may be different ways to handle this. The following sections give options on how to handle these situations.

SENSOR RANGE IS SMALLER THAN SETPOINT OPTIONS

If the desired sensor range is smaller than one of the available setpoint options, then extrapolation may be used to support the desired sensor. For example, for a 0-3V temperature sensor reads -30°C to 120°C, the only range that includes all of 0-3V is 0-5V. The 0-5V range should be used. The range between 3V and 5V will simply never be used. To make the data accurate, set the Minimum Data Range to -30°C, and determine the Maximum Data Range mathematically. See Figure 23.

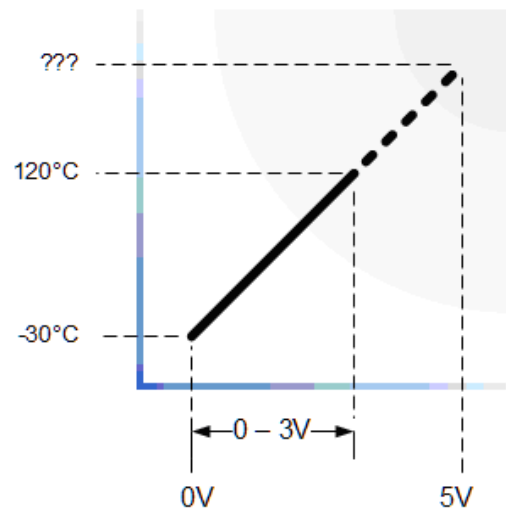


Figure 23: Mathematical Extrapolation of Maximum Data Range

The Maximum Data Range can be found graphically or algebraically. In this example, the Maximum Data Range would be defined by the equation of the line after the slope is determined. Since the data rises by 50 degrees for every volt, increasing two volts above the three volt limit requires the maximum range to be 100 degrees above the sensor limit of 120 degrees, or 220 degrees total. See Figure 24.

$$\left[\frac{[120\text{C} - (-30\text{C})]}{(3\text{V} - 0\text{V})} \right] * (5\text{V}) + (-30\text{C}) = 220\text{C}$$

Figure 24: Example Calculation for Extrapolation of Maximum Data Range

SENSOR RANGE IS LARGER THAN SETPOINT OPTIONS, BUT USABLE RANGE IS NOT

If the desired sensor range is larger than one of the available setpoint options, but the useful range for the sensor is within the supported ranges, then interpolation may be used to support the desired sensor. For example, for a 0-6V temperature sensor that reads -40°C to 500°C, the EMCP 4 will not support the analog voltages higher than 5V. However, as long as the sensor will not exceed 5V, the 0-5V range may be used. To make the data accurate, set the Minimum Data Range to -40°C, and determine the Maximum Data Range mathematically. See Figure 25.

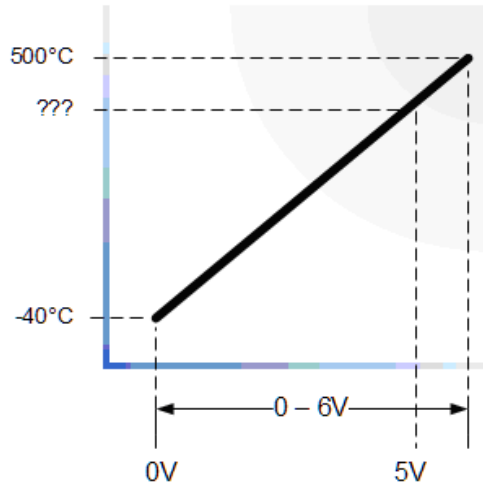


Figure 25: Mathematical Interpolation of Maximum Data Range

The Maximum Data Range can be found graphically or algebraically. In this example, the Maximum Data Range would be defined by the equation of the line after the slope is determined. Since the data rises by 90 degrees for every volt, decreasing one volt below the six volt limit requires the maximum range to be 90 degrees below the sensor limit of 500 degrees, or 410 degrees total. See Figure 26.

$$\left[\frac{[500\text{C} - (-40\text{C})]}{(6\text{V} - 0\text{V})} \right] * (5\text{V}) + (-40\text{C}) = 410\text{C}$$

Figure 26: Example Calculation for Interpolation of Maximum Data Range

SENSOR RANGE IS LARGER THAN SETPOINT OPTIONS, AND USABLE RANGE IS LARGER THAN SETPOINT OPTIONS

If the desired sensor range is larger than one of the available setpoint options, and the useful range for the sensor is outside of the supported ranges, a third party device is required to convert the signal range into a supported range. See Figure 27.

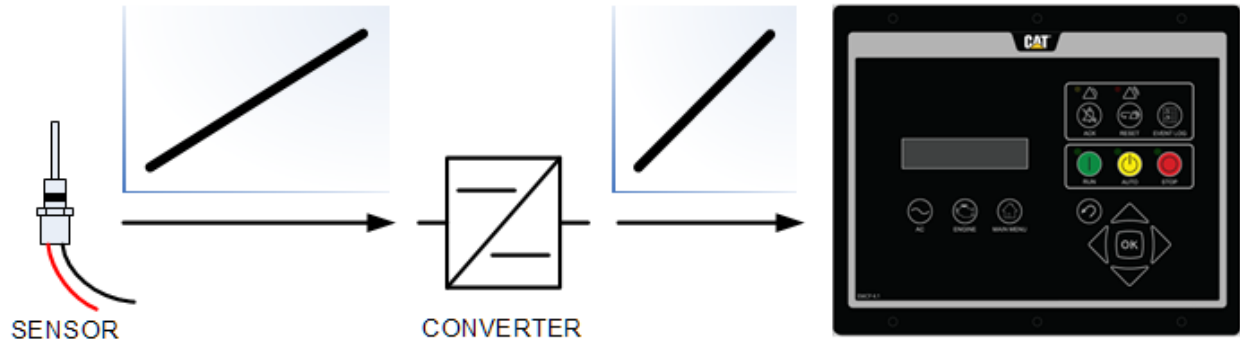


Figure 27: Signal Conversion of Sensor Range

10 OUTPUTS

The EMCP 4.1 and 4.2 support Relay Outputs capable of 2A resistive at 30V DC. The EMCP 4.1 has six Form A Relay Outputs (normally open) while the EMCP 4.2 has six Form A Relay Outputs and two Form C Relay Outputs (both normally open and normally closed).

The EMCP 4.2 also supports two programmable discrete outputs capable of sinking 300mA per input. These outputs will sink a current to draw down a voltage of up to 30V DC down to Battery (-).

Outputs can be configured by using the EMCP 4 display. For some of the setpoints, LEVEL 2 OR LEVEL 3 ACCESS is required. For information on obtaining Level 2 or Level 3 Access refer to Chapter 6, Security.

Security. This chapter will assume that the correct Level 2 or Level 3 Access has already been obtained. Alternately, the Cat Service Tool can be used to configure these outputs.

The programming of the Digital and Relay Outputs starts by selecting a “Usage Type”. The rest of the programming is dependent upon what Usage Type is selected. Figure 28 summarizes the paths possible for Programming Digital and Relay Outputs.

Note: If the Engine Operating State is configured as Hardwired, then Relay Output #1 must be programmed to Starter Motor Relay.

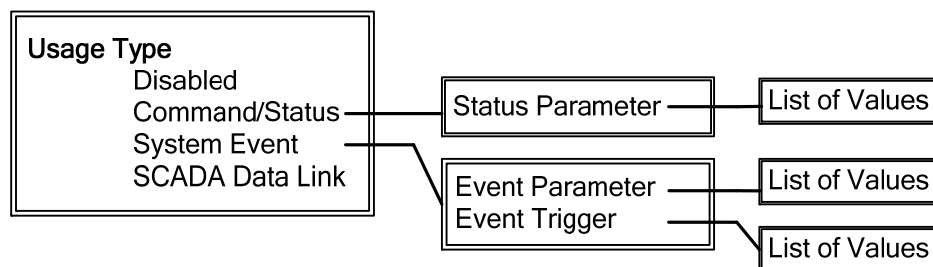


Figure 28: Digital and Relay Output Programming Paths

10.1 PROGRAMMING OUTPUTS USING THE DISPLAY

For some of the setpoints, LEVEL 2 OR LEVEL 3 ACCESS is required. For information on obtaining Level 2 Access refer to Chapter 6, Security.

This section will assume that Level 2 or Level 3 Access has already been obtained.

VIEWING THE CURRENT OUTPUT STATUS

To view the current status of an Output, go through the following menu options:

AT THE MAIN MENU, scroll DOWN  TO VIEW

Press the OK KEY 

Scroll DOWN  to I/O STATUS

Press the OK KEY 

Scroll DOWN  to access RELAY OR DIGITAL OUTPUTS

Press the OK KEY 

The status of all Relay or Digital Outputs is shown.

A dash under an output number indicates an output that is programmed, but inactive. A large "X" under an output number indicates an output that is disabled. A number under an output number indicates an output that is programmed and active.

MAIN MENU

VIEW

CONTROL

VIEW

AC OVERVIEW

I/O STATUS

I/O STATUS

DIGITAL INPUTS

RELAY OUTPUTS

RELAY OUTPUTS

1	2	3	4	5	6	7	8
1	-	X	X	X	X	X	X

With the LEFT ARROW  or RIGHT ARROW , select the RELAY OR DIGITAL OUTPUT that you

want to view, then press the OK KEY 

The programmed Usage Type of the selected relay or Digital Output is shown.

RELAY OUTPUT #2

ENGINE OIL PRESSURE

SPECIFIC HI WARN

Scroll DOWN  to view the remaining parameters for this output (including physical and logical state).

CONFIGURING OUTPUTS FOR STATUS PARAMETERS

Command or Status parameters are used to control specific functions within the control system or to make certain conditions within the system be known.

Note: The Fuel Control Relay does not pickup when the Engine Operating State is set to CAN. Engine Start Initiated can be used in Lieu of the Fuel Control Relay for most purposes.

To configure a Digital Output or Relay Output as a Status Parameter, go through the following menu options (substitute Digital Output for Relay Output in the following steps, as needed):

AT THE MAIN MENU, scroll down  TO
CONFIGURE

Press the OK KEY .

SCROLL DOWN  TO INPUTS & OUTPUTS

Press the OK KEY .

Alternately, access to THE INPUTS & OUTPUTS submenu is accessible from ALL SETPOINTS.

SCROLL DOWN  TO RELAY OUTPUTS

Press the OK KEY .

Select the RELAY OUTPUT that you want to program

Press the OK KEY .

Press the OK KEY  to highlight the current configuration (DISABLED, COMMAND/STATUS, SYSTEM EVENT, OR SCADA DATA LINK).

Scroll DOWN  TO COMMAND/STATUS

Press the OK KEY .

Scroll DOWN  TO STATUS PARAMETER

Press the OK KEY  to highlight the current STATUS PARAMETER.

MAIN MENU
CONTROL
CONFIGURE

INPUTS & OUTPUTS
DIGITAL INPUTS
RELAY OUTPUTS

INPUTS & OUTPUTS
DIGITAL INPUTS
RELAY OUTPUTS

RELAY OUTPUTS
OUTPUT #1
OUTPUT #2

RELAY OUTPUT #1
USAGE TYPE:
DISABLED

RELAY OUTPUT #1
USAGE TYPE
COMMAND/STATUS

RELAY OUTPUT #1
STATUS PARAMETER:
STOP MODE

Select the **STATUS PARAMETER** that you want to program

Press the **OK KEY**



RELAY OUTPUT #1
STATUS PARAMETER:
AUTO MODE

Any Output can be configured for any one of the Command/Status parameters in Table 10:

Run Mode	Air Shutoff
Auto Mode	Programable Cycle Time #2 (EMCP 4.2 only)
Stop Mode	kW Relay Trip #1 (EMCP 4.2 only)
Package Not in Auto	kW Relay Trip #2 (EMCP 4.2 only)
Fuel Control Relay*	Common Alarm
Starter Motor Relay	Breaker #1 Trip
Start Aid	Breaker #2 Trip
Disable Auxiliary AC	Reduced Power Off
Crank Alert	Transfer Fuel In
Engine Start Initiated	Transfer Fuel Out*
Engine Started	Volt Lower Command
Rated Speed	Volt Raise Command
V/Hz Within Limits	Speed Raise Command
Engine in Cooldown	Speed Lower Command
Wait Delay Stop	Nominal Frequency Selection is Low**
Horn Control	Nominal Voltage Selection is Low**
Common Warning	Ignition Shutoff Relay
Common Shutdown	Governor ECM Power Relay
ECU Fault Reset	

*The Fuel Control Relay does not pickup when the Engine Operating State is set to CAN. Engine Start Initiated can be used in lieu of the Fuel Control Relay for most purposes.

** Not available with Standard software

Table 10: Output Command/Status List

Note: If the Engine State Configuration is configured for Hard Wired, then Relay Output #1 must be programmed for the Status Parameter of Starter Motor Relay. As of version 4.2.2 PROD software, Relay Output #2 is no longer required to be programmed for Fuel Control Relay.

DIGITAL/RELAY OUTPUT COMMAND/STATUS DESCRIPTIONS

Below is a brief description of the purpose of each command/status digital/relay output option:

RUN MODE

- Activates when the EMCP is placed in RUN mode (such as when the 'Run' button is pressed). Matches the state of ECS LED on the EMCP.

AUTO MODE

- Activates when the EMCP is placed in AUTO mode (such as when the 'Auto' button is pressed). Matches the state of ECS LED on the EMCP.

STOP MODE

- Activates when the EMCP is placed in STOP mode (such as when the 'Stop' button is pressed). Matches the state of ECS LED on the EMCP.

PACKAGE NOT IN AUTO

- Activates when conditions are present that prevent the EMCP from operating in AUTO mode (such as engine control switch not in auto, engine not in Rated mode, shutdown red lamp is active).

FUEL CONTROL RELAY

- Activates when the engine pre-crank timing delay expires during the engine start sequence and the while the engine is running, along with during fuel priming when engine operating state is configured for Hardwired Input.

STARTER MOTOR RELAY

- Activates during the Crank Duration time during the starting state of the engine starting sequence when the engine operating state setpoint is configured for Hardwired Input.

START AID

- Activates during the Start Aid Activation Time during the pre-crank state of the engine starting sequence.

DISABLE AUX AC

- Activates when the generator set enters the Pre-Crank State. This output will be deactivated during Crank Alert, Start Aid, Cranking, Running, Cooldown, etc, but will stay activated if the generator set is unable to start due to a shutdown fault. Typically used to turn off equipment such as static battery chargers and water heaters when the engine is running.

CRANK ALERT

- Activates during the Crank Alert Activation Time during the pre-crank state of the engine starting sequence.

ENGINE START INITIATED

- Activates when the engine has been commanded to start and remains active until the end of cooldown.

ENGINE STARTED

- Activates when the engine has been commanded to start and the engine speed is greater than Crank Terminate rpm and remains active until engine speed drops below Crank Terminate rpm.

RATED SPEED

- Activates when the engine is configured to run at rated speed (regardless of actual engine speed). Useful to determine when the engine is commanded to run at idle speed. **Note:** This is NOT an indication that the set is at rated speed. It is an indication that the set has not been requested to run at Idle.

V/Hz WITHIN LIMITS

- Activates if voltage and frequency are within the Over/Under Voltage and Over/Under Frequency protection limits (typically 90% to 110% of rated).

ENGINE IN COOLDOWN

- Activates when the engine is running in cooldown mode.

WAIT DELAY STOP

- Activates when the engine is running in the pre-cooldown state. Typically a stop signal has been received, but an inhibit cooldown command is preventing the unit from entering cooldown.

HORN CONTROL

- Activates when a horn alert is sounding. Typically occurs when any event configured with an audible alert event response is PRESENT or ACTIVE and unacknowledged.

COMMON WARNING

- Activates when any warning is PRESENT in the event log (regardless of source).

COMMON SHUTDOWN

- Activates when any shutdown is PRESENT or ACTIVE in the event log (regardless of source).

ECU FAULT RESET

- Activates for a specified period of time when a Reset All Events command is issued. Typically only used to interface to legacy engines.

AIR SHUTOFF

- Activates based on engine shutdown conditions such as engine overspeed, engine speed sensor diagnostic, emergency stop, and engine speed failure to decrease. When activated this output will remain active for 15 seconds.

PROGRAMMABLE CYCLE TIMER OUTPUT #2 (EMCP 4.2 ONLY)

- Activates for the duration of the Programmable Cycle Timer #N Active Time as configured in the Programmable Cycle Timer feature (refer to Chapter 13)

KW RELAY TRIP #1 (EMCP 4.2 ONLY)

- Activates based on the programmable trip point trigger conditions of the Programmable kW Relay Function (refer to Chapter 15)

KW RELAY TRIP #2 (EMCP 4.2 ONLY)

- Activates based on the programmable trip point trigger conditions of the Programmable kW Relay Function (refer to Chapter 15)

COMMON ALARM

- Activates when any shutdown is PRESENT or ACTIVE in the event log or any warning is PRESENT in the event log (regardless of source).

BREAKER #1 TRIP

- Activates when any event configured with a Breaker #1 Trip event response is PRESENT or ACTIVE.

BREAKER #2 TRIP

- Activates when any event configured with a Breaker #2 Trip event response is PRESENT or ACTIVE.

REDUCED POWER OFF

- Activates when the EMCP is NOT in reduced power mode (Useful for placing other controls in a reduced power mode when the EMCP is in Reduced Power Mode).

TRANSFER FUEL IN

- Activates when manual or automatic fuel loading is initiated.

TRANSFER FUEL OUT

- Activates when manual or automatic fuel unloading is initiated. (Not available on standard software)

VOLTAGE RAISE COMMAND

- Activates when a command to raise voltage is received.

VOLTAGE LOWER COMMAND

- Activates when a command to lower voltage is received.

SPEED RAISE COMMAND

- Activates when a command to raise speed is received.

SPEED LOWER COMMAND

- Activates when a command to lower speed is received.

NOMINAL FREQUENCY SELECTION IS LOW

- Activates when a digital input configured for "Nominal Frequency Selection is Low" is active.

Programmable Digital Input "Nominal Frequency is Low" Logical Status	Programmable Digital Input "Nominal Voltage is Low" Logical Status	Ratings Group Selected
0 (high frequency)	0 (high voltage)	Group #1
0 (high frequency)	1 (low voltage)	Group #2
1 (low frequency)	0 (high voltage)	Group #3
1 (low frequency)	1 (low voltage)	Group #4

(Not available on standard software)

NOMINAL VOLTAGE SELECTION IS LOW

- Activates when a digital input configured for “Nominal Voltage Selection is Low” is active.

Programmable Digital Input “Nominal Frequency is Low” Logical Status	Programmable Digital Input “Nominal Voltage is Low” Logical Status	Ratings Group Selected
0 (high frequency)	0 (high voltage)	Group #1
0 (high frequency)	1 (low voltage)	Group #2
1 (low frequency)	0 (high voltage)	Group #3
1 (low frequency)	1 (low voltage)	Group #4

(Not available on standard software)

IGNITION SHUTOFF RELAY

- Note:** this is a shutoff relay so the output is active when ignition is NOT desired. Deactivates during the Engine Purge Cycle with Ignition time and while engine is starting and running. Typically used for gas engine starting/stopping sequence.

GOVERNOR ECM POWER RELAY

- Activates at the start of the “Engine Start Sequence Delay Time” prior to engine cranking and deactivates 15 seconds after engine speed has reached zero rpm.

CONFIGURING OUTPUTS FOR SYSTEM EVENTS

System Events are used to know when specific conditions are reached and to alert the control system of warning or shutdown conditions. To configure a Relay or Digital Output as a System Event, go through the following menu options (substitute Digital Output for Relay Output in the following steps, as needed):

AT THE MAIN MENU, scroll down  TO CONFIGURE

Press the OK KEY 

SCROLL DOWN  TO INPUTS & OUTPUTS

Press the OK KEY 

Alternately, access to THE INPUTS & OUTPUTS submenu is accessible from ALL SETPOINTS.

SCROLL DOWN  TO RELAY OUTPUTS

Press the OK KEY 

MAIN MENU
CONTROL
CONFIGURE

INPUTS & OUTPUTS
DIGITAL INPUTS
RELAY OUTPUTS

INPUTS & OUTPUTS
DIGITAL INPUTS
RELAY OUTPUTS

Select the **RELAY OUTPUT** that you want to program

Press the **OK KEY**



Press the **OK KEY** to highlight the current configuration (**DISABLED**, **COMMAND/STATUS**, **SYSTEM EVENT**, OR **SCADA DATA LINK**).

Scroll **DOWN** to **SYSTEM EVENT**

Press the **OK KEY**



Scroll **DOWN** to **EVENT PARAMETER**

Press the **OK KEY** to edit the current **STATUS PARAMETER**.

Select the type of **EVENT PARAMETER** that you want to program (Pressures, Temperatures, Levels, or Others)

Press the **OK KEY**



Select the **EVENT PARAMETER** that you want to program

Press the **OK KEY**



Scroll **DOWN** to **EVENT TRIGGER**

Press the **OK KEY** to edit the current **EVENT TRIGGER**.

Select the **EVENT TRIGGER** that you want to program

Press the **OK KEY**



RELAY OUTPUTS

OUTPUT #1

OUTPUT #2

RELAY OUTPUT #1

USAGE TYPE:

DISABLED

RELAY OUTPUT #1

USAGE TYPE:

SYSTEM EVENT

RELAY OUTPUT #1

EVENT PARAMETER:

ENG COOLANT TEMP

RELAY OUTPUT #1

EVENT PARAMETER:

PRESSURES

RELAY OUTPUT #1

EVENT PARAMETER:

ENGINE OIL PRES

RELAY OUTPUT #1

EVENT TRIGGER:

ANY SHUTDOWN

RELAY OUTPUT #1

EVENT TRIGGER:

SPECIFIC LO WARN

Any Output can be configured for any one of the System Events in Table 11:

Pressures Engine Oil Pressure Gas Pressure	Others Any SPN Accessory Datalink (4.2 only) Battery Charging System Voltage Battery Voltage Emergency Stop Switch Engine in Cooldown Engine Fail to Start Engine Speed Controls Not in Auto Generator Current Generator Frequency Generator Real Power Generator Voltage Primary Data Link SCADA Data Link (4.2 only) Service Interval Expired Unexpected Engine Shutdown	Custom Events Digital Input #1 Custom Digital Input #2 Custom Digital Input #3 Custom Digital Input #4 Custom Digital Input #5 Custom Digital Input #6 Custom Analog Input #1 Custom Analog Input #2 Custom Analog Input #3 Custom
Temperatures Engine Coolant Temperature Engine Oil Temperature Exhaust Temperature Generator Rear Bearing Temperature Generator Winding #1 Temperature		
Levels Engine Coolant Level Engine Oil Level Fuel Level External Tank Fuel Level	Earth Fault Earth Leakage Engine Control Fuel Leak Air Damper Closed Battery Charger Failure Generator Breaker Open Generator Breaker Closed	

Table 11: Output System Events

Care must be taken in configuring the correct triggers. Only some of these parameters can be configured for a specific System Event and even if it can be configured, it may not be representative of the system requirements. Output system event trigger conditions are listed in Table 12 below.

Category	SPN	Suspect Parameter	Supported FMI Trigger Conditions
Pressures	100	Engine Oil Pressure	1, 3, 4, 14, 17
	1390	Gas Pressure	0, 1, 15, 17
Temperatures	110	Engine Coolant Temperature	0, 3, 4, 14, 15, 17
	175	Engine Oil Temperature	0, 1, 15, 17
	173	Exhaust Temperature	0, 1, 15, 17
	1122	Generator Rear Bearing Temperature	0, 1, 15, 17
	1124	Generator Winding #1 Temperature	0, 15
Levels	111	Engine Coolant Level	0, 1, 15, 17
	98	Engine Oil Level	0, 1, 15, 17
	96	Fuel Level	0, 1, 15, 17
	38	External Tank Fuel Level	0, 1, 15, 17
Others	n/a	Any Suspect Parameter Number	n/a
	1231	Accessory Data Link	11
	167	Battery Charging System Voltage	17
	168	Battery Voltage	0, 15, 17
	970	Auxiliary Engine Shutdown Switch	14, 31
	4006	Engine in Cooldown	31
	1664	Engine Failure to Start	31
	190	Engine Speed	0, 1, 2, 5, 17
	4007	Generator Control Not in Automatic	31
	2448	Generator Current (Amps)	0, 1, 15, 17
	2436	Generator Output Frequency	0, 1, 2, 12, 15, 17
	2452	Generator Output Power	1, 15, 17
	2440	Generator Output Voltage	0, 1, 15, 17
	639	Primary Data Link	11
	3581	SCADA Data Link	11
	2648	Service Maintenance Interval Expired	31
	1383	Unexpected Engine Shutdown	11
	4028	Earth Fault	31
	4029	Earth Leakage	31
	3543	Engine Controller	9
	1239	Fuel Leak	31
	4000	Air Damper Closed	31
	4003	Battery Charger Failure	31
	4013	Generator Circuit Breaker Open	6, 31
	4004	Generator Circuit Breaker Closed	6, 31

Category	SPN	Suspect Parameter	Supported FMI Trigger Conditions
Custom Events	701	Digital Input #1 Custom Event	31
	702	Digital Input #2 Custom Event	31
	703	Digital Input #3 Custom Event	31
	704	Digital Input #4 Custom Event	31
	705	Digital Input #5 Custom Event	31
	706	Digital Input #6 Custom Event	31
	707	Digital Input #7 Custom Event	31
	708	Digital Input #8 Custom Event	31
	1083	Analog Input #1 Custom Parameter	0, 1, 6, 15, 17
	1084	Analog Input #2 Custom Parameter	0, 1, 6, 15, 17
	4158	Analog Input #3 Custom Parameter	0, 1, 6, 15, 17

Table 12: Supported Output System Event SPN and FMI Trigger Conditions

DIGITAL/RELAY OUTPUT SYSTEM EVENT DESCRIPTIONS

Below is a brief description of the purpose of each system event digital/relay output option:

ENGINE OIL PRESSURE

- Activates when an engine oil pressure event (SPN 100) is triggered in the EMCP event log.

GAS PRESSURE

- Activates when a gas pressure event (SPN 1390) is triggered in the EMCP event log.

ENGINE COOLANT TEMPERATURE

- Activates when an engine coolant temperature event (SPN 110) is triggered in the EMCP event log.

ENGINE OIL TEMPERATURE

- Activates when an engine oil temperature event (SPN 175) is triggered in the EMCP event log.

EXHAUST TEMPERATURE

- Activates when an exhaust temperature event (SPN 173) is triggered in the EMCP event log.

GENERATOR REAR BEARING TEMPERATURE

- Activates when a generator rear bearing temperature event (SPN 1122) is triggered in the EMCP event log.

GENERATOR WINDING #1 TEMPERATURE

- Activates when a generator winding #1 temperature event (SPN 1124) is triggered in the EMCP event log.

ENGINE COOLANT LEVEL

- Activates when an engine coolant level event (SPN 111) is triggered in the EMCP event log.

ENGINE OIL LEVEL

- Activates when an engine oil level event (SPN 98) is triggered in the EMCP event log.

FUEL LEVEL

- Activates when a fuel level event (SPN 96) is triggered in the EMCP event log.

EXTERNAL FUEL LEVEL

- Activates when an external fuel level event (SPN 38) is triggered in the EMCP event log.

ANY SUSPECT PARAMETER NUMBER

- Activates when any suspect parameter number is triggered in the EMCP event log.

ACCESSORY DATA LINK

- Activates when an accessory data link diagnostic (SPN-FMI: 1231-11) is triggered in the EMCP event log.

BATTERY CHARGING SYSTEM VOLTAGE

- Activates when a battery charging system voltage event (SPN-FMI: 167-17) is triggered in the EMCP event log.

BATTERY VOLTAGE

- Activates when a battery voltage event (SPN 168) is triggered in the EMCP event log.

AUXILLARY ENGINE SHUTDOWN SWITCH

- Activates when an auxiliary engine shutdown switch event (SPN 970) is triggered in the EMCP event log.

ENGINE IN COOLDOWN

- Activates when an engine in cooldown event (SPN 4006) is triggered in the EMCP event log.

ENGINE FAILURE TO START

- Activates when an engine fail to start event (SPN 1664) is triggered in the EMCP event log.

ENGINE SPEED

- Activates when an engine speed event (SPN 190) is triggered in the EMCP event log.

GENERATOR CONTROL NOT IN AUTOMATIC

- Activates when a generator control not in auto event (SPN 4007) is triggered in the EMCP event log.

GENERATOR CURRENT (AMP)

- Activates when a generator current event (SPN 2448) is triggered in the EMCP event log.

GENERATOR OUTPUT FREQUENCY

- Activates when a generator output frequency event (SPN 2436) is triggered in the EMCP event log.

GENERATOR OUTPUT POWER(kW)

- Activates when a generator output power(kW) event (SPN 2452) is triggered in the EMCP event log.

GENERATOR OUTPUT VOLTAGE

- Activates when a generator output voltage event (SPN 2440) is triggered in the EMCP event log.

PRIMARY DATA LINK

- Activates when a primary data link diagnostic (SPN 639) is triggered in the EMCP event log.

SCADA DATA LINK

- Activates when a SCADA data link diagnostic (SPN 3581) is triggered in the EMCP event log.

SERVICE MAINTENANCE INTERVAL EXPIRED

- Activates when a service maintenance interval expired event (SPN 2648) is triggered in the EMCP event log.

UNEXPECTED ENGINE SHUTDOWN

- Activates when an unexpected engine shutdown event (SPN 1383) is triggered in the EMCP event log.

EARTH FAULT

- Activates when an earth fault event (SPN 4028) is triggered in the EMCP event log.

EARTH LEAKAGE

- Activates when an earth leakage event (SPN 4029) is triggered in the EMCP event log.

ENGINE CONTROLLER

- Activates when an engine controller diagnostic (SPN 3543) is triggered in the EMCP event log.

FUEL LEAK

- Activates when a fuel leak event (SPN 1239) is triggered in the EMCP event log.

AIR DAMPER CLOSED

- Activates when an air damper closed event (SPN 4000) is triggered in the EMCP event log.

BATTERY CHARGER FAILURE

- Activates when a battery charger failure event (SPN 4003) is triggered in the EMCP event log.

GENERATOR CIRCUIT BREAKER OPEN

- Activates when a generator circuit breaker open event (SPN 4013) is triggered in the EMCP event log.

GENERATOR CIRCUIT BREAKER CLOSED

- Activates when a generator circuit breaker closed event (SPN 4004) is triggered in the EMCP event log.

DIGITAL INPUT #N CUSTOM EVENT

- Activates when a digital input #N custom event (SPN 701 to 708) is triggered in the EMCP event log.

ANALOG INPUT #N CUSTOM EVENT

- Activates when an analog input #N custom event (SPN 1083, 1084, 4158) is triggered in the EMCP event log.

CONFIGURING OUTPUTS FOR SCADA DATA LINK

When an Output is configured for SCADA Data Link, an active state will be sent over MODBUS. No alarms or warnings will be generated by the EMCP. To configure a Relay Digital Output for SCADA Data Link, go through the following menu options (substitute Digital Output for Relay Output in the following steps, as needed):

AT THE MAIN MENU, scroll down  TO CONFIGURE

MAIN MENU
CONTROL
CONFIGURE

Press the OK KEY 

SCROLL DOWN  TO INPUTS & OUTPUTS

INPUTS & OUTPUTS
DIGITAL INPUTS
RELAY OUTPUTS

Press the OK KEY 

Alternately, access to THE INPUTS & OUTPUTS submenu is accessible from ALL SETPOINTS.

SCROLL DOWN  TO RELAY OUTPUTS

INPUTS & OUTPUTS
DIGITAL INPUTS
RELAY OUTPUTS

Press the OK KEY 

Select the RELAY OUTPUT that you want to program

Press the OK KEY 

RELAY OUTPUTS
OUTPUT #1
OUTPUT #2

Press the OK KEY  to highlight the current configuration (DISABLED, COMMAND/STATUS, SYSTEM EVENT, OR SCADA DATA LINK).

RELAY OUTPUT #1
USAGE TYPE:
DISABLED

Scroll DOWN  TO SCADA DATA LINK

Press the OK KEY 

RELAY OUTPUT #1
USAGE TYPE:
SCADA DATA LINK

DISABLING OUTPUTS

To disable an Output, go through the following menu options (substitute Digital Output for Relay Output in the following steps, as needed):

AT THE MAIN MENU, scroll down  TO CONFIGURE

Press the OK KEY 

SCROLL DOWN  TO INPUTS & OUTPUTS

Press the OK KEY 

Alternately, access to THE INPUTS & OUTPUTS submenu is accessible from ALL SETPOINTS.

SCROLL DOWN  TO RELAY OUTPUTS

Press the OK KEY 

Select the RELAY OUTPUT that you want to program

Press the OK KEY 

Press the OK KEY  to highlight the current configuration (DISABLED, COMMAND/STATUS, SYSTEM EVENT, OR SCADA DATA LINK).

Scroll DOWN  TO DISABLED

Press the OK KEY 

MAIN MENU
CONTROL
CONFIGURE

INPUTS & OUTPUTS
DIGITAL INPUTS
RELAY OUTPUTS

INPUTS & OUTPUTS
DIGITAL INPUTS
RELAY OUTPUTS

RELAY OUTPUTS
OUTPUT #1
OUTPUT #2

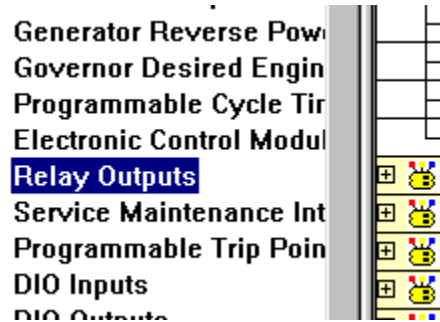
RELAY OUTPUT #1
USAGE TYPE:
DISABLED

RELAY OUTPUT #1
USAGE TYPE:
DISABLED

10.2 PROGRAMMING OUTPUTS USING THE CAT SERVICE TOOL

The EMCP 4 Outputs can be configured by using the Cat Service Tool. The key to programming them is to program the setpoints related to each input in order from top to bottom. Relay and Digital Outputs follow the same steps. For simplicity, the examples below show Relay Outputs. For Digital Outputs, just substitute Digital Output for Relay Output. To program an Output, do the following steps:

1. Connect to the EMCP 4 using the Cat Service Tool as stated in Chapter 4.2.
2. Select Relay (or Digital Outputs) on the left.



3. Determine which output is to be configured. For example, all of the setpoints for Relay Output #1 have the text "#1" in their name.

Event Response Config	Relay Outputs	
Generator AC Monitor	—Relay Output #1 Usage Type	Disabled
Generator AC Power Monitor	—Relay Output #2 Usage Type	Disabled
Generator Current Monitor	—Relay Output #3 Usage Type	Disabled
Generator Over/Under Frequency	—Relay Output #4 Usage Type	Disabled
Generator Over/Under Voltage	—Relay Output #5 Usage Type	Disabled
Generator Reverse Power	—Relay Output #6 Usage Type	Disabled
Governor Desired Engine Speed	—Relay Output #7 Usage Type	Disabled
Programmable Cycle Time	—Relay Output #8 Usage Type	Disabled
Electronic Control Module		
Relay Outputs		
	Service Maintenance Interval	

4. Next follow the steps below according to which Usage Type is desired.

CONFIGURING OUTPUTS FOR STATUS PARAMETERS

Command or Status parameters are used to control specific functions within the control system or to make certain conditions within the system be known.

Note: The Fuel Control Relay does not pickup when the Engine Operating State is set to CAN. Engine Start Initiated can be used in Lieu of the Fuel Control Relay for most purposes.

To configure an Output as a Command or Status Parameter, go through the following menu options:

1. Double click the Output #N Usage type to change this value to Command/Status Parameter from the drop down menu. Click the OK button to program.

The dialog box titled "Change Parameter Value" shows the following information:

- Parameter Name:** Relay Output #1 Usage Type
- Current Value:** Disabled
- New Value:** A dropdown menu is open, showing the following options: Command/Status Parameter (highlighted), Data Link, Disabled, and System Event.
- Please select one of the following:** (This text is partially visible on the left side of the dropdown menu).
- Buttons:** OK and Cancel.

2. The Output #N Command/Status Parameter Data Identification parameter will now be visible in the right pane.

Relay Outputs	
Relay Output #1 Usage Type	Command/Status Parameter
Relay Output #1 Command/Status Parameter Data Identification	Stop Mode

3. Double click the Configure the Command/Status Parameter Data Identification setpoint to change this value from the drop down menu. Click the OK button to program.

The dialog box titled "Change Parameter Value" shows the following information:

- Parameter Name:** Relay Output #1 Command/Status Parameter Data Identification
- Current Value:** Stop Mode
- New Value:** A dropdown menu is open, showing the following options: Air Shutoff (highlighted), Air Shutoff, Auto Mode, Breaker #2 Trip, Common Shutdown, Common Warning, Crank Alert, Disable Aux AC Supply, ECU Fault Reset, Engine Start Initiated, Engine Started, and Engine in Cooldown.
- Please select one of the following:** (This text is partially visible on the left side of the dropdown menu).
- Buttons:** OK and Cancel.

See Table 10 in Chapter 10.1 for a complete list of possible Status Parameter Data Identifications.

CONFIGURING OUTPUTS FOR SYSTEM EVENTS

System Events are used to know when specific conditions are reached and to alert the control system of warning or shutdown conditions. To configure an Output as a System Event, go through the following menu options:

1. Double click the Output #N Usage type to change this value to System Event from the drop down menu. Click the OK button to program.

The dialog box titled "Change Parameter Value" shows the "Parameter Name" as "Relay Output #1 Usage Type". The "Current Value" is "Disabled". The "New Value" dropdown menu is open, showing a list of options: "Command/Status Parameter", "Data Link", "Disabled", and "System Event". The "System Event" option is highlighted. The "Please select one of the" text is partially visible. At the bottom are "OK" and "Cancel" buttons.

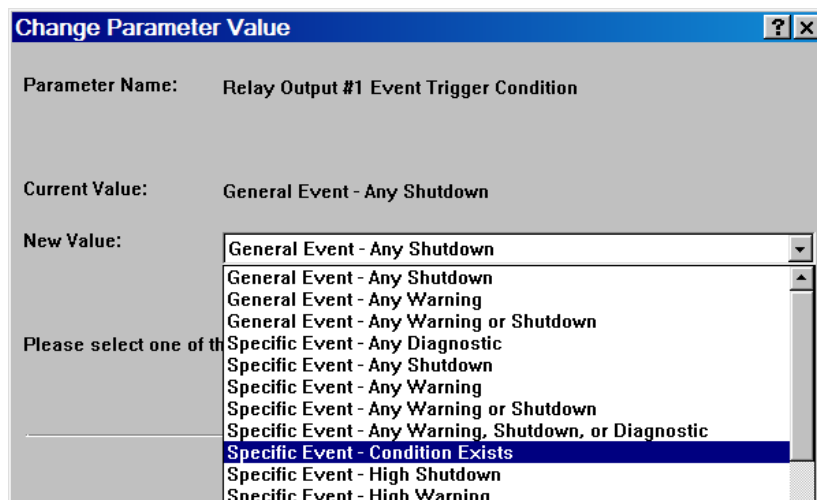
2. The Output #N Suspect Parameter Number (SPN) and Event Trigger Condition parameters will now be visible in the right pane.

Relay Outputs	
Relay Output #1 Usage Type	System Event
Relay Output #1 Event Suspect Parameter Number	Engine Oil Pressure
Relay Output #1 Event Trigger Condition	General Event - Any Shutdown

3. Double click the Output #N Suspect Parameter Number (SPN) setpoint to change this value from the drop down menu. Click the OK button to program.

The dialog box titled "Change Parameter Value" shows the "Parameter Name" as "Relay Output #1 Event Suspect Parameter Number". The "Current Value" is "Engine Oil Pressure". The "New Value" dropdown menu is open, showing a list of options: "Accessory Data Link", "Air Damper Closed", "Air Filter Differential Pressure", "Analog Input #1 Custom Parameter", "Analog Input #2 Custom Parameter", "Analog Input #3 Custom Parameter", "Any Suspect Parameter Number", "Battery Charger Failure", "Battery Charging System Voltage", "Battery Voltage", and "Custom Event #1". The "Battery Charger Failure" option is highlighted. The "Please select one of the" text is partially visible. At the bottom are "OK" and "Cancel" buttons.

4. Double click the Output #N Event Trigger Condition setpoint to change this value from the drop down menu. Click the OK button to program.

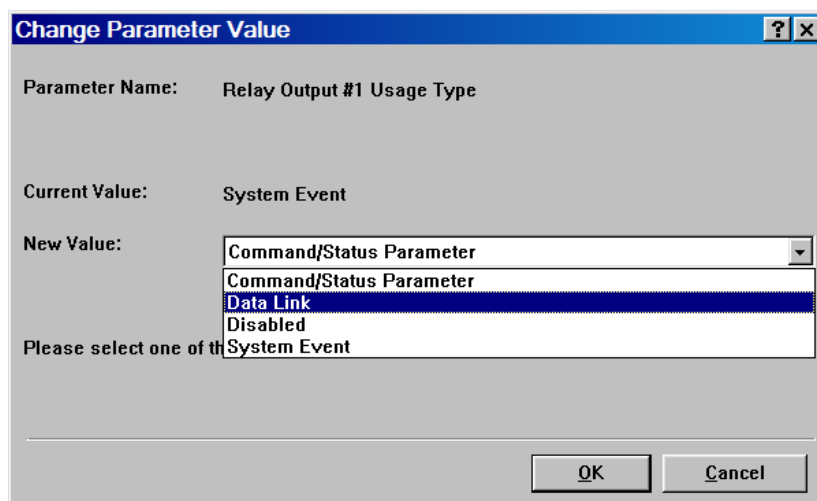


See Table 11 in Chapter 10.1 for a complete list of possible System Events.

CONFIGURING OUTPUTS FOR SCADA DATA LINK

When an Output is configured for SCADA Data Link, an active state will be sent over MODBUS. No alarms or warnings will be generated by the EMCP. To configure an Output for SCADA Data Link, go through the following menu options:

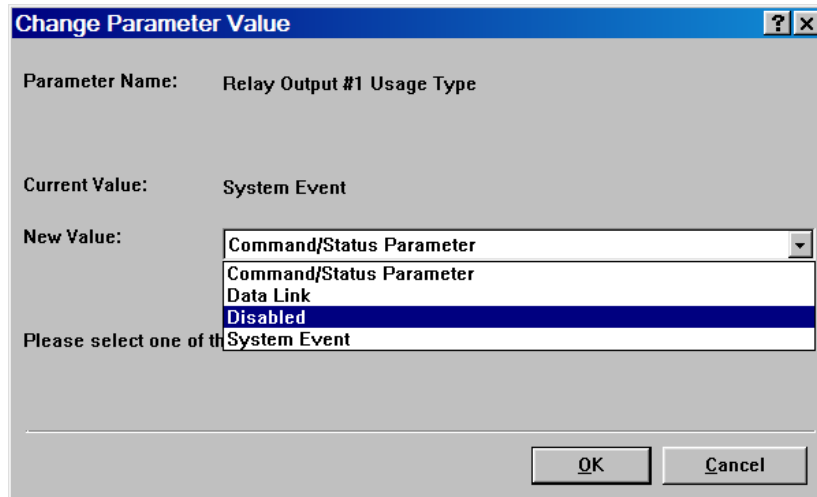
1. Double click the Output #N Usage type to change this value to Data Link from the drop down menu. Click the OK button to program.



DISABLING OUTPUTS

To disable an Output, go through the following menu options:

1. Double click the Relay Output #N Usage type to change this value to Disabled from the drop down menu. Click the OK button to program.



11 MODIFIABLE TEXT STRINGS

The EMCP 4 supports the renaming of Custom Events for the event log. This feature is called **MODIFIABLE TEXT STRINGS**. This is useful when an existing SPN and text string do 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 Cat Service Tool using any character in the supported character set of the EMCP 4 software flash file. Furthermore, the Cat 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 4 to the computer.

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

1. One of the Digital Inputs must be configured as a Custom Event with a Failure Mode Identifier of Status (or Condition Exists). For more information on configuring Digital Inputs, see Chapter 8.1.
2. A custom string must be entered, using the Modifiable Text Strings tool in the Cat 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 entering a modifiable text string for Custom Event #1 is given in Figure 29.

BUILDING FIRE DETECTED	
Input	Value
EMCP 4	
Digital Input Custom Event 1, Line 1	BUILDING FIRE DETECTED
Digital Input Custom Event 1, Line 2	SHUTDOWN
Digital Input Custom Event 2, Line 1	

Figure 29: Customizing A Text String With the Cat Service Tool

The EMCP 4 supports one Modifiable text string per Custom Event on each programmable Digital Input.

11.1 LANGUAGE SUPPORT

The primary language for the EMCP 4 control will always be 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 4 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 (Custom Event #N) for a given input.

The EMCP 4 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 is not able to install multiple flash files supporting different languages simultaneously.

The EMCP 4 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 Cat 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.

Different language software supports different sets of characters. Therefore, Modifiable Text String configuration files created in one language will not become translated if new language software is flashed into the EMCP 4. The original text string will still show as originally entered, or it may not show correctly if the new software language does not support all the characters in the original language.

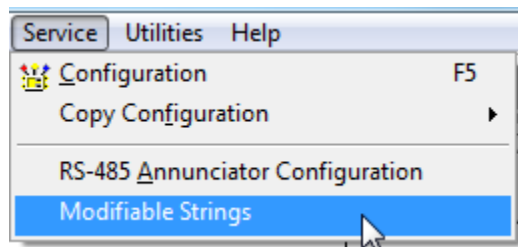
11.2 PROGRAMMING MODIFIABLE TEXT STRINGS USING THE CAT SERVICE TOOL

To configure a Modifiable Text String using the Cat Service Tool, go through the following menu options:

1. Connect the EMCP to the Cat Electronic Technician as described in Chapter 4.2.

Note: The Service Tool must be connected to CAN 1 and the EMCP must be selected during the connection if multiple ECMs are present.

2. Select "Modifiable Strings" under "Service" from the choices at the top of the software screen.



3. The “Modifiable Strings” screen will appear.

Description	Value
File Part Number	
File Version	
File Description	

Input	Value

4. In order to load the existing text string file from the ECM, click the “Load From ECM” button on the bottom of the screen.

Load From File... Save To File... **Load From ECM** Save To ECM

EMCP 4.2

5. The stored strings, if any, will appear. For first time configuration, the strings will be blank.

Input	Value
EMCP 4	
Digital Input Custom Event 1, Line 1	
Digital Input Custom Event 1, Line 2	
Digital Input Custom Event 2, Line 1	
Digital Input Custom Event 2, Line 2	
Digital Input Custom Event 3, Line 1	
Digital Input Custom Event 3, Line 2	
Digital Input Custom Event 4, Line 1	
Digital Input Custom Event 4, Line 2	
Digital Input Custom Event 5, Line 1	
Digital Input Custom Event 5, Line 2	
Digital Input Custom Event 6, Line 1	
Digital Input Custom Event 6, Line 2	

- Click in the Value column next to the event to be modified. Type the desired text string. The Modifiable Text String is considered a pair of text strings, and the user has the option of customizing the pair of text strings. The second line has less available space, because the event log index is also displayed on that line.

Description	Value
File Part Number	-1
File Version	1
File Description	Modifiable String

ABCDEF GHIJKLMNOPQRS

Input	Value
EMCP 4	
Digital Input Custom Event 1, Line 1	ABCDEF GHIJKLMNOPQRS
Digital Input Custom Event 1, Line 2	
Digital Input Custom Event 2, Line 1	
Digital Input Custom Event 2, Line 2	
Digital Input Custom Event 3, Line 1	
Digital Input Custom Event 3, Line 2	
Digital Input Custom Event 4, Line 1	
Digital Input Custom Event 4, Line 2	
Digital Input Custom Event 5, Line 1	
Digital Input Custom Event 5, Line 2	
Digital Input Custom Event 6, Line 1	
Digital Input Custom Event 6, Line 2	

Load From File... Save To File... Load From ECM Save To ECM

- Once all text strings are entered for all events desired, click on the “Save to ECM” button on the bottom of the screen.

Load From File... Save To File... Load From ECM Save To ECM

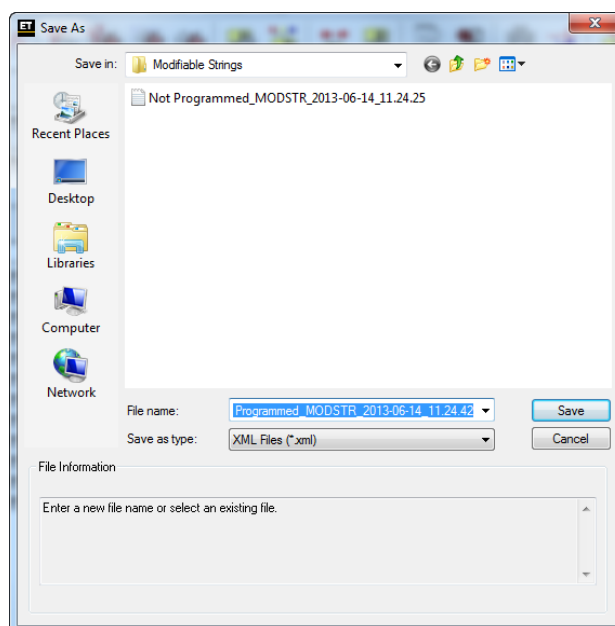
EMCP 4.2

- To then save the same file to the hard disk, click on the “Save to File...” and browse to the appropriate folder.

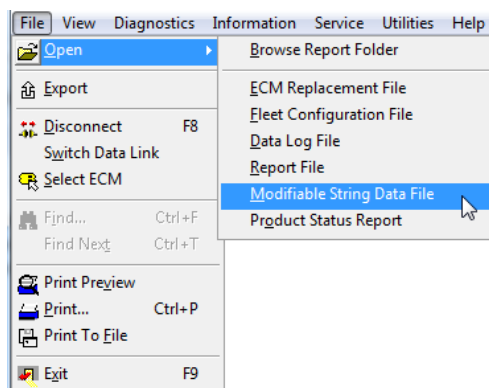
Load From File... Save To File... Load From ECM Save To ECM

EMCP 4.2

9. Once the file destination is found, click “Save”.



10. To edit a saved text string in ET while not connected to the ECM, navigate to File>Open>Modifiable String Data File. This is equivalent to clicking on the “Load From File...” button on the bottom left side of the “Modifiable Strings” screen.



11. Select the desired string data and click “Open”. This opens the “Modifiable Strings” screen again.
12. Edit as desired, then save to ECM, or save to a file.

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.

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.

It is advisable to split the text across both lines even if it can fit on a single line since the default terms will show if text has not been entered.

Note: The user must save any offline changes before attempting to connect the Service Tool to the EMCP 4, or the changes will not be saved.

12 SAVING AND RESTORING SETPOINTS

The EMCP 4 supports the saving and uploading of the EMCP 4 setpoints through a setpoint configuration file. This file, called the ECM Replacement File, or Fleet Replacement File, is accessible via the ECM Replacement tool of the Cat Service Tool software. The file contains information specific to the EMCP 4, and includes the setpoint values that are specific to a given EMCP 4 module. The user has the option of saving the data to an ECM Replacement File from an EMCP 4 module or uploading the data from the ECM Replacement File to another EMCP 4 module. The user also has the option of uploading general configuration data to several EMCP 4 modules by means of a similar tool called Fleet Configuration. Both of these options are accomplished through the Cat Service Tool software.

Note: This chapter only addresses setpoints residing in the EMCP 4. To save and restore setpoints for other (optional) modules on the EMCP 4 CAN data links, a similar procedure must be followed for each individual module.

12.1 SAVING EMCP 4 CONFIGURATION DATA

The Cat Service Tool is used to save an EMCP 4 configuration.

The EMCP 4 configuration should be saved upon initial access or after any configuration change. This will be required for future accessibility when exchanging or replacing the EMCP 4 module.

After connecting to the EMCP 4, navigate to Service > Copy Configuration (see Figure 30). There are two options:

- Fleet Configuration
- ECM Replacement

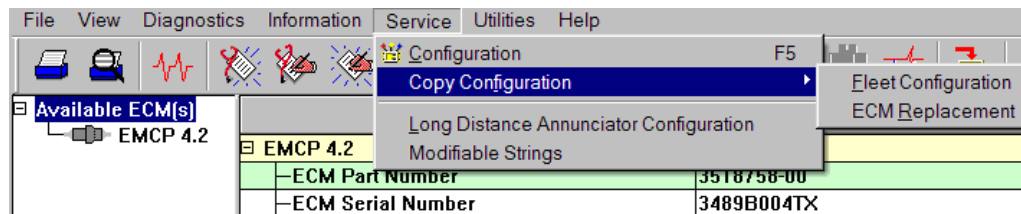


Figure 30: Cat Service Tool EMCP 4 GSC Summary Screen

The loading of EMCP 4 configuration data is very similar between **ECM REPLACEMENT** and **FLEET CONFIGURATION**. For illustration purposes, the **ECM REPLACEMENT** option will be described here.

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 ignoring module-specific data such as **ENGINE SERIAL NUMBER** and **ENGINE OPERATING HOURS**.

ECM REPLACEMENT OPTION

To save EMCP 4 configuration data to an ECM Replacement file:

1. From the Service Tool menu, select the following: Service > Copy Configuration > ECM Replacement. See Figure 30.
2. The software will prompt the user to open a previously saved ECM Replacement file. Click "Cancel".
3. The following message is displayed: "**No Data Is Available. Load From ECM Now?**" Press "No".
4. Click "**Load from ECM**" from the bottom left of the ECM Replacement screen to upload the setpoints. See Figure 31.

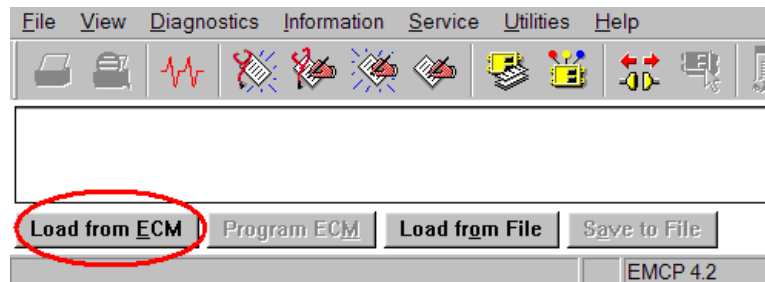


Figure 31: Load from ECM

- After the software loads the data, the replacement file parameters will be shown. See Figure 32.

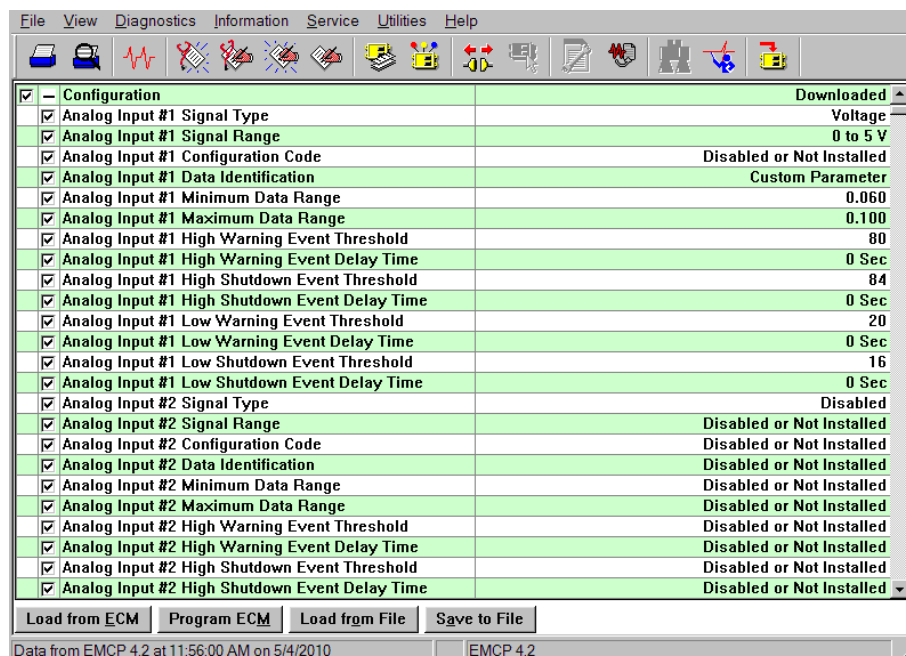


Figure 32: ECM Replacement File Parameters

- Select which ECM's configuration data is to be viewed and/or saved for future use by adding, or removing check boxes from the side of the parameters.
- After any selection changes are completed, click "**Save to File**" from the bottom of the ECM Replacement screen to save the file. See Figure 33. Make sure to note where the file is stored.

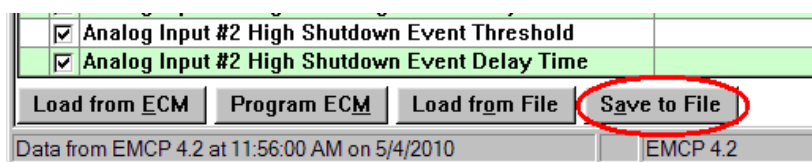


Figure 33: Save to File

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 4 CONFIGURATION DATA

The loading of EMCP 4 configuration data is very similar between **ECM REPLACEMENT** and **FLEET CONFIGURATION**. For illustration purposes, the **ECM REPLACEMENT** option will be described here.

Warning: When loading an ECM Replacement File, the engine operating hours will increase to the newly loaded value (if larger than the old value). To avoid this, deselect the Engine Operating Hours setting.

To load an ECM Replacement file to an EMCP 4:

1. From the Service Tool menu, select the following: Service > Copy Configuration > ECM Replacement. See Figure 30.
2. The software will prompt the user to open a previously saved ECM Replacement file.
3. Navigate to the location where the file is stored and click "Open".
4. The software will confirm opening the file. See Figure 34. Click "OK".

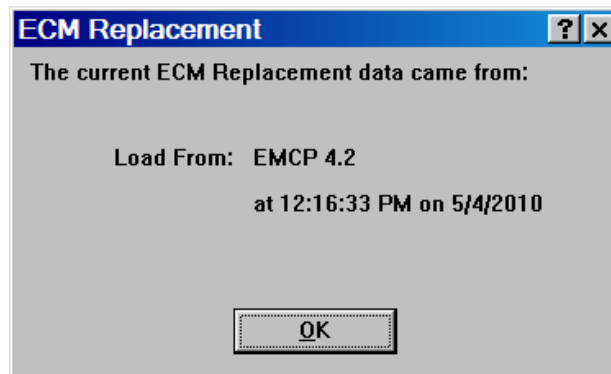


Figure 34: Load from File

5. The replacement file parameters will be shown. See Figure 35.

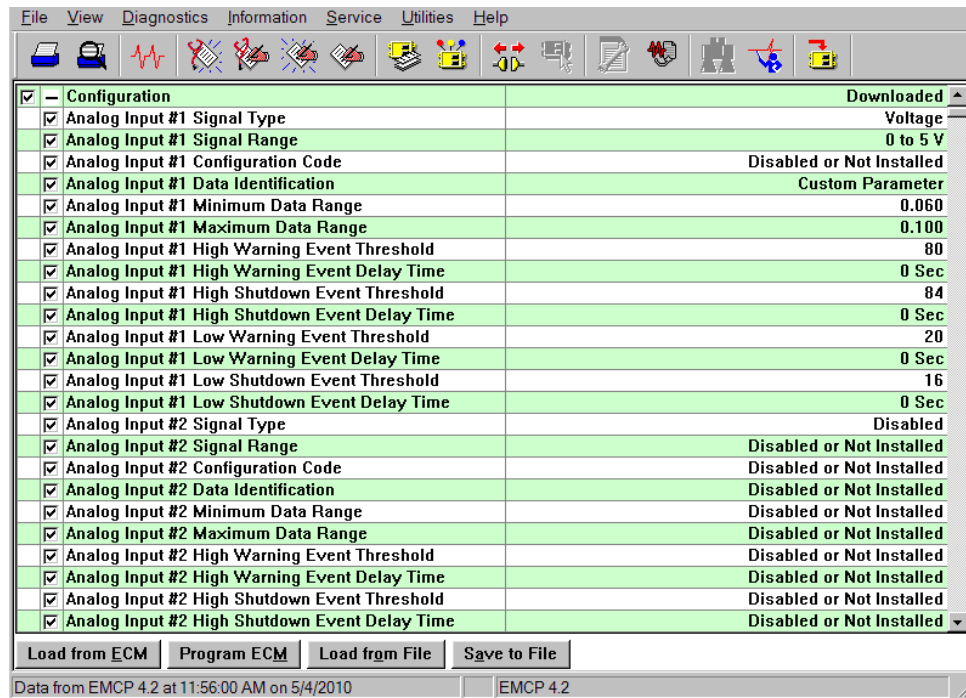


Figure 35: ECM Replacement File Parameters

6. Select which ECM's configuration data is to be programmed into the EMCP 4 by adding, or removing check boxes from the side of the parameters.
7. After any selection changes are completed, click **"Program ECM"** from the bottom of the ECM Replacement screen to load the file into the EMCP 4. See Figure 36.

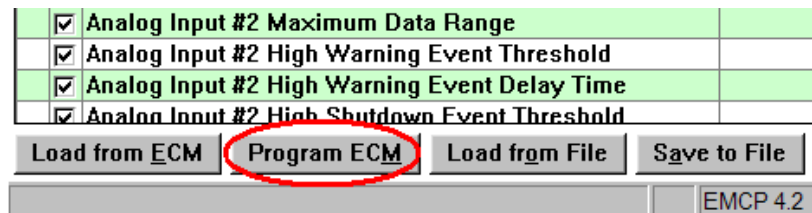


Figure 36: Program ECM

8. If another replacement file is to be programmed or if the user is already at the ECM Replacement screen prior to opening a replacement file, press the “Load from File” button at the bottom of the screen and follow steps 3 through 7 above. See Figure 37.

☒	Analog Input #2 Maximum Data Range	
☒	Analog Input #2 High Warning Event Threshold	
☒	Analog Input #2 High Warning Event Delay Time	
☒	Analog Input #2 High Shutdown Event Threshold	

EMCP 4.2

Figure 37: Load ECM Replacement File

Note: By default, ECM Replacement files are stored in the ECM Replacement folder, while Fleet Configuration files are stored in the Fleet Configuration folder.

The above steps, for uploading saved configuration data, will need to be repeated for each EMCP 4 module needing same or similar setpoint configurations. For programming multiple units with the same setpoints, it is recommended to use Fleet Configuration files.

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 4.2 ONLY)

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 exercising gensets, or cases where two or more generators are required to automatically share the duty of supplying a load throughout the week.

Using the PCT, each genset can be programmed to start and stop at pre-set times. The PCT is capable of handling a seven day sequence with seven independent starts happening one or more times each week. The timing of these start/stop cycles may be programmed in advance, either locally or via the service tool.

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 run the genset to have the charging alternator help keep the battery charged.

Caution: External equipment such as 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. All seven days can be selected, if desired.

PROGRAMMABLE CYCLE TIMER #1: Activation Start Time

The time of day (in hours and minutes) that the timer will activate. The time must be programmed using a 24-hour clock.

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

The Programmable Cycle Timer's first output will be activated when this timer is active and will allow the genset to start if in Auto.

PROGRAMMABLE CYCLE TIMER #1: Output #2 Activation Configuration

The Programmable Cycle Timer's second output will be activated when this timer is active. Output # 2 can be assigned to a programmable output for connection to an external device. This external device can be used to control a load bank, transfer switch or other device.

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 an internal Remote Initiate command. **OUTPUT #2** is customer configurable via a discrete output. This allows the operator to configure a timed relay, for external connectivity.

Note: The outputs of all seven timers are tied together in an "OR" fashion. This means that if any one, or more, timer is activated, then any output will activate (depending on programming).

The status of each output is indicated by a **1**, **0**, or **-** in the **PROG CYCLE** column under #1 through #7. See Figure 38.

A number **ONE (1)** means that this PCT is driving that output to be **TRUE**

A 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 **DASH (-)** means that this PCT is **NOT** programmed to activate this output.

PCT	1	2	3	4	5	6	7
PCT OUTPUT1	0	-	1	-	-	-	-
PCT OUTPUT2	-	-	-	-	1	-	-

Figure 38: PCT Main Screen

In Figure 38, **PCT #1** is **INACTIVE** on Output #1. Output #2 is **NOT** enabled and will never activate, as programmed.

PCT #3 is **ACTIVE** on Output #1, and **NOT** enabled on Output #2.

PCT #5 is **NOT** enabled and will never activate, as programmed, on Output #1. Output #2 is **ACTIVE**.

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

To select a specific Programmable Cycle Timer, use the **LEFT**  and **RIGHT**  buttons until the desired PCT is within the selection box and then press the **OK KEY**



13.1 CONFIGURING THE PROGRAMMABLE CYCLE TIMER USING THE DISPLAY

To configure a Programmable Cycle Timer with the display, go through the following menu options:

At **MAIN MENU**, scroll down  to **CONTROL**

Press the **OK KEY** 

Scroll **DOWN**  to **PROG CYCLE TIMER**

Press the **OK KEY** 

The box surrounding the first column outlines the first of seven timers.

Press the **OK KEY**  to program this timer.

The box surrounding the first row outlines the day selection.

Press the **OK KEY**  to select the day(s) for this timer.

Use the **UP**  and **DOWN**  arrow keys

along with the **LEFT**  and **RIGHT**  arrow keys to select the days that this timer will activate.

Press the **OK KEY**  when done.

Scroll **DOWN**  to select the **START TIME**

Press the **OK KEY** 

Use the arrow keys to enter the **START TIME**

Press the **OK KEY**  when done.

MAIN MENU
VIEW
CONTROL

CONTROL
IDLE/RATED
PROG CYCLE TIMER

PCT	1	2	3	4	5	6	7
PCT OUTPUT1	-	-	-	-	-	-	-
PCT OUTPUT2	-	-	-	-	-	-	-

PROG CYCLE TIMER 1
0 1 2 3 4 5 6 (0=SUN)
START TIME 00:00

☒ SUNDAY
☒ MONDAY
☐ TUESDAY

PROG CYCLE TIMER 1
0 1 2 3 4 5 6 (0=SUN)
START TIME 00:00

PROG CYCLE TIMER 1
0 1 2 3 4 5 6 (0=SUN)
START TIME 00:00

Scroll **DOWN**  to select the **RUN FOR** time

Press the **OK KEY** .

Use the arrow keys to enter the **RUN FOR** time

Press the **OK KEY**  when done.

Scroll **DOWN**  to select the **OUTPUT STATE** for Output #1

Press the **OK KEY** .

Select the **OUTPUT STATE** that you want to program

Press the **OK KEY**  when done.

Scroll **DOWN**  to select the **OUTPUT STATE** for Output #2

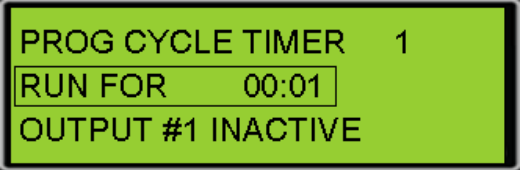
Press the **OK KEY** .

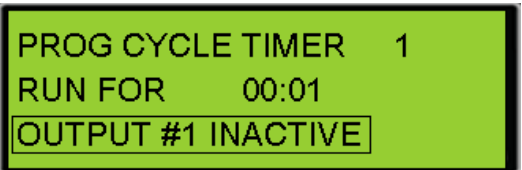
Select the **OUTPUT STATE** that you want to program

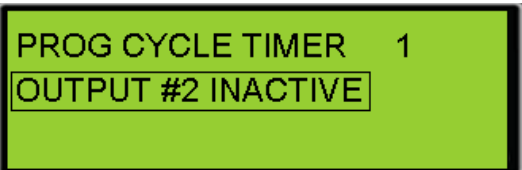
Press the **OK KEY**  when done.

Press the **ESCAPE KEY**  to return to the Programmable Cycle Timer main screen. Use the

LEFT  and **RIGHT**  buttons to select the other timers and repeat the above steps.








13.2 CONFIGURING THE PROGRAMMABLE CYCLE TIMER USING THE CAT SERVICE TOOL

To configure a Programmable Cycle Timer with the Cat Service Tool, go through the following menu options:

1. Connect to the EMCP 4 using the Cat Service Tool as stated in Chapter 4.2.
2. Select Programmable Cycle Timer on the left.



3. Double click the Programmable Cycle Timer #N Activation Day setpoint for a given day to change this value from the drop down menu. Click the OK button to program.

Change Parameter Value

Parameter Name: Programmable Cycle Timer #1 Activation Day - Sunday

Current Value: Activate

New Value: Activate
Activate
Deactivate

Please select one of the listed values for this parameter.

OK Cancel

4. Double click the Programmable Cycle Timer #N Activation Start Time setpoint to change this value. Click the OK button to program.

Change Parameter Value

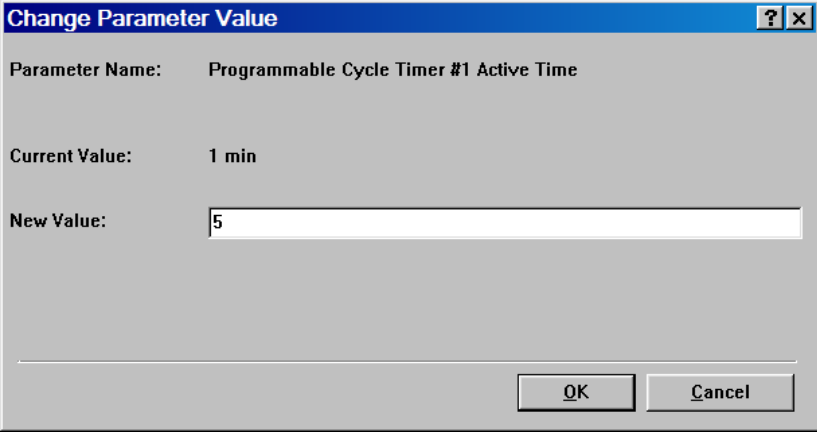
Parameter Name: Programmable Cycle Timer #1 Activation Start Time

Current Value: 9:14 AM

New Value: 12:00 AM

OK Cancel

5. Double click the Programmable Cycle Timer #N Active Time setpoint to change this value. Click the OK button to program.

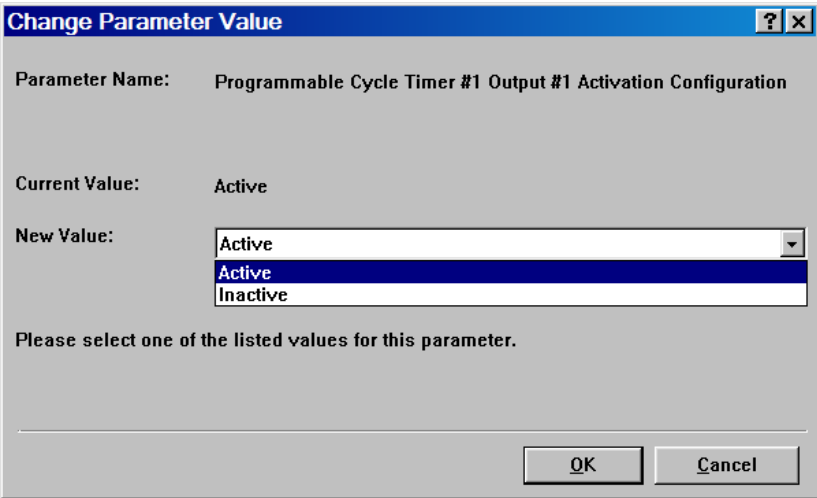


The dialog box titled "Change Parameter Value" has a blue header bar with a help icon and a close button. It contains the following fields:

- Parameter Name:** Programmable Cycle Timer #1 Active Time
- Current Value:** 1 min
- New Value:** A text input field containing the number "5".

At the bottom right, there are two buttons: "OK" and "Cancel".

6. Double click the Programmable Cycle Timer #N Output #1 Active Configuration setpoint to change this value from the drop down menu. Click the OK button to program.



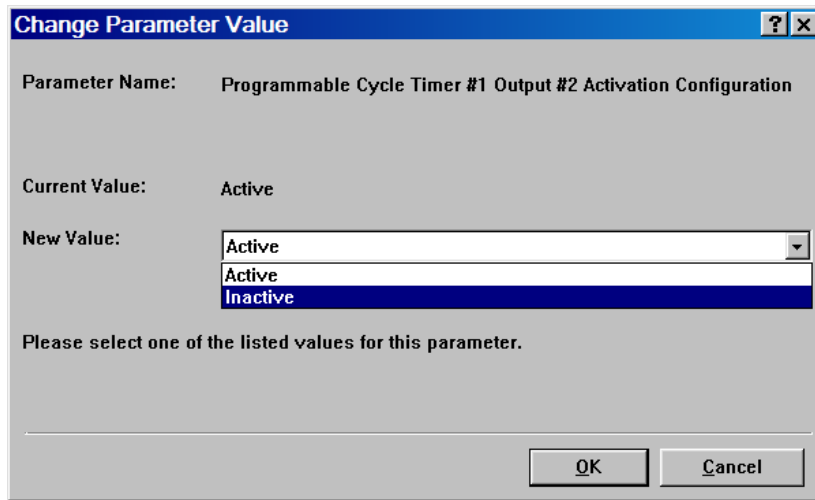
The dialog box titled "Change Parameter Value" has a blue header bar with a help icon and a close button. It contains the following fields:

- Parameter Name:** Programmable Cycle Timer #1 Output #1 Activation Configuration
- Current Value:** Active
- New Value:** A dropdown menu with "Active" selected. The dropdown list is open, showing "Active" and "Inactive" as options.

Below the dropdown menu, there is a text prompt: "Please select one of the listed values for this parameter."

At the bottom right, there are two buttons: "OK" and "Cancel".

7. Double click the Programmable Cycle Timer #N Output #2 Active Configuration setpoint to change this value from the drop down menu. Click the OK button to program.



The image shows a 'Change Parameter Value' dialog box. The title bar is blue with a question mark icon and a close button. The dialog has a light gray background. It contains the following text and controls:

- Parameter Name:** Programmable Cycle Timer #1 Output #2 Activation Configuration
- Current Value:** Active
- New Value:** A drop-down menu with three options: 'Active', 'Active', and 'Inactive'. The 'Inactive' option is currently selected and highlighted in blue.
- Text:** Please select one of the listed values for this parameter.
- Buttons:** 'OK' and 'Cancel' buttons are located at the bottom right.

8. Repeat the above steps to program additional timers.

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, including Annunciator communication
- ☒ All inputs except Remote Initiate
- ☒ All outputs
- ☒ LED's (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

- ☒ Sending a hardwired remote start signal to the controller
- ☒ Cycling power to the controller
- ☒ A key on the keypad is pressed
- ☒ The Programmable Cycle Timer is about to enter a period when it will activate an output.

ACTIONS TO ENABLE RPM

1. 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 to Configure -> All Setpoints -> Reduced Power Mode.
2. 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.

The following conditions must be met in order for the EMCP 4 to enter Reduced Power Mode:

1. Engine speed must be 0
2. Remote Initiate signal cannot be active
3. Must not be close to the starting time of a Programmed Cycle Timer

SEMI-AWAKE

The EMCP 4 becomes **SEMI-AWAKE** when in Reduced Power Mode. Approximately every 30 minutes it will do status checks of the control for about 40 seconds. During **SEMI-AWAKE** the display remains off and the LED's (lamps) continue to blink. The EMCP will start up to check for Analog Input faults, engine speed sensor diagnostics, and AC faults. If any of these faults become active at this time, the system will respond accordingly (warning or shutdown LED indicators may turn on). During the semi-awake time any active relays (such as common alarm) will energize.

Once the **SEMI-AWAKE** time is completed the control will return to full RPM (deactivating any relays that are active). An active event will not prevent the control from entering reduced power mode. If a programmable cycle timer is set to become active in the near future, the timer before waking will be adjusted to ensure the controller wakes in time to process the programmable cycler timer.

15 PROGRAMMABLE KW RELAY FUNCTION (EMCP 4.2 ONLY)

The EMCP 4.2 has two Programmable kW Relay functions configured to respond to the %kW of the genset. These functions can be mapped to the EMCP Outputs. In addition, these functions can be used to trigger events using an event response configuration located under Events/Generator Protection Configuration. These events will then be recorded within the Event Log, and may be sent back if remote monitoring of events is being performed.

The setpoints within the Programmable kW Relay functions can be changed from the display, and are as follows:

PROGRAMMABLE TRIP POINT #N TRIGGER CONDITION

Choices: Disabled, Trip Above Threshold, Trip Below Threshold

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

PROGRAMMABLE TRIP POINT #N PERCENTAGE THRESHOLD

Range: -100-120%

This is the threshold of rated kW that the function must pass in order to change the state of the output.

PROGRAMMABLE TRIP POINT #N HYSTERESIS PERCENTAGE

Range: -100-100%

Once the output is on, the value must return by this much *past* the Threshold before the output turns off again. For example, if this value is 5% and the Percentage Threshold is 90%, then the relay will activate at 90% but 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 oscillate.

PROGRAMMABLE TRIP POINT #N TRIP ACTIVATION DELAY TIME

Range: 0-999 seconds

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

PROGRAMMABLE TRIP POINT #N TRIP DEACTIVATION DELAY TIME

Range: 0-999 seconds

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

15.1 CONFIGURING THE PROGRAMMABLE KW RELAY FROM THE DISPLAY

To configure a Programmable kW Relay with the display, go through the following menu options:

AT THE MAIN MENU, scroll down  to CONFIGURE

Press the OK KEY .

SCROLL DOWN  to ALL SETPOINTS

Press the OK KEY .

SCROLL DOWN  to PROG kW RELAY TRIP

Press the OK KEY .

Select the PROG kW RELAY TRIP that you want to program

Press the OK KEY .

Press the OK KEY  to highlight the current configuration.

Select the type of PROG kW RELAY TRIP #N TRIGGER CONDITION that you want to program (DISABLED, TRIP BELOW THRESH, TRIP ABOVE THRESH).

Press the OK KEY .

Scroll DOWN  to PROG kW RELAY TRIP #N PERCENTAGE THRESHOLD

Press the OK KEY  to edit the current PROG kW RELAY TRIP #N PERCENTAGE THRESHOLD.

MAIN MENU
CONTROL
CONFIGURE

CONFIGURE
INPUTS & OUTPUTS
ALL SETPOINTS

SETPOINTS
REDUCED PWR MODE
PROG kW RELAY TRIP

PROG kW RELAY TRIP
kW RELAY TRIP #1
kW RELAY TRIP #2

PROG kW RELAY TRIP
#1 TRIGGER CONDITION
DISABLED

PROG kW RELAY TRIP
#1 TRIGGER CONDITION
TRIP ABOVE THRESH

PROG kW RELAY TRIP
#1 % THRESHOLD
0%

Select the **PROG kW RELAY TRIP #N PERCENTAGE THRESHOLD** that you want to program

Press the **OK KEY**



Scroll **DOWN**  to **PROG kW RELAY TRIP #N HYSTERESIS PERCENTAGE**

Press the **OK KEY**  to edit the current **PROGRAMMABLE TRIP POINT FUNCTION #N HYSTERESIS PERCENTAGE**.

Select the **PROG kW RELAY TRIP #N HYSTERESIS PERCENTAGE** that you want to program

Press the **OK KEY**



Scroll **DOWN**  to **PROG kW RELAY TRIP #N TRIP ACTIVATION DELAY TIME**

Press the **OK KEY**  to edit the current **PROGRAMMABLE TRIP POINT FUNCTION #N TRIP ACTIVATION DELAY TIME**.

Select the **PROG kW RELAY TRIP #N TRIP ACTIVATION DELAY TIME** that you want to program

Press the **OK KEY**



Scroll **DOWN**  to **PROG kW RELAY TRIP #N TRIP DEACTIVATION DELAY TIME**

Press the **OK KEY**  to edit the current **PROG kW RELAY TRIP #N TRIP DEACTIVATION DELAY TIME**.

Select the **PROG kW RELAY TRIP #N TRIP DEACTIVATION DELAY TIME** that you want to program

Press the **OK KEY**



**PROG kW RELAY TRIP
#1 % THRESHOLD**

+ 0 0 5

**PROG kW RELAY TRIP
#1 % HYSTERESIS %
0 %**

**PROG kW RELAY TRIP
#1 % HYSTERESIS %**

0 0 5

**PROG kW RELAY TRIP
#1 ACTIVATE DELAY
0 SECONDS**

**PROG kW RELAY TRIP
#1 ACTIVATE DELAY**

0 0 3

**PROG kW RELAY TRIP
#1 DEACTIVATE DELAY
0 SECONDS**

**PROG kW RELAY TRIP
#1 DEACTIVATE DELAY**

0 0 2

15.2 CONFIGURING THE PROGRAMMABLE KW RELAYS USING THE CAT SERVICE TOOL

To configure a Programmable kW Relay with the Cat Service Tool, go through the following menu options:

1. Connect to the EMCP 4 using the Cat Service Tool as stated in Chapter 4.2.
2. Select kW Relay Setpoints on the left.

Programmable Cycle Time	Trigger Condition	
Electronic Control Module	Programmable Trip Point Function #2	0 %
Relay Outputs	Percentage Threshold	
Service Maintenance Interval	Programmable Trip Point Function #2	0 %
kW Relay Setpoints	Hysteresis Percentage	
DIO Inputs	Programmable Trip Point Function #2	0 %

3. Double click the Programmable Trip Point #N Trigger Condition setpoint to change this value from the drop down menu. Click the OK button to program.

Change Parameter Value [?] [X]

Parameter Name: Programmable Trip Point Function #1 Trigger Condition

Current Value: Disabled

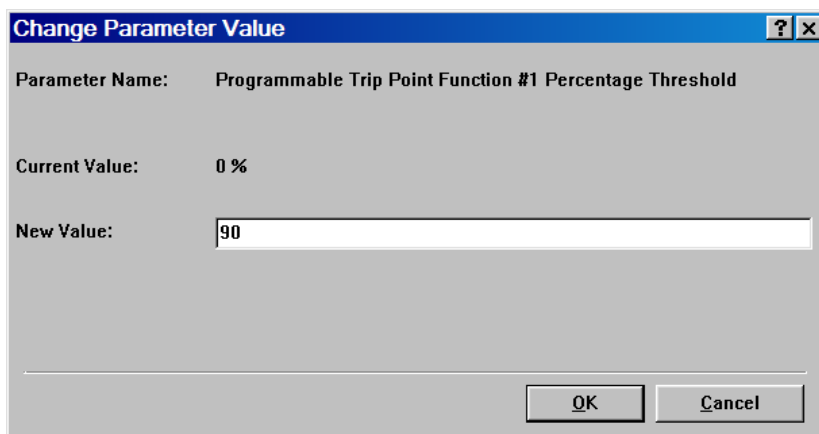
New Value: Disabled

Disabled
Trip Above Threshold
Trip Below Threshold

Please select one of the listed values for this parameter.

OK Cancel

4. Double click the Programmable Trip Point #N Percentage Threshold setpoint to change this value. Click the OK button to program.

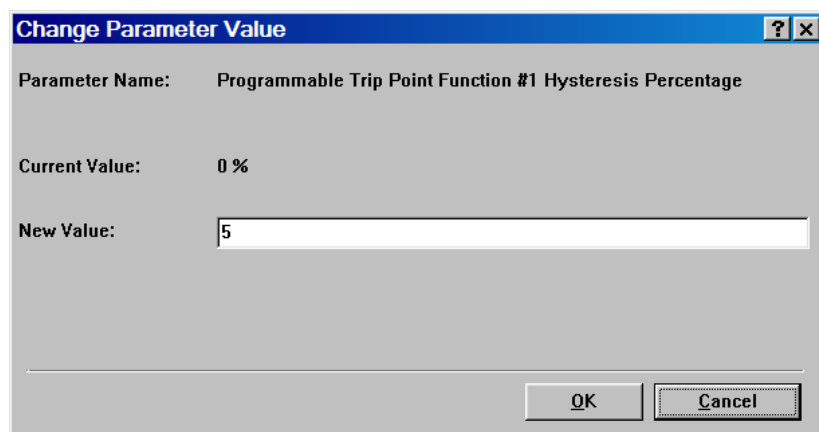


The dialog box titled "Change Parameter Value" has a blue header bar with a question mark icon and a close button. It contains the following fields:

- Parameter Name:** Programmable Trip Point Function #1 Percentage Threshold
- Current Value:** 0 %
- New Value:** 90

At the bottom right, there are two buttons: "OK" and "Cancel".

5. Double click the Programmable Trip Point #N Hysteresis Percentage setpoint to change this value. Click the OK button to program.

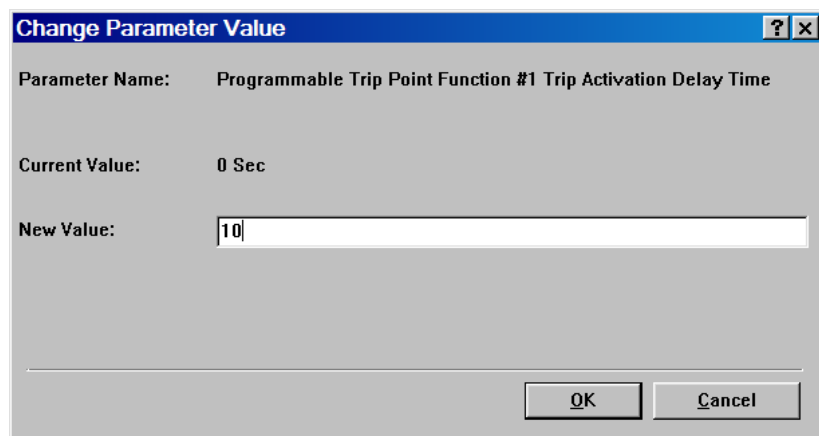


The dialog box titled "Change Parameter Value" has a blue header bar with a question mark icon and a close button. It contains the following fields:

- Parameter Name:** Programmable Trip Point Function #1 Hysteresis Percentage
- Current Value:** 0 %
- New Value:** 5

At the bottom right, there are two buttons: "OK" and "Cancel".

6. Double click the Programmable Trip Point #N Output #1 Trip Activation Delay Time setpoint to change this value from the drop down menu. Click the OK button to program.

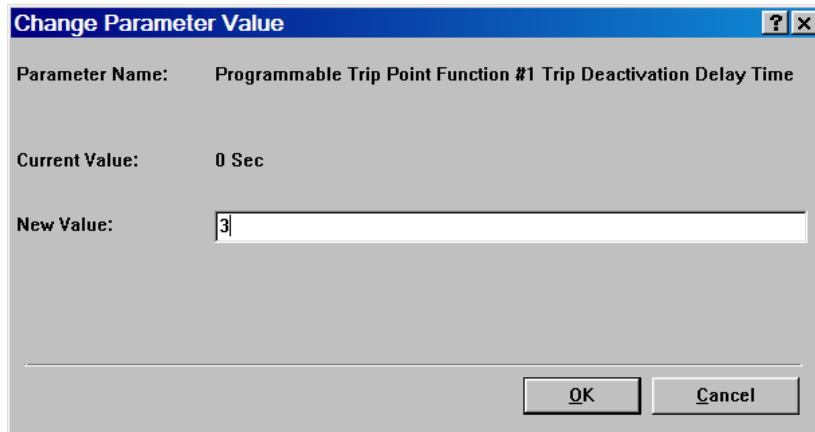


The dialog box titled "Change Parameter Value" has a blue header bar with a question mark icon and a close button. It contains the following fields:

- Parameter Name:** Programmable Trip Point Function #1 Trip Activation Delay Time
- Current Value:** 0 Sec
- New Value:** 10

At the bottom right, there are two buttons: "OK" and "Cancel".

7. Double click the Programmable Trip Point #N Output #12 Trip Deactivation Delay Time setpoint to change this value from the drop down menu. Click the OK button to program.



The image shows a software dialog box titled "Change Parameter Value". It has a blue header bar with a question mark icon and a close button. The dialog contains the following fields and controls:

- Parameter Name:** Programmable Trip Point Function #1 Trip Deactivation Delay Time
- Current Value:** 0 Sec
- New Value:** A text input field containing the number "3".
- Buttons:** "OK" and "Cancel" buttons at the bottom right.

8. Repeat the above steps to program an additional timer.

16 CAN DATA LINKS

16.1 PRIMARY CAN DATA LINK (CAN 1)

The Primary CAN Data Link is supported by all levels of the EMCP 4.

The Primary CAN 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 Cat Digital Voltage Regulator (Cat DVR), a Thermocouple Module, and the Cat Clean Emissions Module System.

For the other modules, logs are not kept in the EMCP if power is cycled to the EMCP. Other modules may log the events and repopulate the EMCP with the logged events.

PRIMARY CAN WIRING

The Primary CAN communication wires are brought out of the EMCP 4 as part of the 70-pin connector. The pins, as designated on the EMCP 4 connector, are shown in Table 13.

PRIMARY CAN COMMUNICATION WIRES		
Pin #	Name	Description
34	CAN 1 -	Differential (-) for CAN
42	CAN 1 SH	Shield for CAN
50	CAN 1 +	Differential (+) for CAN

Table 13: Primary CAN Data Link on the 70-pin EMCP 4 connector

NETWORK TOPOLOGY

The physical topology of the CAN network used in the Primary CAN 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 120 ohm termination resistor on the extreme ends of the main trunk.

An example of the topology for the EMCP 4.1 and 4.2 is illustrated in Figure 39.

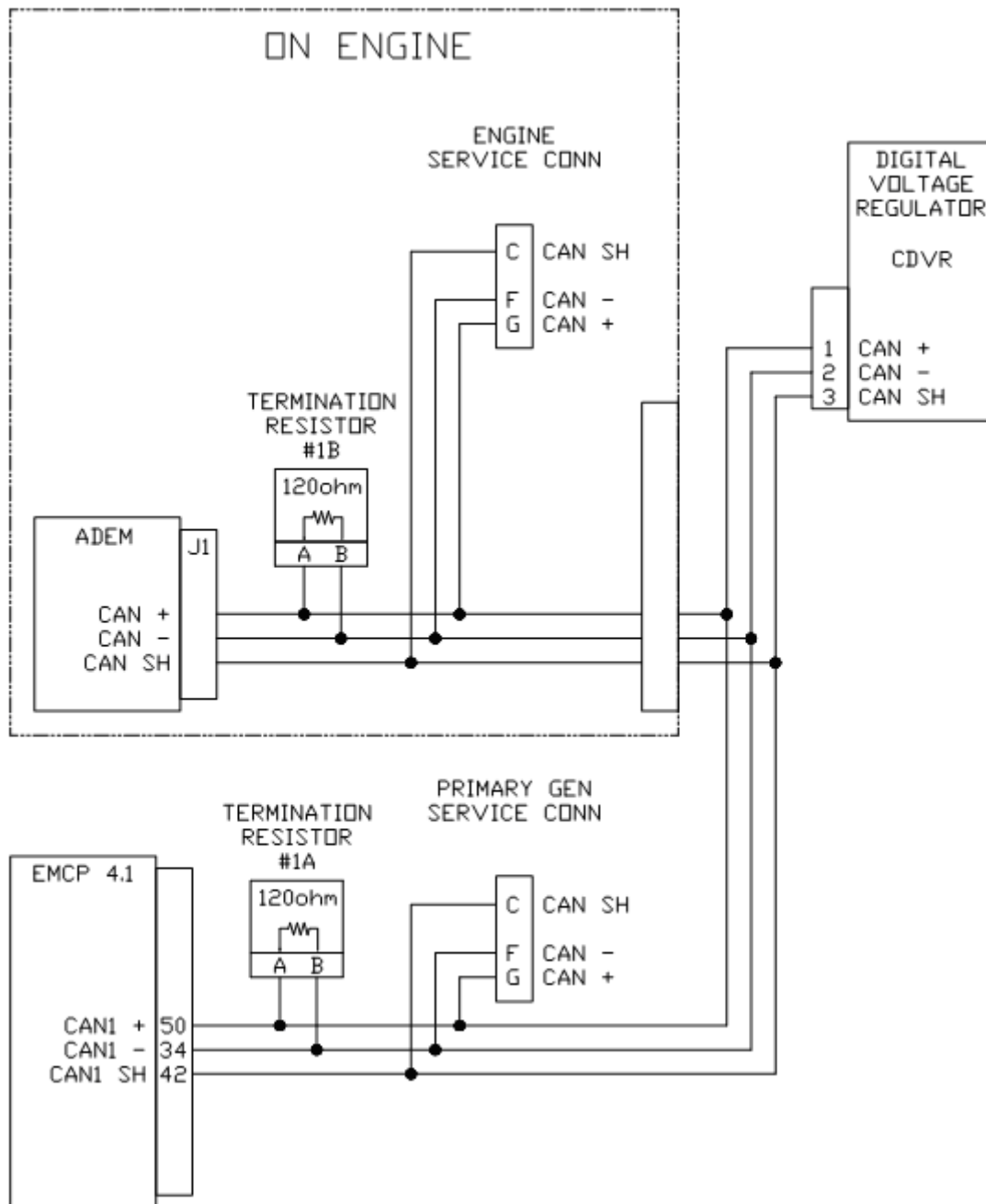


Figure 39: EMCP 4.1 CAN 1 Wiring Diagram

16.2 ACCESSORY CAN DATA LINK (CAN 2) (EMCP 4.2 ONLY)

The Accessory CAN Data Link is not supported by the EMCP 4.1.

The Accessory Data Link (CAN 2) 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.

ACCESSORY CAN WIRING

The Accessory CAN communication wires are brought out of the EMCP 4.2 as part of the 70-pin connector. The pins, as designated on the EMCP 4 connector, are shown in Table 14.

ACCESSORY CAN COMMUNICATION WIRES		
Pin #	Name	Description
62	CAN 2 +	Differential (+) for CAN
63	CAN 2 SH	Shield for CAN
64	CAN 2 -	Differential (-) for CAN

Table 14: EMCP 4.2 Accessory CAN Data Link on 70-pin EMCP 4 connector

NETWORK TOPOLOGY

The physical topology of the CAN network used in the Accessory CAN 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 120 ohm termination resistor on the extreme ends of the main trunk.

The topology for the EMCP 4.2 in the default configuration, with no remote devices connected, is illustrated in Figure 39.

The topology for the EMCP 4.2 with some remote devices connected is illustrated in Figure 40.

Note: The devices shown in Figure 40 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 Chapter 17 for the maximum number of devices supported on each level.

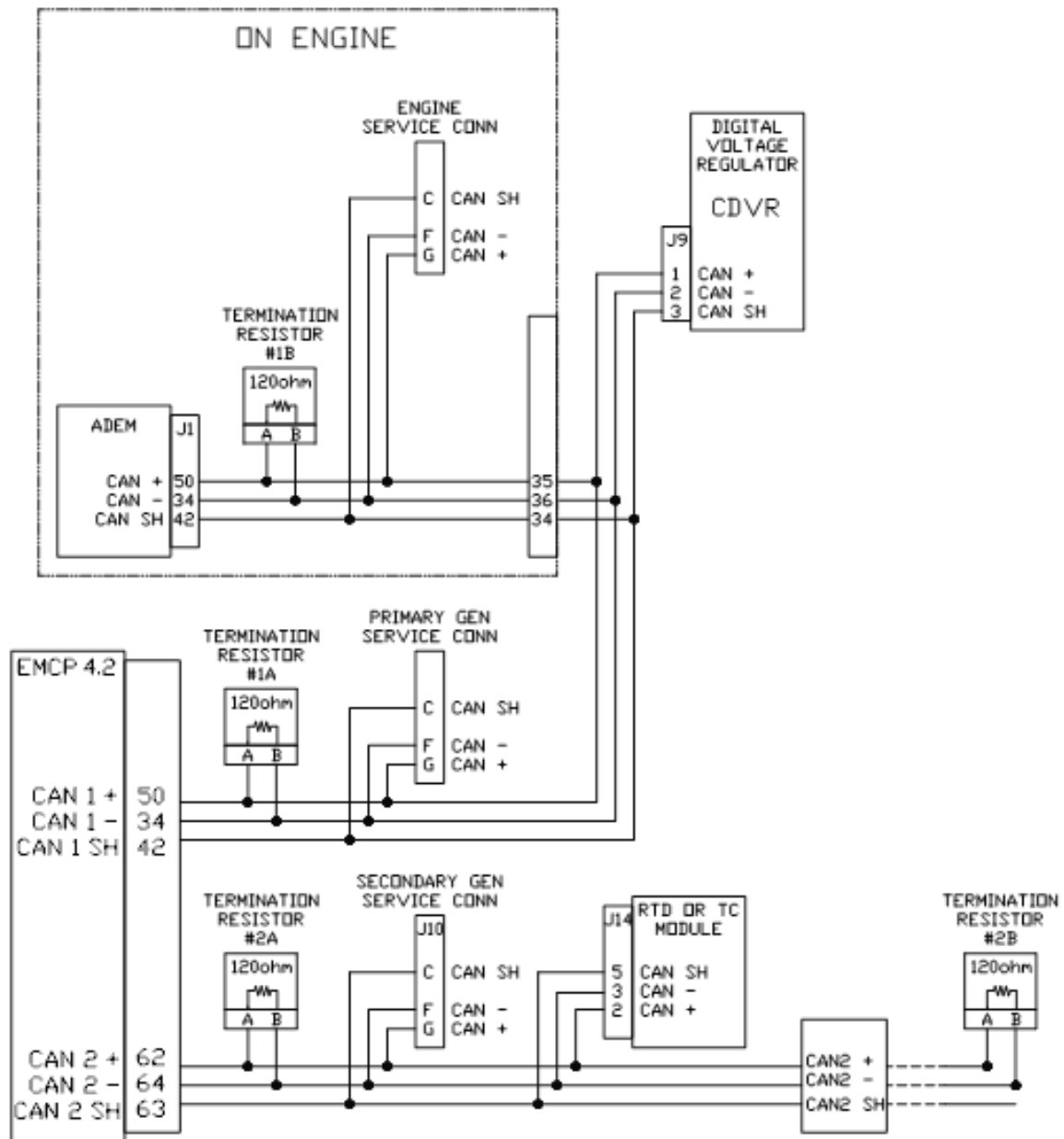


Figure 40: EMCP 4.2 CAN 1 and CAN 2 Wiring Diagram (With Optional Modules)

17 OPTIONAL MODULES

The EMCP 4 consists of the EMCP 4 Genset Controller, as well as some optional auxiliary modules. These modules connect to the EMCP 4 via either the Primary or Accessory CAN Data Link, or an RS-485 SCADA Data Link (Modbus RTU, Half Duplex). The EMCP 4 can also communicate with a Cat engine ECM on the CAN network (though this is not considered an optional module for those engines).

Different numbers of modules are supported for different levels of EMCP 4. The maximum numbers of modules supported on the CAN networks are given in Table 15.

MODULE	EMCP 4.1	EMCP 4.2	
	Primary CAN 1	Primary CAN 1	Accessory CAN 2
Engine ECM	1 or 2	1 or 2	0
CDVR	1	1	0
CAN Annunciator	0	0	4
Thermocouple	0	1	1
RTD	0	0	1
DIO	0	0	4

Table 15: Number of Optional Modules Supported on CAN Networks

Note: The number of RS-485 Annunciators is only limited by the RS-485 standard impedance for wiring and devices. (EMCP 4.1 does not support the RS-485 annunciator.)

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

THE ANNUNCIATORS

The CAN Annunciator module is an auxiliary alarm indication device, consisting of 16 pairs of indicator LED's, 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.

The RS-485 Annunciator module is an auxiliary alarm indication device, consisting of 16 pairs of indicator LED's, and an audible horn. Each annunciator can be mapped to one of four predefined group of alarms (including custom groups) based on application needs. A custom film kit is available to customize the graphic/text indication. For further information see Chapter 17.2.

THE THERMOCOUPLE, RTD, & DIO

EMCP 4 uses a common form factor for the three modules known as the Thermocouple, RTD (Resistance Temperature Detector) and DIO (Discrete I/O) modules. The same case design is used for all three.

The Thermocouple module, RTD module and DIO module feature identical rugged packaging and 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 17.23, for the RTD module see Chapter 17.4, and for the DIO module see Chapter 17.5.

THE CAT DIGITAL VOLTAGE REGULATOR

The Cat Digital Voltage Regulator (Cat DVR) module is an auxiliary voltage regulator device, regulating the generator voltage 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 4 for monitoring purposes. For further information see RENR7941 Cat Digital Voltage Regulator.

17.1 CAN ANNUNCIATOR

The EMCP CAN Annunciator serves to display system alarm conditions and status indications. The CAN Annunciator has been designed for use on the EMCP 4 Accessory CAN Data Link and may be used in either Local or Remote applications, providing customers with enhanced site flexibility.

In Local application, the CAN Annunciator may be mounted on the Package generator set with the EMCP 4 to provide a complete package-mounted monitoring solution.

The Annunciator may also be mounted separately from the generator set to provide Remote indication of system operating and alarm conditions.

A maximum of four CAN Annunciators can be mounted locally or remotely and connected to the Accessory CAN 2 data link.



CAN ANNUNCIATOR FEATURES

The Annunciator includes:

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

An additional pair of LED's provides status indication of the CAN data link connection

Annunciation of alarm conditions received from any module on the CAN 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 LED's for site specific requirements (Custom Label Kit purchased separately)

Superior visibility of the LED's 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 or remotely (up to 800 feet) on the Accessory CAN Data Link

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

288 mm (11.34 in) High x 158 mm (6.22 in) Wide x 66 mm (2.37 in) Deep

ANNUNCIATOR SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

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

Over voltage capability is 80 VDC for 2 minutes @ 70°C

Reverse voltage capability is –32 VDC for 1 hour @ 70°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 (UL Listed).

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature -40°C to 70°C

Storage Temperature -50°C to +85°C

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

Can be mounted directly on the generator set panel or remotely

NETWORK COMMUNICATIONS INTERFACE

Incorporates a communications port, able to operate on the EMCP 4 Accessory CAN Data Link

Node address is auto configurable

Optical isolation is provided for the CAN line

Module retains configured setpoints in non-volatile memory with loss of communications and power

Configuration is accomplished with the Cat Service Tool over the CAN 2 network

ANNUNCIATOR WIRING

The back of the CAN Annunciator module contains an 8-terminal screw terminal block. Attached to the block is a 6-pin Deutsch adapter. The pin outs for both are shown in Figure 41 and Table 16.

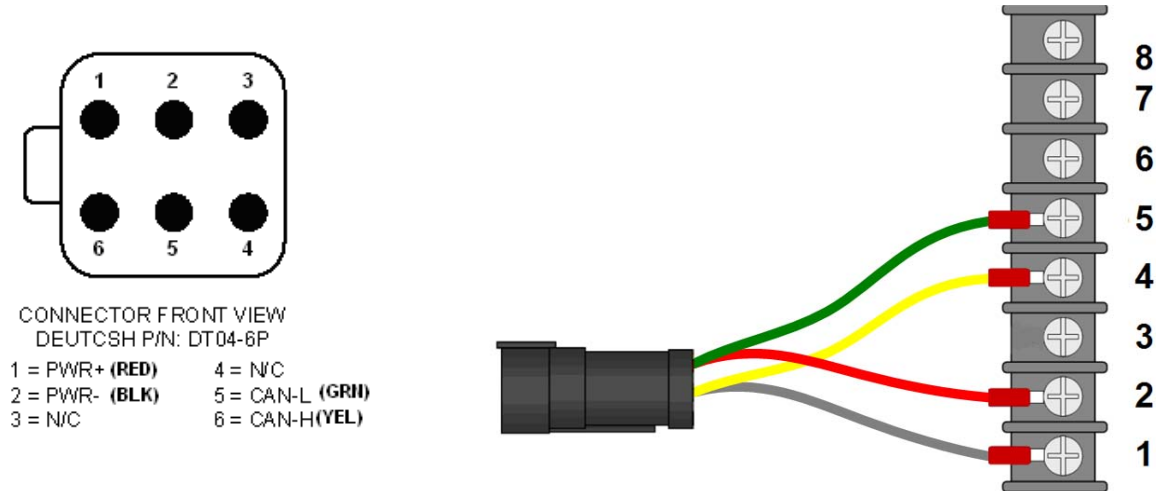


Figure 41: Annunciator Deutsch Connector Pin Configuration and Terminal Block

ANNUNCIATOR TERMINAL BLOCK PIN CONFIGURATION		
Terminal #	Function	Description
1	PWR-	- Battery Input
2	PWR+	+ Battery Input, also connects to Horn(+)
3	N/C	Not Connected
4	CAN2-L	CAN Data link LOW
5	CAN2-H	CAN Data link HIGH
6	Lamp Test	Lamp Test
7	Alarm Ack	Alarm Acknowledge
8	Horn Driver	Connects to negative terminal of Horn

Table 16: Annunciator Terminal Block Pin Configuration

LED COLORS

Each pair of LED's 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 17 LED Colors:

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

Table 17: LED Colors

MODULE STATUS LED

A red/green pair located at the bottom of the CAN Annunciator, is used to report Module/Network Status. The various states indicated are explained in Table 18.

BEHAVIOR	EXPLANATION
Red solid	CAN 2 data link diagnostic. For example: the module is wired wrong (Data Link), wrong cable, or no terminating resistor.
Green solid	CAN 2 data link OK
Green flashing	No CAN 2 data link diagnostic, but no communication detected. Hooking the Annunciator up with the power on.
Red/Green alternating	No application software loaded

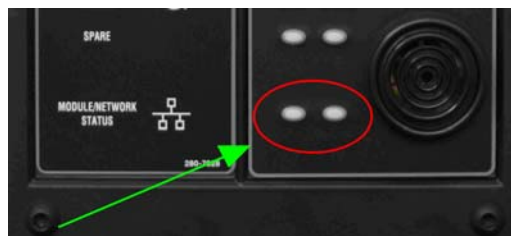


Table 18: CAN Annunciator Module / Network Status LED Behavior

CAN ANNUNCIATOR SOFTWARE CONFIGURATION

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

The service tool software must be installed on a Windows PC. The Cat communication adapter must be connected between the PC and the CAN 2 Accessory data link on which the target CAN 2 Annunciator is connected.

GLOBAL ACKNOWLEDGE

The CAN Annunciator can be configured to both initiate and respond to an Event Acknowledge message over the CAN Accessory data link. If this setpoint is enabled, the CAN Annunciator events may be acknowledged locally on the CAN Annunciator by pressing the Alarm Acknowledge button or remotely by pressing the Alarm Acknowledge button on the EMCP 4 or by pressing the Acknowledge button on another CAN Annunciator configured for Global Acknowledge 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 Configuration tool within Cat Electronic Technician.

ECU INSTANCE NUMBER

The Module Description will also indicate a number that identifies the CAN Annunciator uniquely from any other CAN Annunciator modules on the Accessory CAN Data Link.

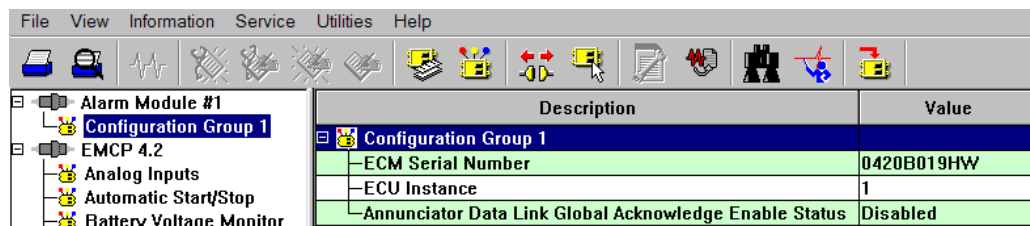
This number is called the **ECU INSTANCE** and it is programmable.

The service tool configuration screen identifies the serial number of the CAN Annunciator that is connected. This is important in matching the desired ECU Instance to the actual hardware.

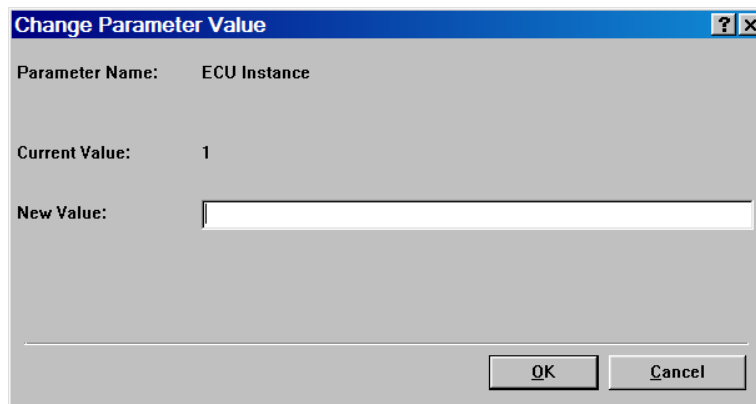
Note: If two CAN Annunciators on the same communications network are programmed for the same ECU Instance number, neither will communicate.

CONFIGURING ANNUNCIATOR LED BEHAVIOR

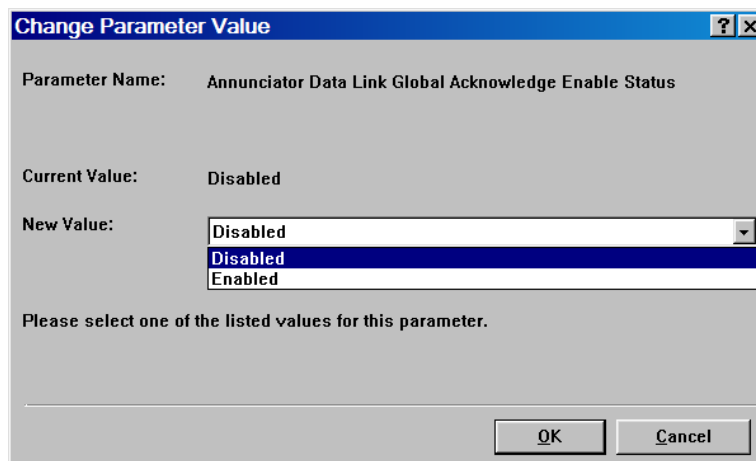
1. Connect to the Annunciator using the Cat Service Tool as stated in Chapter 4.2.
2. Select Configuration Group #N from the left pane.



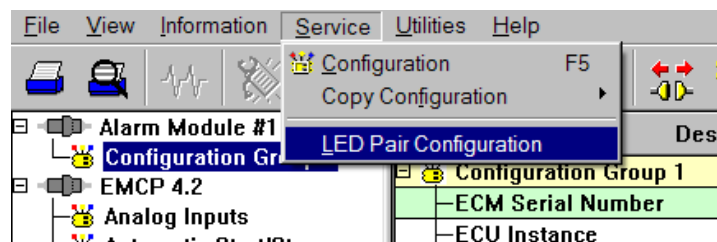
3. Double click ECU Instance Number to enter a new ECU Instance Number.



4. Double click Annunciator Data Link Global Acknowledge Enable Status to change this value from the drop down menu.



5. Select Service > LED Pair Configuration.



6. The LED pairs will become visible in a new window.

LED Pair#	Trigger Condition	Severity Level	Suspect Parameter Number	Failure Mode Identifier
1	Specific Event	Condition Met, Red On, Other Not Used, Horn On	Emergency Stop Shutdown [970]	
2	Specific Event	Condition Met, Red On, Other Not Used, Horn On	Engine Failure to Start Shutdown [1664]	
3	Specific Event	Low Warning	Engine Coolant Temperature [110]	
4	Specific Event	High Warning or High Shutdown	Engine Coolant Temperature [110]	
5	Specific Event	Low Warning or Low Shutdown	Engine Oil Pressure [100]	
6	Specific Event	High Shutdown	Engine Speed [190]	
7	Specific Event	Low Warning or Low Shutdown	Engine Coolant Level [111]	
8	Specific Event	Low Warning or Low Shutdown	Fuel Level [Local Tank] [96]	
9	Specific Event	Condition Met, Amber On, Other Not Used	Unknown SPN [4002]	
10	Specific Event	Condition Met, Amber On, Other Not Used, Horn On	Generator Control Not in Automatic Warning [4007]	
11	Specific Event	High Warning or High Shutdown	Battery Voltage [168]	
12	Specific Event	Low Warning	Battery Voltage [168]	
13	Specific Event	Specific Diagnostic	Battery Charging System Voltage [167]	Root Cause Not Known
14	Specific Event	Low Warning	Starting Air Pressure [82]	
15	Specific Event	Condition Met, Red On, Other Not Used, Horn On	Unknown SPN [4000]	
16	Disabled			

7. Double click on an LED pair to configure the pair.

Change LED Pair Configuration

LED Pair Configuration - Alarm Group #1

LED Pair#: 1

Trigger Condition: Specific Event

Severity Level: Condition Met, Red On, Other Not Used

Suspect Parameter Number: Emergency Stop Shutdown [970]

Failure Mode Identifier:

OK Cancel

8. Select the Trigger condition for the pair in the drop down menu.

Change LED Pair Configuration

LED Pair Configuration - Alarm Group #1

LED Pair#: 1

Trigger Condition: Specific Event

Severity Level: Condition Met, Red On, Other Not Used

Suspect Parameter Number: Emergency Stop Shutdown [970]

Failure Mode Identifier:

OK Cancel

9. Select the Severity Level for the pair in the drop down menu.

Change LED Pair Configuration

LED Pair Configuration - Alarm Group #1

LED Pair#: 1

Trigger Condition: Specific Event

Severity Level: Condition Met, Red On, Other Not Used

Suspect Parameter Number:

Failure Mode Identifier:

Condition Met, Red On, Other Not Used
 Condition Met, Amber On, Other Not Used, Horn On
 Condition Met, Amber On, Red Off
 Condition Met, Red On, Amber Off
 Condition Met, Red On, Other Not Used
 Condition Met, Red On, Other Not Used, Horn On
 Condition Not Met, Amber On, Other Not Used
 Condition Not Met, Amber On, Other Not Used, Horn On
 Condition Not Met, Red On, Other Not Used
 Condition Not Met, Red On, Other Not Used, Horn On

10. Select the Suspect Parameter Number for the pair in the drop down menu.

Change LED Pair Configuration

LED Pair Configuration - Alarm Group #1

LED Pair#: 1

Trigger Condition: Specific Event

Severity Level: Condition Met, Red On, Other Not Used

Suspect Parameter Number: Emergency Stop Shutdown [970]

Failure Mode Identifier:

Accessory Data Link Fault (J1939 #2) [1231]
 Emergency Shutdown Override Mode Active Warning [1237]
 Emergency Stop Shutdown [970]
 Engine Failure to Start Shutdown [1664]
 Fuel Tank Leak [1239]
 Generator Control Not in Automatic Warning [4007]

11. The Failure Mode Identifier does not normally need to be programmed since the Severity Level typically has this information embedded.

To configure the behavior of the LED pairs, enter the LED Pair Configuration screen by selecting Service → LED Pair Configuration.

Each LED pair has four parameters associated with it. Each parameter is dependent on the parameter(s) preceding it (to the left); first Trigger Condition, next Severity Level, then Suspect Parameter Number, and finally Failure Mode Identifier (if required).

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.

File View Information Service Utilities Help				
LED Pair#	Trigger Condition	Severity Level	Suspect Parameter Number	Failure Mode Identifier
1	Specific Event	Condition Met, Red On, Other Not Used, Horn On	Emergency Stop Shutdown [970]	
2	Specific Event	Condition Met, Red On, Other Not Used, Horn On	Engine Failure to Start Shutdown [1664]	
3	Specific Event	Low Warning	Engine Coolant Temperature [110]	
4	Specific Event	High Warning or High Shutdown	Engine Coolant Temperature [110]	
5	Specific Event	Low Warning or Low Shutdown	Engine Oil Pressure [100]	
6	Specific Event	High Shutdown	Engine Speed [190]	
7	Specific Event	Low Warning or Low Shutdown	Engine Coolant Level [111]	
8	Specific Event	Low Warning or Low Shutdown	Fuel Level (Local Tank) [96]	
9	Specific Event	Condition Met, Amber On, Other Not Used	Unknown SPN [4002]	
10	Specific Event	Condition Met, Amber On, Other Not Used, Horn On	Generator Control Not in Automatic Warning [4007]	
11	Specific Event	High Warning or High Shutdown	Battery Voltage [168]	
12	Specific Event	Low Warning	Battery Voltage [168]	
13	Specific Event	Specific Diagnostic	Battery Charging System Voltage [167]	Root Cause Not Known
14	Specific Event	Low Warning	Starting Air Pressure [82]	
15	Specific Event	Condition Met, Red On, Other Not Used, Horn On	Unknown SPN [4000]	
16	Disabled			

Figure 42: Cat Service Tool CAN 2 Annunciator Led Configuration Screen

DISABLED is used to disable the LED pair. When Disabled is selected, the other three parameters cannot be changed.

SEVERITY LEVEL

Severity Level defines which types of events the LED pair will react to. Selections that begin with Condition Exists will respond to CAN 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 CAN 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) CAN 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 UENR1209 Systems Operation Testing and Adjusting Manual for a complete list of supported SPNs.

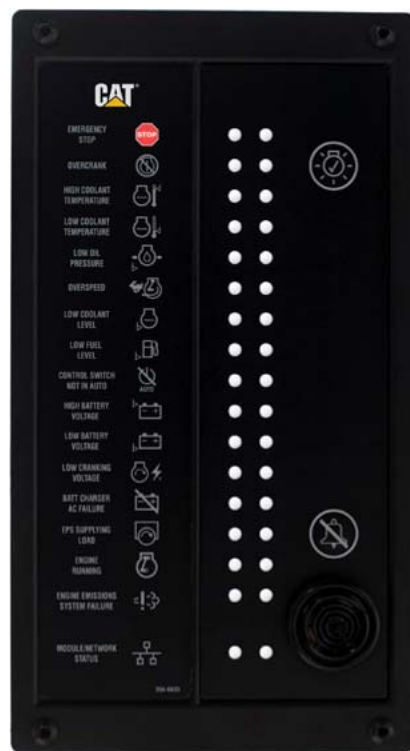
17.2 RS-485 ANNUNCIATOR (EMCP 4.2 ONLY)

The EMCP RS-485 Annunciator serves to display system alarm conditions and status indications. The RS-485 Annunciator has been designed for use on a dedicated EMCP 4 fully isolated two wire RS-485 SCADA Data Link (Half Duplex), and may be used in either Local or Remote applications, providing customers with enhanced site flexibility. The RS-485 Annunciator uses a custom master-slave communication protocol. The EMCP 4.2 controller will be the Master, and the RS-485 Annunciator(s) will be the slave(s). Configuration takes place within the EMCP 4.

In Local application, the RS-485 Annunciator may be mounted on the Package generator set with the EMCP 4 to provide a complete package-mounted monitoring solution.

The RS-485 Annunciator may also be mounted separately from the generator set to provide Remote indication of system operating and alarm conditions.

The number of RS-485 Annunciators is limited by the RS-485 standard.



ANNUNCIATOR FEATURES

The Annunciator includes:

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

An additional pair of LED's provides status indication of the dedicated RS-485 Annunciator Network communication connection

Ability to annunciate alarm conditions sent from the EMCP 4 within preconfigured alarm groups

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 LED's for site specific requirements (Custom Label provided with Custom Alarm Group #1 and #2 RS-485 Annunciator)

Superior visibility of the LED's in direct sunlight

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

Configurable with Cat ET via settings within the EMCP 4

Can be mounted either locally on the package generator set or remotely (up to 4000 feet)

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 68 mm (2.67 in) Deep

ANNUNCIATOR SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

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

Reverse voltage capability is -32 VDC for 1 hour @ 70°C

Over voltage capability is 80 VDC for 2 minutes @ 70°C

Single, 8-pin connector provides both power and communication

Designed to meet relevant European standards for EMI/RFI/Immunity without the use of external filtering

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature -40 to 70°C

Storage Temperature -50°C to +85°C

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

Failure Point 85°C. If the ambient temperature were to exceed 85°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

EMCP 4 provides a dedicated, fully isolated RS-485 SCADA Data Link (Half Duplex) separate from the RS-485 (MODBUS) port used on the EMCP 4

Operates at 19200 bits per second

Configuration is accomplished with the Cat Service Tool by connecting to the EMCP 4

RS-485 Annunciator communication is not compatible with third party devices.

RS-485 ANNUNCIATOR WIRING

The back of the RS-485 Annunciator module contains an 8-terminal screw terminal block. Attached to the block is an 8-pin Deutsch receptacle, Cat part number 3E-3388 (Deutsch DT04-08PA-E005). The mating plug is Cat part number 155-2264 (Deutsch DT06-08SA-EP08, or equivalent). The pin outs for both the receptacle and terminal block are shown in Figure 42 and Table 19 and 20.

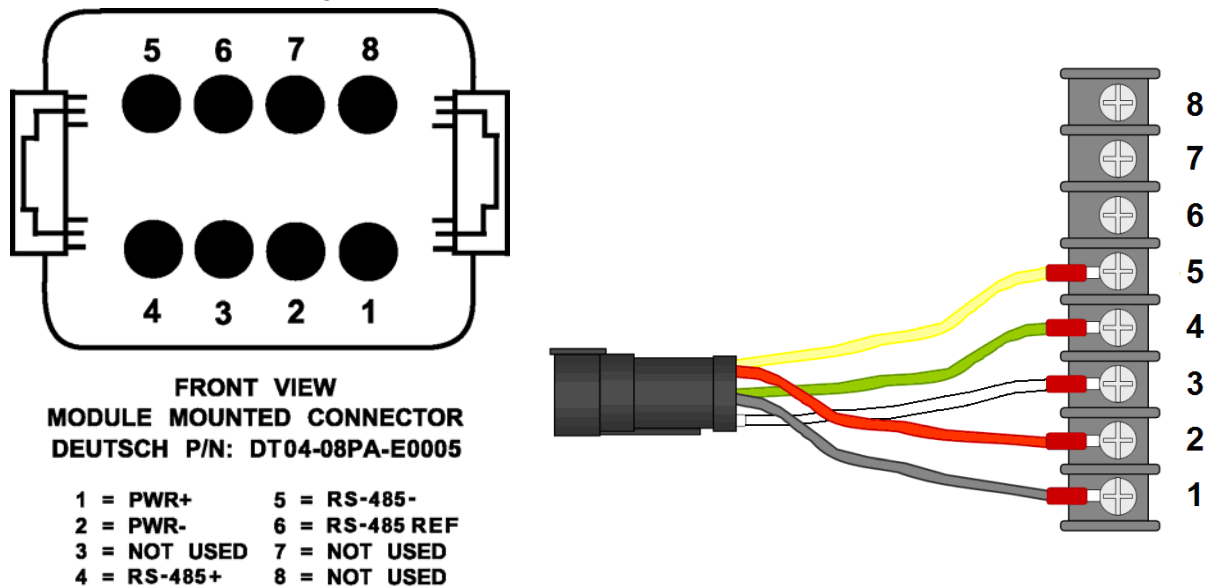


Figure 43: RS-485 Annunciator Deutsch Connector Pin Configuration and Terminal Block

RS-485 ANNUNCIATOR DEUTSCH CONNECTOR PIN CONFIGURATION		
Pin #	Function	Comments
1	BATT +	+ Battery input
2	BATT -	- Battery input
3	NOT USED	NOT USED
4	RS-485 B (+)	+ Non-Inverting Positive RS-485 input signal
5	RS-485 A (-)	- Inverting Negative RS-485 input signal
6	RS-485 R	RS-485 Reference
7	NOT USED	NOT USED
8	NOT USED	NOT USED

Table 19: RS-485 Annunciator Deutsch Connector Pin Configuration

RS-485 ANNUNCIATOR TERMINAL BLOCK PIN CONFIGURATION		
Terminal #	Function	Description
1	BATT -	- Battery input
2	BATT +	+ Battery input
3	RS-485 R	RS-485 Reference
4	RS-485 A (-)	- Inverting Negative RS-485 input signal
5	RS-485 B (+)	+ Non- Inverting Positive RS-485 input signal
6	Lamp Test SW	Lamp Test
7	Alarm ACK	Alarm Acknowledge
8	Horn Drive	Connects to negative terminal on Horn

Table 20: RS-485 Annunciator Terminal Block Pin Configuration

LED COLORS

Each pair of LED's on the RS-485 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 21 LED Colors:

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

Table 21: LED Colors

MODULE STATUS LED

A red/green pair located at the bottom of the RS-485 Annunciator, is used to report Module/Network Status. The various states indicated are explained in Table 22.

BEHAVIOR	EXPLANATION
Red solid	Data link diagnostic. For example: the module is wired wrong (Data Link), or no terminating resistor.
Green solid	Data is being received from the EMCP 4
Green flashing	Loss of communication
Red/Green flashing	No application software loaded, or Alarm Group Selection Mode is active



Table 22: Annunciator Module / Network Status LED Behavior

LAMP TEST FUNCTION

The Annunciator supports a lamp test function from a button press on the EMCP 4.

The lamp test function cycles continuously through two test modes while pressing and holding in the Lamp Test button. The first mode is a column test mode. The left column of LED's will be lit for one second while the right column is off. Then the right column of LED's will be lit for one second, while the left column is off. This will occur twice.

During the second run of this test mode (during the first cycle only), the horn will be on.

The second test mode is an individual LED test mode. In this mode, the LED's will light one at a time, starting from the top left LED, down to the left hand module status LED, then over to the right hand module status LED, then up to the top right LED. Each LED will be lit for 1/2 second, after which it will turn off and the next LED will be lit. At the completion of this test mode, the cycle will restart with the first test mode. However, on subsequent runs of the first test mode, the horn will not turn on.

The RS-485 Annunciator returns to normal operation once the lamp test button is released.

ALARM ACKNOWLEDGE

The RS-485 Annunciator supports an acknowledge event/silence horn function from a button press on the RS-485 Annunciator or from the EMCP 4. Both cases have different behavior and are outlined below.

When an active event is received from the EMCP 4 and is acknowledged locally with a button press on the RS-485 Annunciator module, any flashing LED tied to that event will stop flashing and maintain a steady illumination and the horn will be silenced.

Note: Only the local RS-485 Annunciator module that acknowledges the active event will change the state of its flashing LED(s) and silence the horn. The acknowledge signal of the annunciation is not broadcast to any other units on the RS-485 Annunciator Data Link.

When an active event is received from the EMCP 4 and is acknowledged globally with a button press on the EMCP 4 controller, it is transmitted to the RS-485 Annunciator(s) module(s). Any flashing LED tied to that event will stop flashing and maintain a steady illumination and the horn will be silenced.

Note: In this case, the EMCP 4 may acknowledge active events on multiple RS-485 Annunciators simultaneously.

The horn silence/acknowledge function will cause the local horn to be silenced until another event causes an LED to be activated.

RS-485 ANNUNCIATOR ALARM GROUPS

The RS-485 Annunciator supports four different Alarm Groups. Alarm Group 01, 02, 03, and Alarm Group 04. Two of these Alarm Groups, 03 and 04, are fixed and are not configurable and two Alarm Groups, 01 and 02, are reserved for custom event settings and are fully configurable.

Selecting which of the four Alarm Groups to configure the RS-485 Annunciator is determined by the film that is placed on the front left panel. The Alarm Groups and the events that make up the films for each of the Alarm Groups are detailed below in Tables 24, 25 and 26. Configuring the RS-485 Annunciator to one of the four Alarm Groups is accomplished through the front panel of the RS-485 Annunciator and is described further in Alarm Group Selection Mode below.

ALARM GROUP SELECTION MODE (AGSM)

The RS-485 Annunciator supports an Alarm Group Selection Mode (AGSM) that provides the ability to configure the RS-485 Annunciator to monitor a predetermined set of 32 events communicated by the EMCP 4 through the dedicated RS-485 Annunciator Data Link.

Alarm Group selection and assignment are determined by the desired functions of the RS-485 Annunciator (Custom or non-configurable) and the film that is placed on the front left panel that reflects the predefined events monitored by the RS-485 Annunciator. When in AGSM, the top first four rows of LED's will indicate which Alarm Group the RS-485 Annunciator has been assigned to by powering 'on' both LED's in each row, i.e. row 1 for Alarm Group 01, row 2 for Alarm Group 02, row 3 for Alarm Group 03, and row 4 for Alarm Group 04. (**Note:** The RS-485 Annunciator will be preprogrammed to Alarm Group 04.)

The RS-485 Annunciator will continue to communicate to the EMCP 4 while in AGSM. Events received from the EMCP 4 while in AGSM will not be annunciated until AGSM has been exited only if the event that is received is an event in the selected Alarm Group.

Once the RS-485 Annunciator has successfully been assigned to an Alarm Group, it shall receive and process any Event transmitted from the EMCP 4 to the assigned Alarm Group without power cycling the module.

The Network Status LED's will alternate flashing at a 2Hz rate at all times while in AGSM.

ENTERING AGSM

The RS-485 Annunciator shall enter AGSM by depressing the two buttons on the front panel of the RS-485 Annunciator (Lamp Test and Alarm ACK) for 3 seconds. The RS-485 Annunciator shall acknowledge entrance of AGSM by flashing the top 4 rows of LED's 4 times at a 1 second rate.

After the 3 second period has timed out, the row representing the currently assigned alarm group address will be powered on, the remaining 11 rows of LED's will not be powered on. See Table 23 AGSM LED Behavior below.

Row	Column 1	Column 2
1	Solid if Assigned to Alarm Group 01, else off	Solid if Selected to Alarm Group 01, else off
2	Solid if Assigned to Alarm Group 02, else off	Solid if Selected to Alarm Group 02, else off
3	Solid if Assigned to Alarm Group 03, else off	Solid if Selected to Alarm Group 03, else off
4	Solid if Assigned to Alarm Group 04, else off	Solid if Selected to Alarm Group 04, else off
5	Off	Off
6	Off	Off
7	Off	Off
8	Off	Off
9	Off	Off
10	Off	Off
11	Off	Off
12	Off	Off
13	Off	Off
14	Off	Off
15	Off	Off
16	Off	Off

Table 23: AGSM LED Behavior

RE-CONFIGURING/SELECTING ALARM GROUP ADDRESS

While the RS-485 Annunciator is still in AGSM it will cycle through the four Alarm Groups by pressing one of the two buttons on the front panel. Pressing the Lamp Test button will cycle up through the 4 Alarm Groups and pressing the Alarm ACK button will cycle down through the 4 Alarm Groups.

Upon reaching Alarm Group 04 (row 4) while cycling down through the Alarm Groups with the Alarm ACK button, an additional Alarm ACK button press will bring the selection to Alarm Group 01 (row 1). Upon reaching the Alarm Group 01 (row 1) while cycling up through the Alarm Groups with the Lamp Test button, an additional Lamp Test button press will bring the selection to Alarm Group 04 (row 4).

When selecting a new Alarm Group address, the left column (red LED) will represent the previously configured Alarm Group selection. The right column (amber LED) will represent the currently selected Alarm Group. When AGSM is exited, the currently selected register address will be configured as the new Alarm Group.

EXITING AGSM

The Annunciator will exit AGSM under two possible conditions:

- A time out period without any button presses
- Pressing and holding the two buttons (ACK and Horn buttons) for 3 seconds

After a period of 15 seconds without any button presses, the RS-485 Annunciator will automatically exit AGSM and disregard any changes made to the Alarm Group selection and remain configured to the Alarm Group prior to entering AGSM.

When an Alarm Group selection has been made and the two buttons are pressed (Lamp Test and Alarm ACK) and held in continuously for 3 seconds, the RS-485 Annunciator will update the current configured Alarm Group to the current selected Alarm Group and then exit AGSM. Be sure to pay attention to confirm that the group being saved is the correct Alarm Group.

After exiting AGSM under either one of the two exit conditions listed, the RS-485 Annunciator will flash all 16 rows of LED's for 3 seconds at which time the RS-485 Annunciator will enter regular annunciation mode.

RS-485 ANNUNCIATOR CUSTOM ALARM GROUP CONFIGURATION

The RS-485 Annunciator is field-programmable by the EMCP 4 via the Cat Service Tool when configured for Alarm Group's 01 and 02. Alarm Group's 01 and 02 support customization of the 32 events for the 16 LED's.

The service tool software must be installed on a Windows PC. The Cat communication adapter must be connected between the PC and the CAN Primary data link on which the target EMCP 4 is connected.

CUSTOM ALARM GROUP SELECTION

When the Cat Service Tool is communicating, the EMCP 4 shall be selected as the target module. Located at the top of the Cat Service Tool screen is the tool bar, select Service → RS-485 Annunciator. The RS-485 Annunciator configuration screen will be displayed with the Alarm Group Select at the top left of the screen. There are two possible selections for Alarm Groups: #1 and #2.

To configure the RS-485 Annunciator LED's, select each of the LED's individually. With the selected LED window displayed the initial selection is for 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.

DISABLED is used to disable the LED pair. When Disabled option is selected, the other three parameters cannot be changed.

SEVERITY LEVEL

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

For example, LED pair #1 is configured for Condition Exists, Red On, Other Not Used, Horn On with SPN 970 (Emergency Stop Active). This means that when the RS-485 Annunciator receives data from the EMCP 4 over the RS-485 Annunciator Data Link 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) 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 the choice made in the Severity Level column, the FMI column is grayed out for any of these selections.

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

SUSPECT PARAMETER NUMBER

The Suspect Parameter Number column is used to select one of the listed SPN's in the drop down menu or type in a specific SPN number for an SPN that may not be listed in the drop down menu for the parameter assigned to the LED pair. Most supported SPNs can be selected from the list.

ENGINE RUNNING

When configuring the RS-485 Annunciator for ENGINE RUNNING, special consideration must be taken to trigger the event. The event can be triggered in a variety of ways. A selection of Engine Running trigger conditions is provided in ET and on the EMCP display.

Event Response Configuration	Event Response Configuration - Other System Events	
Event Response Configuration	Event Response Configuration - Custom Events	
Event System	Event System	
Fuel Transfer	Engine Running Conditions - Custom Event Digital Input	Activate
Generator AC Monitor	Engine Running Conditions - Engine Running	Do Not Activate
Generator AC Power Monitor	Engine Running Conditions - Volts/Hertz within Limits	Do Not Activate
Generator Current Monitor	Engine Running Conditions - Engine Running at Rated Speed	Do Not Activate
Generator Over/Under Frequency	Fuel Transfer	
Generator Over/Under Voltage	Generator AC Monitor	

Figure 44: Cat Service Tool Engine Running Conditions Configuration Screen

ENG RUN LAMP
CONDITIONS

VIEW EDIT

☒ DIG IN #1 (SPN 701)
☒ ENGINE RUNNING
☐ V&Hz WITHIN LIMITS

☐ RUNNING AT RATED

Figure 45: EMCP 4.2 Display Engine Running Conditions Configuration Screen

The Engine Running Conditions are logically combined together such that any selection will activate the condition and consist of the following options:

- Custom Event Digital Input (SPN 701)
- Engine Running (based on Engine Overview state with non-zero engine speed)
- V/Hz Within Limits (unit is close to rated voltage and rated frequency)
- Engine Running at Rated Speed (Engine Running, not in Idle, not in Cooldown)

For using the Custom Event Digital Input trigger condition, the SPN shall be configured for Auxiliary I/O #1 (SPN 701) and it shall have a Severity Level configured for any one of the Condition Met setpoints. Digital Input #1 shall be physically wired to the active status signal that is to be used to trigger this programmed LED. If it is only to be based upon the status of the generator set controlled by the EMCP, then an output such as Relay Output #2, Fuel Control Relay, or Engine Start Initiated for Common Engine Interface generator sets on the EMCP 4 can be used. The Fuel Control Relay or Engine Start Initiated active status signal is continually active only while the engine is in running.

Alarm Group #3 has LED #15 pre-configured for Engine Running and requires selecting one or multiple Engine Running Conditions to trigger an Engine Running event on the RS-485 Annunciator. If using a custom Alarm Group, use SPN 4244 and Severity Level of Condition Met.

Change LED Pair Configuration

LED Pair Configuration - Alarm Group #1

LED Pair#: 15

Trigger Condition: Specific Event

Severity Level: Condition Met, Green On, Other Not Used

Suspect Parameter Number: Engine Running [4244] # 4244

Failure Mode Identifier:

OK Cancel

Figure 46: RS-485 Annunciator Custom Alarm Group Engine Running LED Configuration

ALARM GROUPS

The RS-485 Annunciator is capable of being configured for one of four Alarm Groups. Two of these Alarm Groups are fixed, two are configurable. Selection of the Alarm Group to be used is accomplished by using the front panel of the RS-485 Annunciator module as explained above in Alarm Group Selection Mode (AGSM).

The assignment of films for each of the Alarm Groups is outlined below:

Alarm Group # 1 (Custom Configurable 1) - Film #1 (see Table 24) and custom film

Alarm Group # 2 (Custom Configurable 2) - Film #1 (see Table 24) and custom film

Alarm Group # 3 (Fixed) - Film #1 (see Table 24)

Alarm Group # 4 (Fixed) - Film #2, or Film #3 (see Tables 25 and 26)

Note: Alarm Groups #1 and #2 are blank until configured.

Row	LED Colors	Default LED and Setpoint Assignments	Horn
1	Red	E-Stop Shutdown	Y
	Amber	Not Used	NA
2	Red	Overcrank	Y
	Amber	Not Used	NA
3	Red	High Coolant Temp Shutdown	Y
	Amber	High Coolant Temp Warning	Y
4	Red	Not Used	NA
	Amber	Low Coolant Temp Warning	Y
5	Red	Low Oil Pressure Shutdown	Y
	Amber	Low Oil Pressure Warning	Y
6	Red	Overspeed Shutdown	Y
	Green	Not Used	NA
7	Red	Low Coolant Level Shutdown	Y
	Amber	Low Coolant Level Warning	Y
8	Red	Low Fuel Level Shutdown	Y
	Amber	Low Fuel Level Warning	Y
9	Red	Not Used	NA
	Amber	Generator Not in Auto Warning	Y
10	Red	High Battery Voltage Shutdown	Y
	Amber	High Battery Shutdown Warning	Y
11	Red	Not Used	NA
	Amber	Low Battery Voltage Warning	Y
12	Red	Not Used	NA
	Amber	Low Cranking Voltage Warning	Y
13	Green	Not Used	NA
	Amber	Battery Charger AC Failure	Y
14	Green	Not Used	NA
	Amber	EPS Supplying Load	N
15	Red	Not Used	NA
	Green	Engine Running	N
16	Red	SCR – Tier 4	Y
	Amber	SCR – Tier 4	Y

Table 24: Film #1. Alarm Group 01 & 02 default film and Alarm Group 03 film assignments.

NFPA 99/110 events. Includes Fuel Level, Engine Running, and Tier 4 SCR events

Row	LED Colors	Default LED and Setpoint Assignments	Horn
1	Red	E-Stop Shutdown	Y
	Amber	Not Used	NA
2	Red	Overcrank	Y
	Amber	Not Used	NA
3	Red	High Coolant Temp Shutdown	Y
	Amber	High Coolant Temp Warning	Y
4	Red	Not Used	NA
	Amber	Low Coolant Temp Warning	Y
5	Red	Low Oil Pressure Shutdown	Y
	Amber	Low Oil Pressure Warning	Y
6	Red	Overspeed Shutdown	Y
	Green	Not Used	NA
7	Red	Low Coolant Level Shutdown	Y
	Amber	Low Coolant Level Warning	Y
8	Red	Low Fuel Level Shutdown	Y
	Amber	Low Fuel Level Warning	Y
9	Red	Not Used	NA
	Amber	Generator Not in Auto Warning	Y
10	Red	High Battery Voltage Shutdown	Y
	Amber	High Battery Shutdown Warning	Y
11	Red	Not Used	NA
	Amber	Low Battery Voltage Warning	Y
12	Red	Not Used	NA
	Amber	Low Cranking Voltage Warning	Y
13	Green	Not Used	NA
	Amber	Battery Charger AC Failure	Y
14	Green	Not Used	NA
	Amber	EPS Supplying Load	N
15	Red	Air Damper Shutdown	Y
	Green	Not Used	NA
16	Red	SCR – Tier 4	Y
	Amber	SCR – Tier 4	Y

Table 25: Film #2. Alarm Group 04. NFPA 99/110 events.

Includes Fuel Level, Air Damper Shutdown, and Tier 4 SCR events.

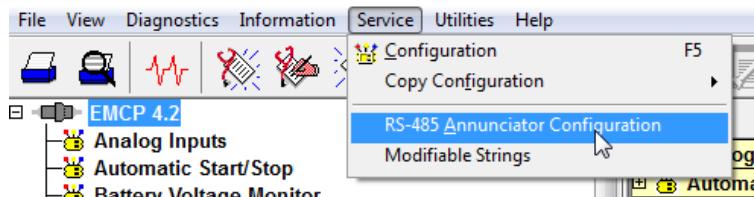
Row	LED Colors	Default LED and Setpoint Assignments	Horn
1	Red	E-Stop Shutdown	Y
	Amber	Not Used	NA
2	Red	Overcrank	Y
	Amber	Not Used	NA
3	Red	High Coolant Temp Shutdown	Y
	Amber	High Coolant Temp Warning	Y
4	Red	Not Used	NA
	Amber	Low Coolant Temp Warning	Y
5	Red	Low Oil Pressure Shutdown	Y
	Amber	Low Oil Pressure Warning	Y
6	Red	Overspeed Shutdown	Y
	Green	Not Used	NA
7	Red	Low Coolant Level Shutdown	Y
	Amber	Low Coolant Level Warning	Y
8	Red	Low Fuel Level Shutdown	Y
	Amber	Low Fuel Level Warning	Y
9	Red	Not Used	NA
	Amber	Generator Not in Auto Warning	Y
10	Red	High Battery Voltage Shutdown	Y
	Amber	High Battery Shutdown Warning	Y
11	Red	Not Used	NA
	Amber	Low Battery Voltage Warning	Y
12	Red	Not Used	NA
	Amber	Low Cranking Voltage Warning	Y
13	Green	Not Used	NA
	Amber	Battery Charger AC Failure	Y
14	Green	Not Used	NA
	Amber	EPS Supplying Load	N
15	Red	Air Damper Shutdown	Y
	Green	Not Used	NA
16	Red	Not Used	NA
	Amber	Not Used	NA

Table 26: Film #3. Alarm Group 04 film assignments. NFPA 99/110 events.

Includes Fuel Level and Air Damper Shutdown. Does not include Tier 4 SCR

CONFIGURING CUSTOM ALARM GROUPS USING CAT SERVICE TOOL

1. Connect to the EMCP 4 using the Cat Service Tool as stated in Chapter 4.2.
2. Select Service > RS-485 Annunciator Configuration.

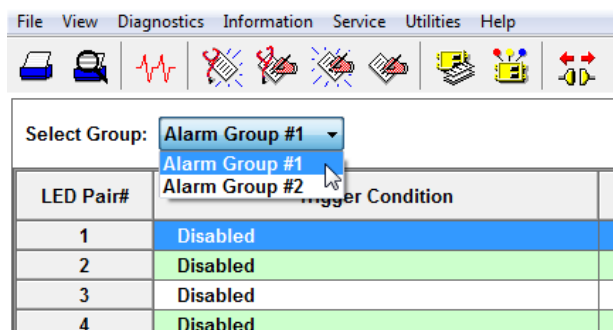


Note: This option will not appear if the EMCP 4 was not selected in the ECM Summary Screen when connecting to Cat ET.

3. The LED pairs will become visible in a new window.

File View Diagnostics Information Service Utilities Help				
Select Group: Alarm Group #1				
LED Pair#	Trigger Condition	Severity Level	Suspect Parameter Number	Failure Mode Identifier
1	Specific Event	Condition Met, Red On, Other Not Used	Emergency Stop Shutdown [970]	
2	Disabled			
3	Disabled			
4	Disabled			
5	Disabled			
6	Disabled			
7	Disabled			
8	Disabled			
9	Specific Event	Condition Met, Amber On, Other Not Used	Generator Control Not In Automatic Start State [4007]	
10	Disabled			
11	Disabled			
12	Disabled			
13	Disabled			
14	Disabled			
15	Disabled			
16	Disabled			

4. Select the Alarm Group for the Annunciator by choosing from the drop down menu.



5. Double click on an LED pair to configure the pair.

Change LED Pair Configuration

LED Pair Configuration - Alarm Group #1

LED Pair#: 1

Trigger Condition: Specific Event

Severity Level: Condition Met, Red On, Other Not Used

Suspect Parameter Number: Emergency Stop Shutdown [970] # 970

Failure Mode Identifier:

OK Cancel

6. Select the Trigger condition for the pair in the drop down menu.

Change LED Pair Configuration

LED Pair Configuration - Alarm Group #1

LED Pair#: 1

Trigger Condition: Specific Event

Severity Level: Condition Met, Red On, Other Not Used

Suspect Parameter Number: Emergency Stop Shutdown [970] # 970

Failure Mode Identifier:

OK Cancel

7. Select the Severity Level for the pair in the drop down menu.

Change LED Pair Configuration

LED Pair Configuration - Alarm Group #1

LED Pair#: 1

Trigger Condition: Specific Event

Severity Level: Condition Met, Red On, Other Not Used

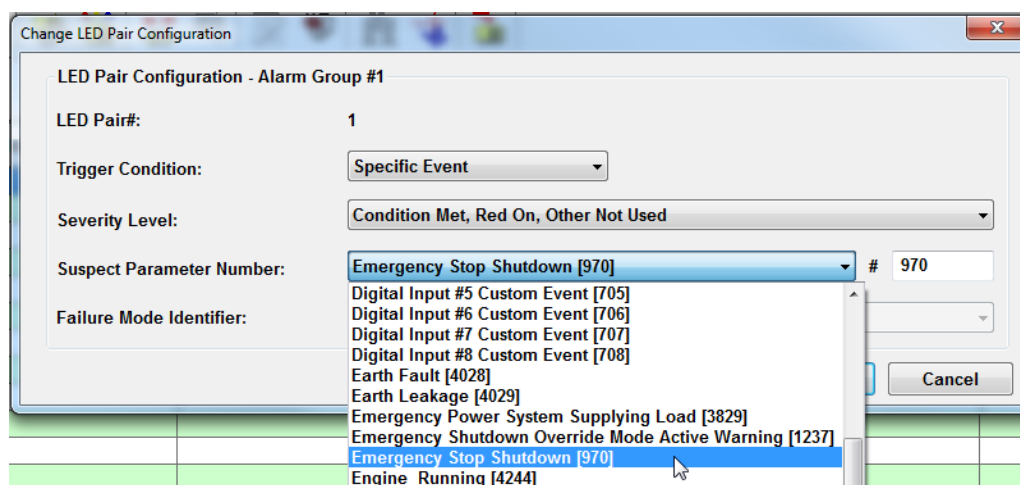
Suspect Parameter Number: Emergency Stop Shutdown [970] # 970

Failure Mode Identifier:

OK Cancel

For a complete list of choices for Severity Level, see the tables below.

8. Select the Suspect Parameter Number for the pair in the drop down menu.



For a complete list of choices for Suspect Parameter Number, see the tables below.

9. The Failure Mode Identifier does not normally need to be programmed since the Severity Level typically has this information embedded. See information below for a Diagnostic SPN.

If the LED Trigger Condition is configured as General Event, the Severity Level can be configured according to Table 27.

Trigger Condition Severity Level	Allowed for LED Pairs...		
	1-5, 7-12, 16	13-14	6, 15
Low Warning	√	√	
Low Shutdown	√		√
High Warning	√	√	
High Shutdown	√		√
High or Low Warning	√	√	
High or Low Shutdown	√		√
Low Warning or Low Shutdown	√		
High Warning or High Shutdown	√		
High or Low Warning, High or Low Shutdown	√		
High or Low Warning, High or Low Shutdown or Diagnostic	√	√	√
Diagnostic Other Than Warning/Shutdown/Condition Exists	√	√	

Table 27: General Event Severity Levels

If the LED Trigger Condition is configured as Specific Event, the Severity Level can be configured according to Table 28.

Trigger Condition Severity Level	Allowed for LED Pairs...		
	1-5, 7-12, 16	13-14	6, 15
Low Warning	√	√	
Low Shutdown	√		√
High Warning	√	√	
High Shutdown	√		√
High or Low Warning	√	√	
High or Low Shutdown	√		√
Low Warning or Low Shutdown	√		
High Warning or High Shutdown	√		
High or Low Warning, High or Low Shutdown	√		
High or Low Warning, High or Low Shutdown or Diagnostic	√	√	√
Diagnostic Other Than Warning/Shutdown/Condition Exists	√	√	
Specific Diagnostic	√	√	√
Condition Exists, Red On, Other Not Used	√		√
Condition Exists, Amber On, Other Not Used	√	√	
Condition Exists, Green On, Other Not Used		√	√
Condition Exists, Red On, Amber Off	√		
Condition Exists, Red On, Green Off			√
Condition Exists, Amber On, Red Off	√		
Condition Exists, Amber On, Green Off		√	
Condition Exists, Green On, Red Off			√
Condition Exists, Green On, Amber Off		√	
Condition Does Not Exist, Red On, Other Not Used	√		√
Condition Does Not Exist, Amber On, Other Not Used	√	√	
Condition Does Not Exist, Green On, Other Not Used		√	√
Condition Exists, Red On, Other Not Used, Horn On	√		√
Condition Exists, Amber On, Other Not Used, Horn On	√	√	
Condition Exists, Green On, Other Not Used, Horn On		√	√
Condition Does Not Exist, Red On, Other Not Used, Horn On	√		√
Condition Does Not Exist, Amber On, Other Not Used, Horn On	√	√	
Condition Does Not Exist, Green On, Other Not Used, Horn On		√	√

Table 28: Specific Event Severity Levels

For Trigger Condition Severity Level listed in the table above from 'Low Warning' to 'Specific Diagnostic' the following Suspect Parameter Number options can be used:

Suspect Parameter Number Text	Value
Fuel Level (External Tank)	38
Aftercooler Temperature	52
Starting Air Pressure	82
Fuel Filter Differential Pressure	95
Fuel Level (Local Tank)	96
Engine Oil Level	98
Oil Filter Differential Pressure	99
Engine Oil Pressure	100
Crankcase Pressure	101
Air Filter Differential Pressure	107
Barometric Pressure	108
Engine Coolant Temperature	110
Engine Coolant Level	111
Battery Voltage (switched)	158
Battery Charging System Voltage	167
Battery Voltage	168
Ambient Air Temperature	171
Inlet Air Temperature	172
Exhaust Temperature	173
Engine Oil Temperature	175
Engine Speed	190
Long Distance Annunciator Data Link Fault (Root Cause Not Known)	625
Primary Data Link Fault	639
Emergency Stop Shutdown	970
Analog Input #1 Custom Parameter	1083
Analog Input #2 Custom Parameter	1084
Generator Rear Bearing Temperature	1122
Generator Front Bearing Temperature	1123
Generator Winding Temperature #1	1124
Generator Winding Temperature #2	1125
Generator Winding Temperature #3	1126
Accessory Data Link Fault	1231
Unexpected Engine Shutdown	1383
Right Exhaust Temperature	2433
Left Exhaust Temperature	2434
Generator Frequency	2436
Generator AC Voltage	2440

Suspect Parameter Number Text	Value
Generator AC Current	2448
Generator Real Power (kW)	2452
Generator Reactive Power (kVAr)	2456
Generator to Bus Synchronization Failure (Low)	2529
Dead Bus Arbitration Failure (Low)	2530
Engine Controller (Abnormal Update Rate)	3543
Modbus Data Link	3581
Generator Breaker Closed	4004
Generator Breaker Open	4013
Utility to Generator Transfer Failure (High)	4015
Analog Input #4 Custom Parameter	4157
Analog Input #3 Custom Parameter	4158
Cranking Voltage	4256

For the Trigger Condition Severity Levels listed in the table above from 'Condition Exists, Red On, other Not Used' to 'Condition Does Not Exist, Green On, other Not used, Horn On' the following Suspect Parameter Number options can be used:

Suspect Parameter Number Text	Value
Digital Input # 1 Custom Event	701
Digital Input # 2 Custom Event	702
Digital Input # 3 Custom Event	703
Digital Input # 4 Custom Event	704
Digital Input # 5 Custom Event	705
Digital Input # 6 Custom Event	706
Digital Input # 7 Custom Event	707
Digital Input # 8 Custom Event	708
Isolated Digital Input #1 Custom Event	3920
Isolated Digital Input #2 Custom Event	3921
Isolated Digital Input #3 Custom Event	3922
Isolated Digital Input #4 Custom Event	3923
Emergency Stop Shutdown	970
Emergency Shutdown Override Mode Active	1237
Fuel Tank Leak	1239
Engine Failure to Start	1664
Service Interval Warning	2648
Generator Unavailable to Start/Run	3677
EPS Supplying Load	3829
Air Damper Closed	4000
ATS in Normal Position	4001
ATS in Emergency Position	4002
Battery Charger Failure	4003
Generator Breaker Closed	4004
Utility Breaker Closed	4005
Engine in Cooldown	4006
Generator Control Not in Automatic Warning	4007
Generator Breaker Failure to Open	4009
Generator Breaker Failure to Close	4011
Generator Breaker Open	4013
Loss of Utility	4017
Generator Breaker Locked Out	4018
Utility Breaker Locked Out	4019
Bus Phase Sequence Incorrect	4024
Generator Phase Sequence Incorrect	4025
Earth Fault	4028
Earth Leakage	4029
Engine Running	4244

If the Trigger Condition Severity Level is programmed for Diagnostic, then the Failure Mode Identifier for any pair of LED's can be configured as any of the following:

Data Erratic, Intermittent, or Incorrect	Abnormal Rate of Change
Voltage Above Normal, or Shorted to High Source	Root Cause Not Known
Voltage Below Normal, or Shorted to Low Source	Bad Intelligent Device or Component
Current Below Normal or Open Circuit	Out Of Calibration
Current Above Normal or Grounded Circuit	Special Instructions
Mechanical System Not Responding or Out of Adjustment	Received Network Data In Error
Abnormal Frequency or Pulse Width or Period	Data Drifted High
Abnormal Update Rate	Data Drifted Low

17.3 THERMOCOUPLE MODULE (EMCP 4.2 ONLY)

THERMOCOUPLE FEATURES

Reads up to 20 Type J or K thermocouple inputs

Temperatures are configured to indicate the SAE CAN 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 47).



THERMOCOUPLE SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

Accept 5-32 VDC power (12 or 24 VDC nominal)

Over voltage capability is 32 VDC 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

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

ENVIRONMENTAL SPECIFICATIONS

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

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

NETWORK COMMUNICATIONS INTERFACE

Capable of operating on the EMCP 4 Accessory CAN (2) data link

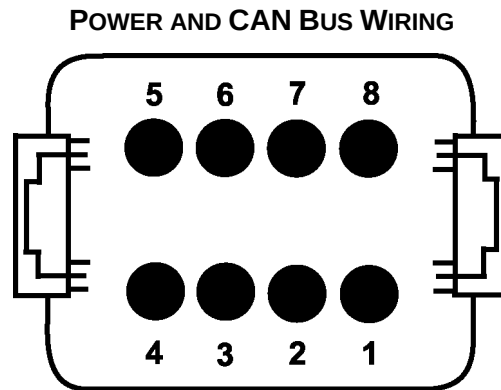
Optical isolation is provided for the CAN line

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 4 or Service Tool when the EMCP 4 is not available; synchronization time is accurate to within 1 second

Includes a watchdog timer to atomically reboot should the microprocessor lock

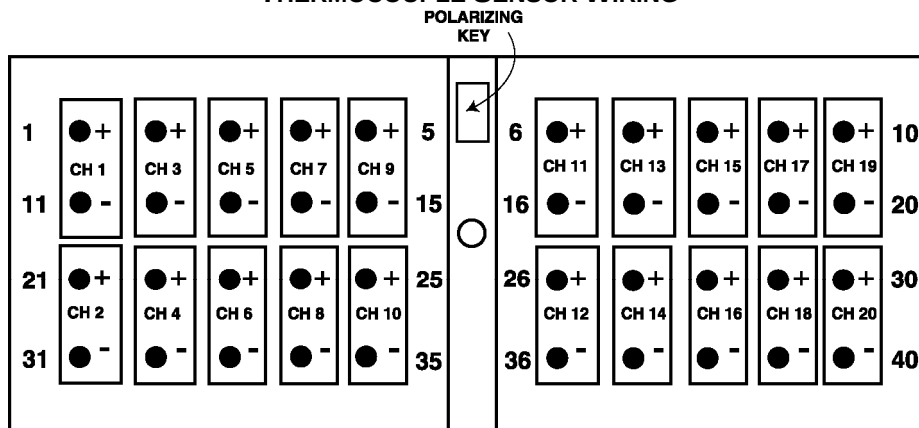
Module operates normally with loss of communication link, retaining configured values and error codes in non-volatile memory

Configuration and firmware updates are accomplished with the Cat Service Tool over the CAN network

THERMOCOUPLE 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

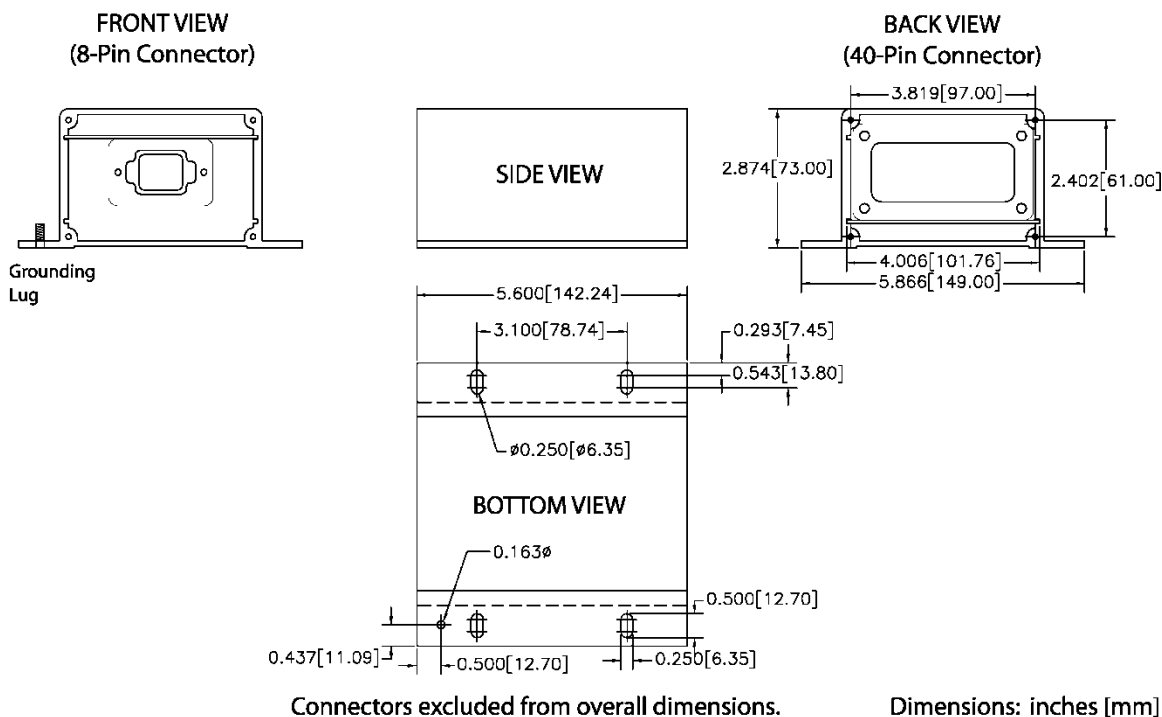


Figure 47: Thermocouple, RTD, And Discrete I/O Module Physical Layout

THERMOCOUPLE MODULE – CONFIGURATION

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

The service tool software must be installed on a Windows PC. The Cat communication adapter must be connected between the PC and the CAN 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 48.

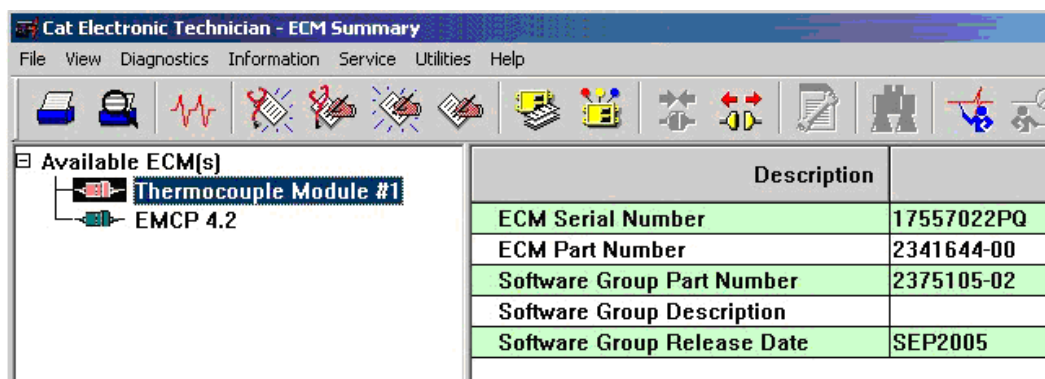


Figure 48: Cat Service Tool Thermocouple Module Summary Screen

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

Figure 49 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.

Note: ECU Instance #1 is reserved for the Accessory Data Link (CAN 2), while ECU Instance #2 is reserved for the Primary Data Link (CAN 1).

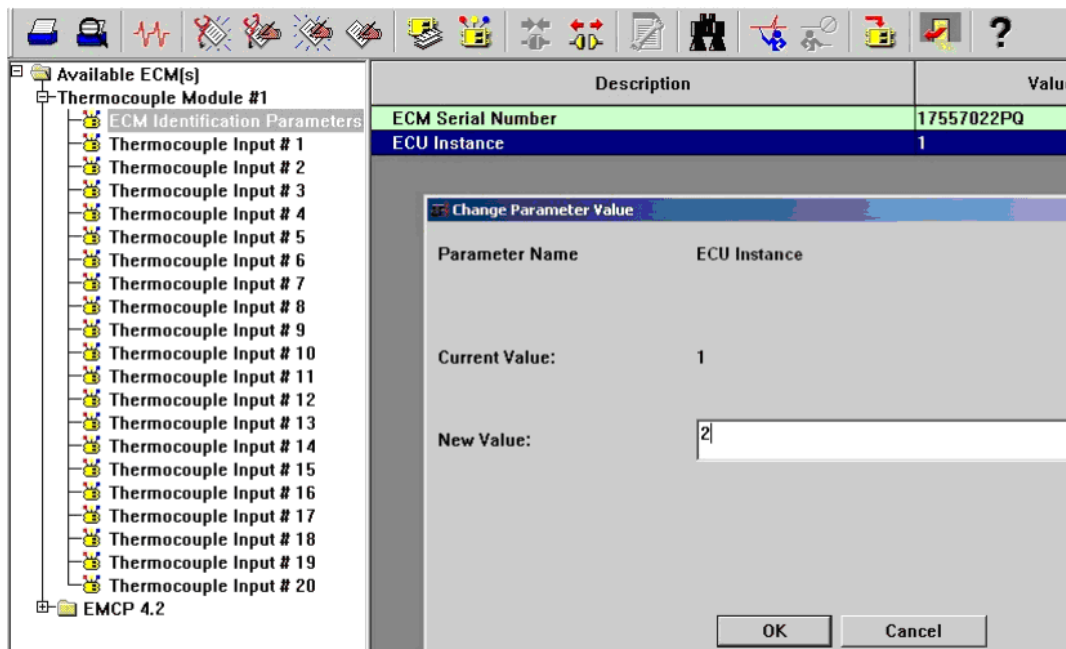


Figure 49: Cat Service Tool Thermocouple Module Identification Parameters

Upon changing the ECU instance, the Cat 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 50, 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.

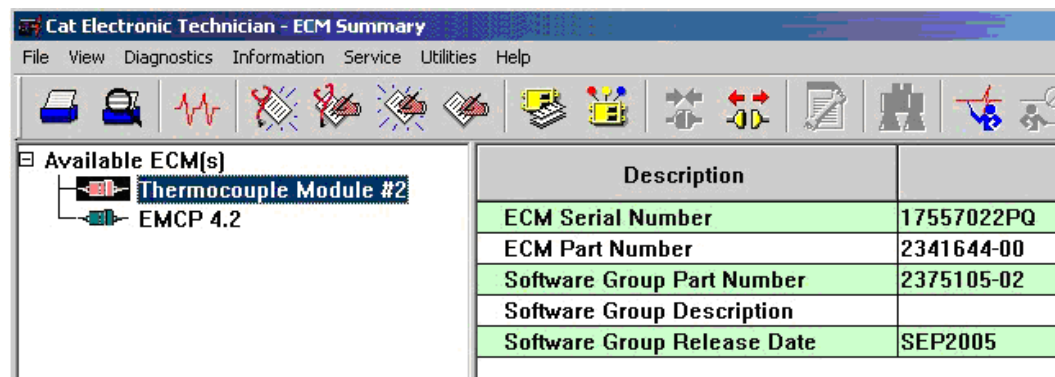
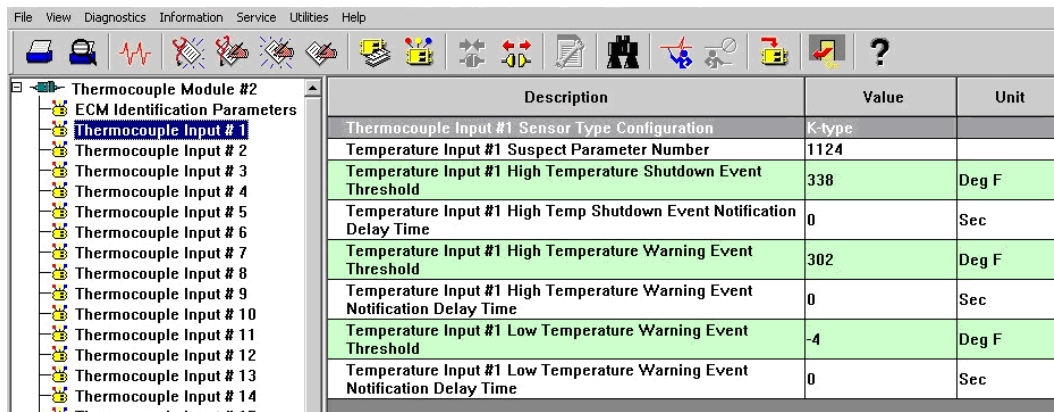


Figure 50: Cat Service Tool Thermocouple Module After ECU Instance Change

CONFIGURING THERMOCOUPLE INPUTS

Figure 51 shows the **THERMOCOUPLE INPUT #1** Configuration list, when using the Cat 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 51: Cat 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. Reference the TC Module specification sheet (LEHE0126) for available Temperature Inputs.

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 52. See UENR1209 for specific information on what possible SPN values can be used.

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

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

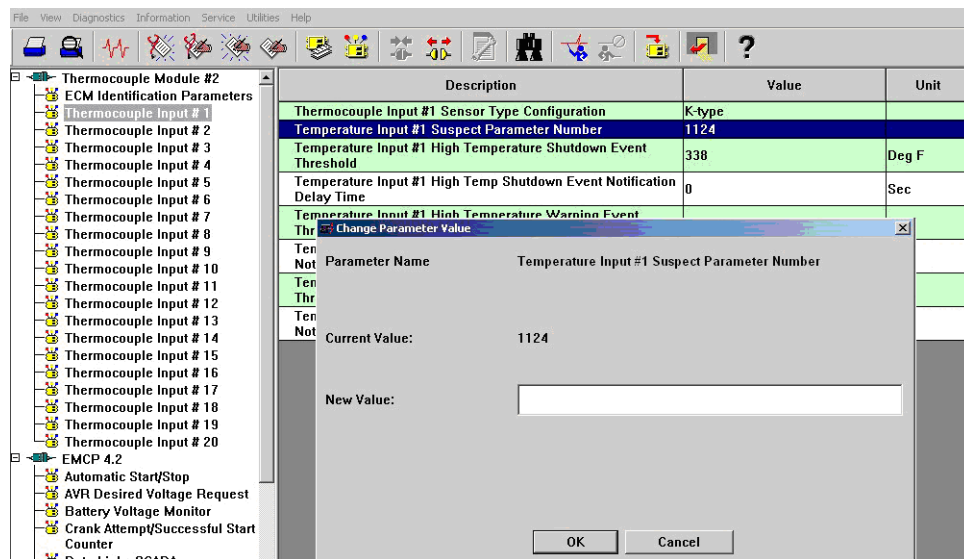


Figure 52: Cat Service Tool Thermocouple Module Suspect Parameter Number

The **LOW TEMPERATURE WARNING EVENT THRESHOLD** sets the 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.

17.4 RTD MODULE (EMCP 4.2 ONLY)

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 15M Ohm/°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 53)



RTD SPECIFICATIONS**ELECTRICAL SPECIFICATIONS**

Accept 5-32 VDC power (12 or 24 VDC nominal)

Over voltage capability is 32 VDC 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 VDC 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

Designed to meet relevant European standards for EMI/RFI/Immunity without the use of external filtering

ENVIRONMENTAL SPECIFICATIONS

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

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

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

Protected against 95% humidity non-condensing, 30°C to 60°C

NETWORK COMMUNICATIONS INTERFACE

Operates on the EMCP 4 Accessory CAN Data Links

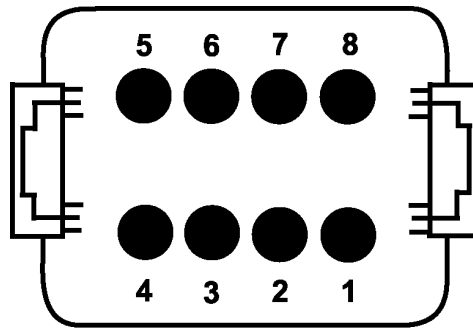
Optical isolation is provided for the CAN line

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 4 or Service Tool when the GSC is not available; synchronization time is accurate to within 1 second

Includes a watchdog timer

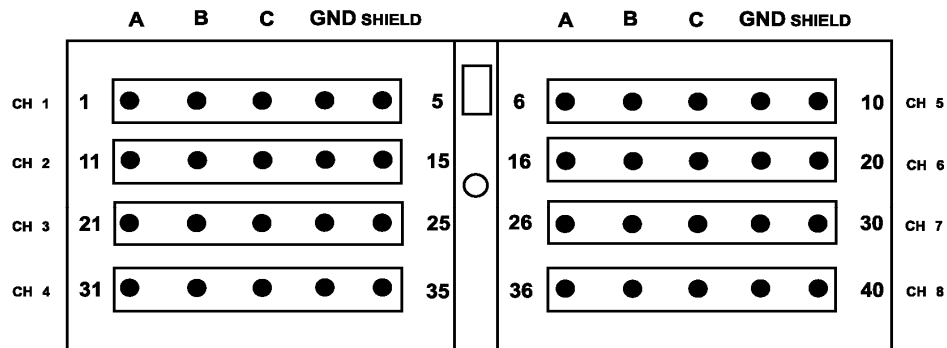
Module operates normally with loss of communication link, retaining configured values and error codes in non-volatile memory

Configuration and firmware updates are accomplished with the Cat Service Tool over the CAN network

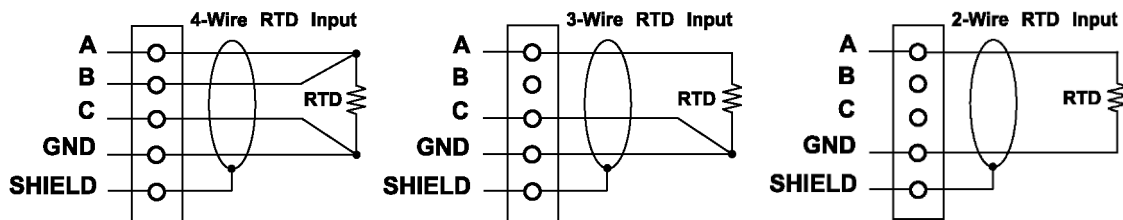
RTD WIRING**POWER AND CAN BUS WIRING**

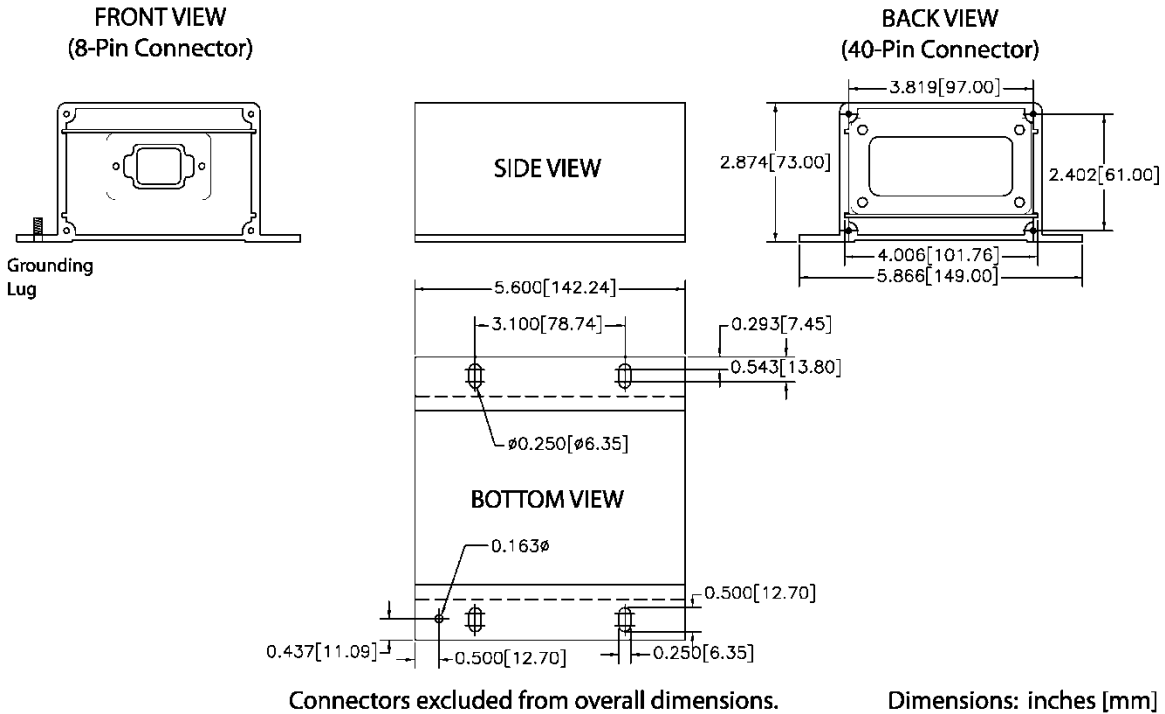
**FRONT VIEW
MODULE MOUNTED CONNECTOR
DEUTSCH P/N: DT13-08PA**

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

RTD SENSOR WIRING

**FRONT VIEW OF
MODULE MOUNTED CONNECTOR**

RTD WIRING TYPICAL CONNECTIONS

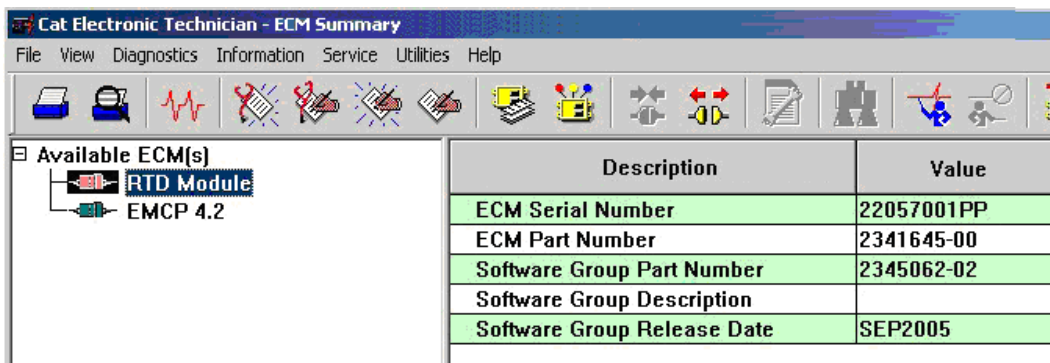
RTD PHYSICAL LAYOUT**Figure 53: Thermocouple, RTD, And Discrete I/O Module Physical Layout****RTD MODULE – CONFIGURATION**

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

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

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

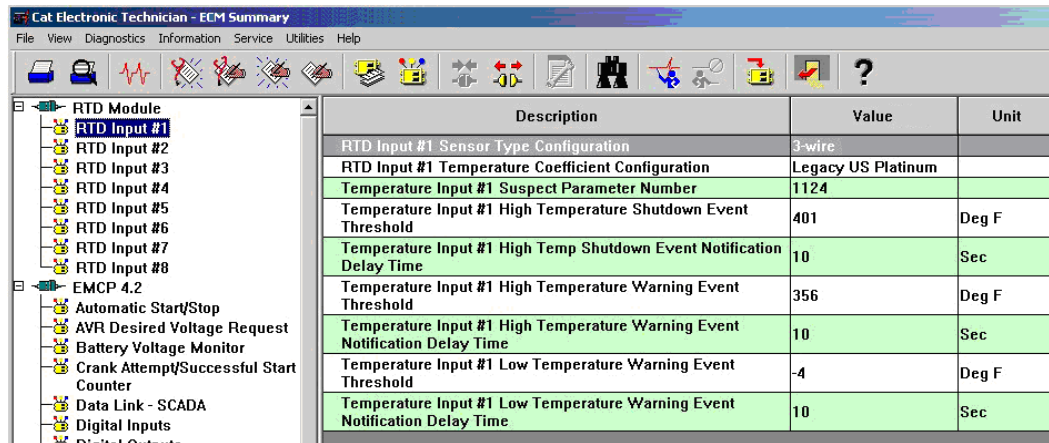
When connecting to the RTD module, the user will first see the Module Summary screen shown in Figure 54.

**Figure 54: Cat 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 55. All eight RTD inputs have identical parameters and options.



The screenshot shows the 'Cat Electronic Technician - ECM Summary' window. On the left is a tree view with 'RTD Module' expanded, showing 'RTD Input #1' through 'RTD Input #8'. Below that are 'EMCP 4.2' settings like 'Automatic Start/Stop', 'AVR Desired Voltage Request', 'Battery Voltage Monitor', 'Crank Attempt/Successful Start Counter', 'Data Link - SCADA', 'Digital Inputs', and 'Digital Outputs'. The main pane displays a table for 'RTD Input #1' configuration.

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 55: Cat 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. Reference the RTD Module specification sheet (LEHE0124) for available Temperature Inputs.

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 to the desired parameter as shown in Figure 56. See UENR1209 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.

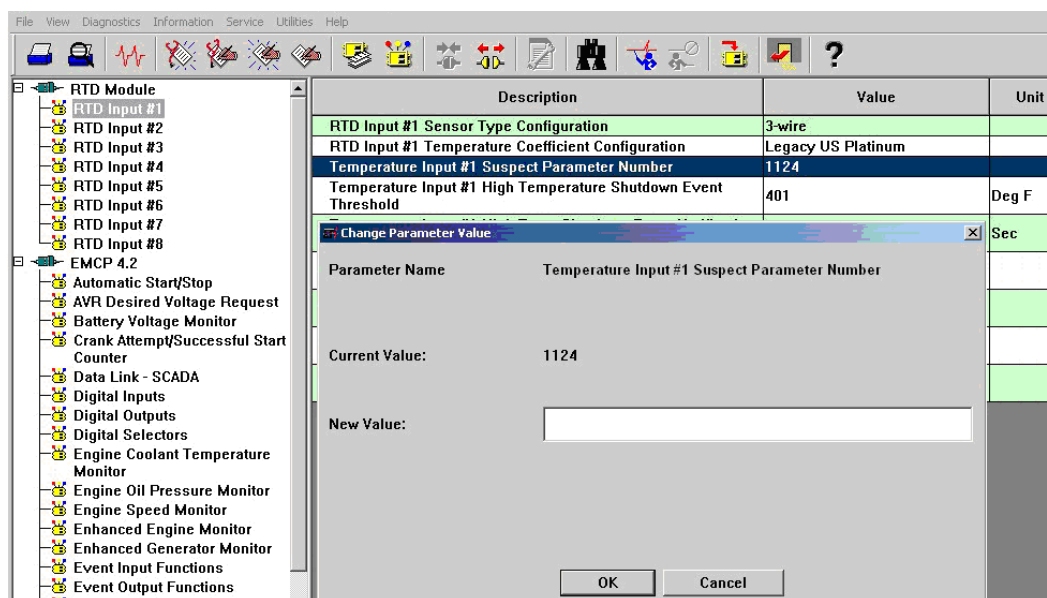


Figure 56: Cat Service Tool RTD Module Suspect Parameter Number

17.5 DISCRETE I/O MODULE (EMCP 4.2 ONLY)

The EMCP 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 4.2 Accessory CAN 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 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 57)



DISCRETE I/O SPECIFICATIONS**ELECTRICAL SPECIFICATIONS**

Accept 5-32 VDC power (12 or 24VDC nominal)

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

Resistive Loads rated for 3A@30 VDC

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

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

Maximum current draw of 400mA + 50mA per energized relay @ 12VDC/24VDC

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

ENVIRONMENTAL SPECIFICATIONS

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

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

NETWORK COMMUNICATIONS INTERFACE

Operates on the EMCP 4.2 Accessory CAN Data Link

Node address is auto configurable

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 4 or Service Tool when the GSC is not available; synchronization time is accurate to within 1 second

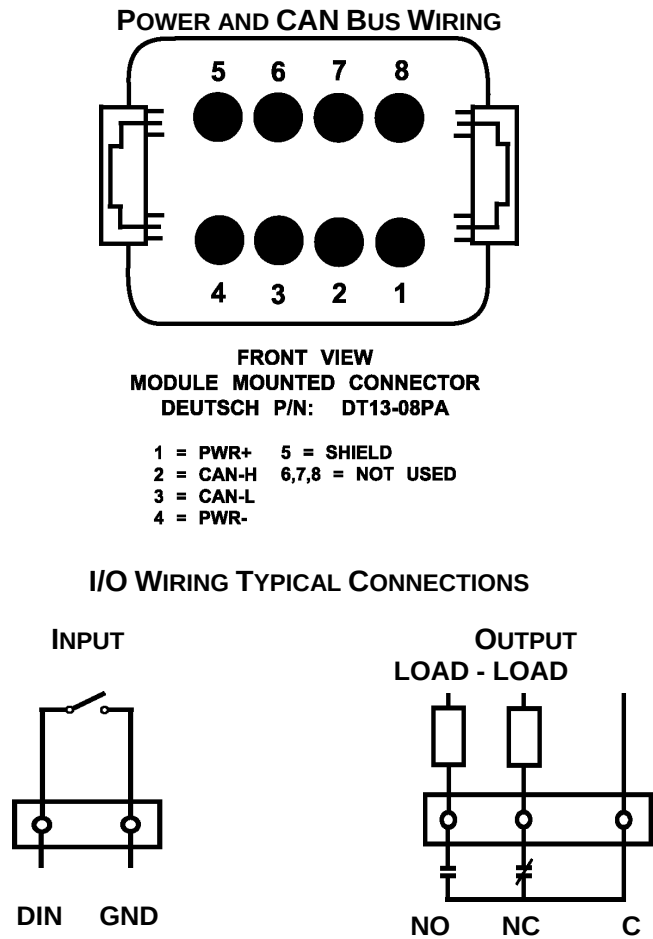
Includes a watchdog timer to automatically reboot should the microprocessor lock

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 Cat Service Tool over the CAN network

Monitored parameters and alarms are read-only over the network

DISCRETE I/O WIRING



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		

Table 29: Discrete I/O

Note: The GND pin is not the package ground, but the Isolated Reference for the module.

DISCRETE I/O PHYSICAL LAYOUT

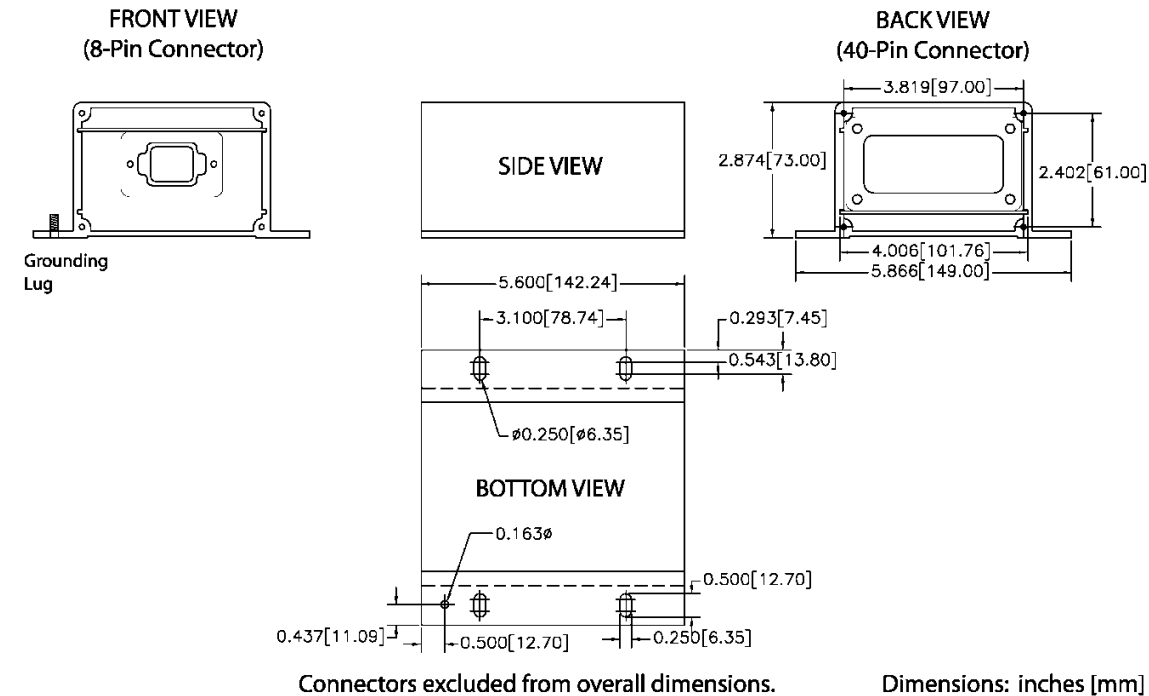


Figure 57: Thermocouple, RTD, And Discrete I/O Module Physical Layout

DISCRETE I/O SOFTWARE CONFIGURATION

The DIO module is field-programmable using the Cat Service Tool. It is also flash programmable to update software using the Cat Service Tool.

The service tool software must be installed on a Windows PC. The Cat communication adapter must be connected between the PC and the CAN data link on which the target DIO module is connected. (The service tool may be connected to the EMCP 4 Accessory Data Link service connector).

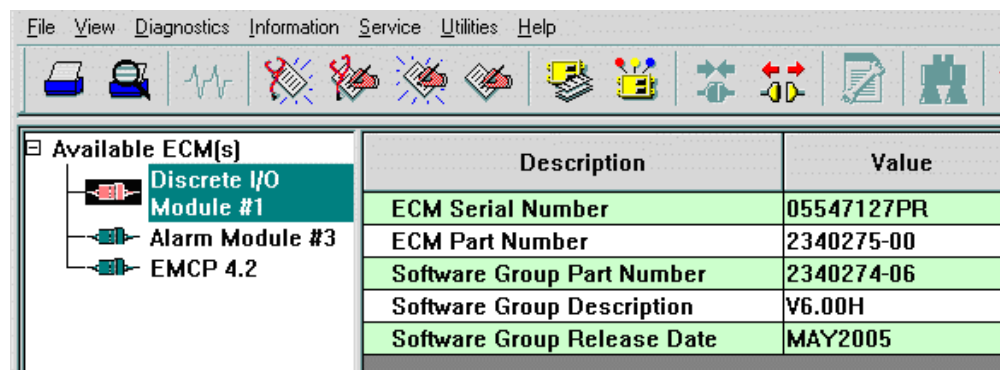


Figure 58: Cat Service Tool DIO Summary Screen

When connecting to the DIO, the user will first see the Module Summary screen shown in Figure 58. 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.

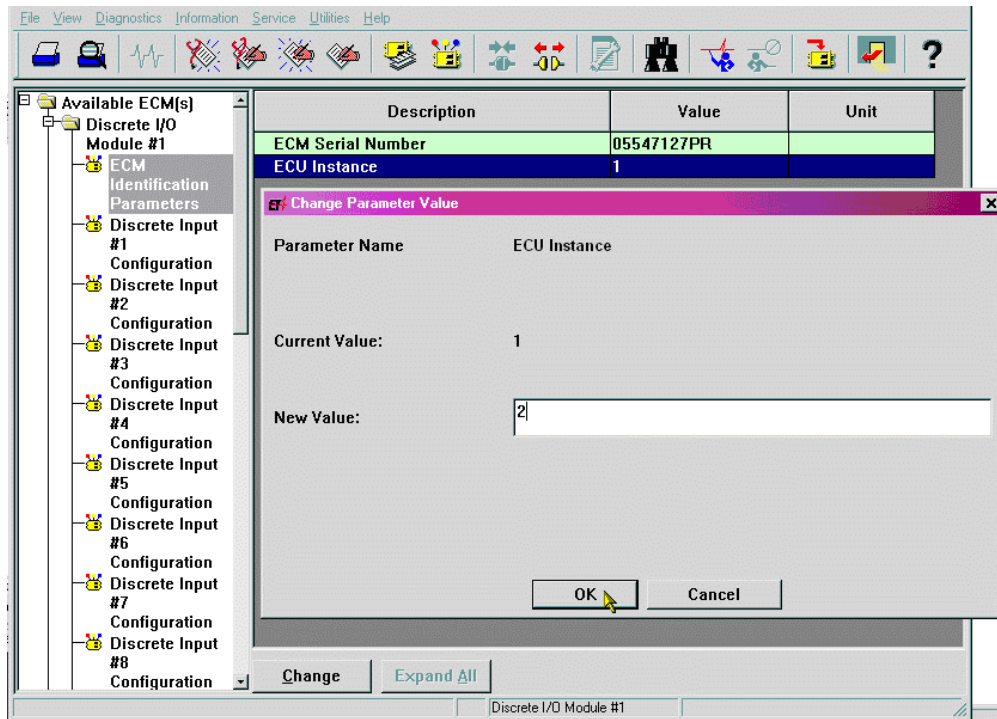


Figure 59: Cat Service Tool DIO Identification Parameters

Figure 59 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.

Note: 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 Cat 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 60, 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.

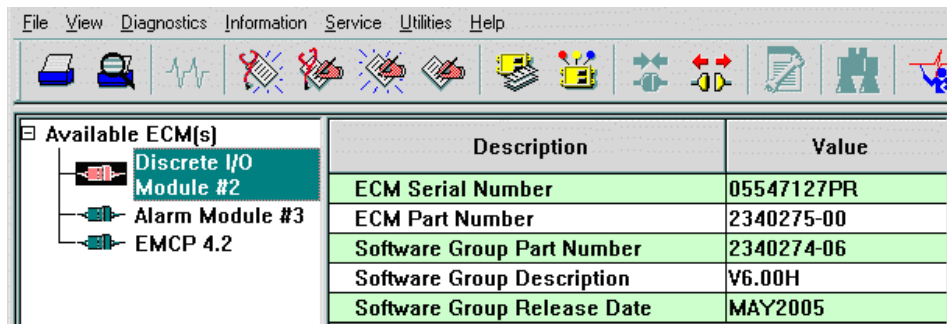


Figure 60: Cat Service Tool DIO After ECU Instance Change

CONFIGURING DIGITAL INPUTS

Figure 61 shows the Discrete Input #1 Configuration list using the service tool configuration tool. All twelve discrete inputs have identical parameters and options.

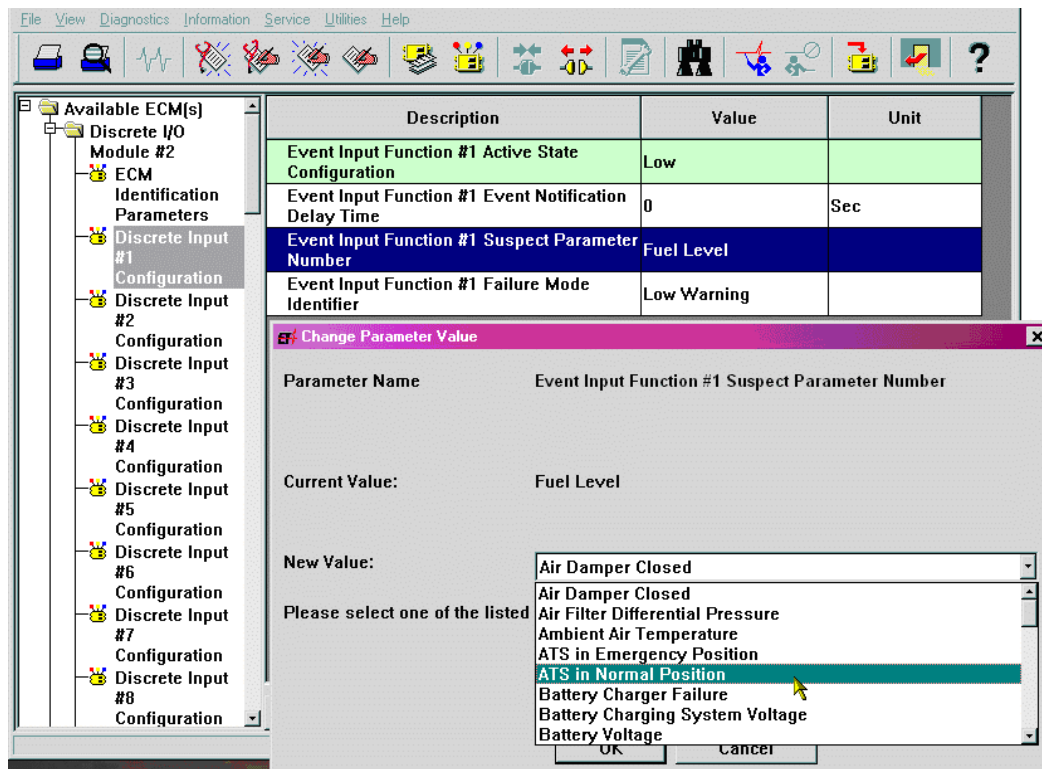


Figure 61: Cat Service Tool DIO Digital Input Configuration

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 from 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.

Note: Discrete Inputs configured for Custom Event SPNs (701-718) are shared between the EMCP and DIO Modules. Therefore ONLY one Custom Event SPN-FMI can be used between the two modules for each Input #.

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 4 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 4 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 62. All eight Relay Outputs have identical parameters and options.

The **suspect parameter number** (SPN) is a choice from 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.

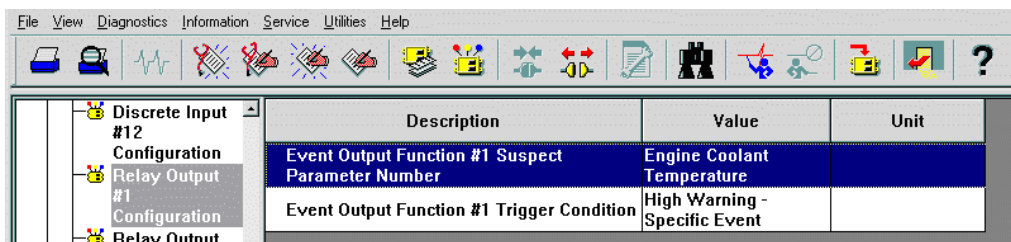


Figure 62: Cat Service Tool DIO Relay Output Configuration

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 4.2 ONLY)

The **SCADA DATA LINK** or **MODBUS** is supported on the EMCP 4.2.

The EMCP 4.2 has 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 4 in much the same way an operator does from the panel.

- The host device connects to the EMCP GSC through an RS-485 SCADA Data Link (Modbus RTU, Half Duplex).
- The data is transmitted in a binary format over the serial connection.
- The host device acts as Modbus Master, and the EMCP 4 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 4.
- The EMCP 4 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 4. Various data rates between 9600 bits/second (baud) and 57,600 bits/second are available. See the **SOFTWARE CONFIGURATION** Chapter 18.3 for instructions.

For more information on the SCADA Data Link, refer to the EMCP 4 SCADA DATA LINKS A & I GUIDE (LEBE0010).

Note: The EMCP 4 controller defaults to NOT allowing Remote Genset Control via SCADA communications. This setting can be changed from the display under MAIN MENU/CONFIGURE/ALL SETPOINTS/CONTROL/AUTO START/STOP/REMOTE GENSET CONTROL ENABLE STATUS.

Note: This port may be required to be used to communicate to switchgear or other monitoring device. Only a single host device can be used with this port.

18.1 WIRING

SCADA COMMUNICATION wires are brought out of the EMCP 4.2 as part of the 70-pin connector. The pins, as designated on the EMCP connector, are shown in Table 30.

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

Table 30: SCADA Pins on EMCP 70 Pin Connector

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 63 shows a possible wiring configuration to a RS-485 device.
- Figure 64 shows a possible wiring configuration to a RS-485 to RS-232 converter.

Note: See documentation of connected device to verify wiring configuration.

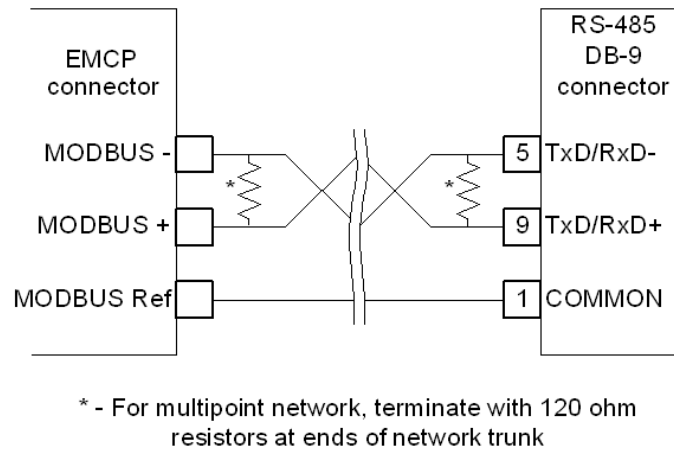


Figure 63: Possible Wiring Configuration To An RS-485 Device

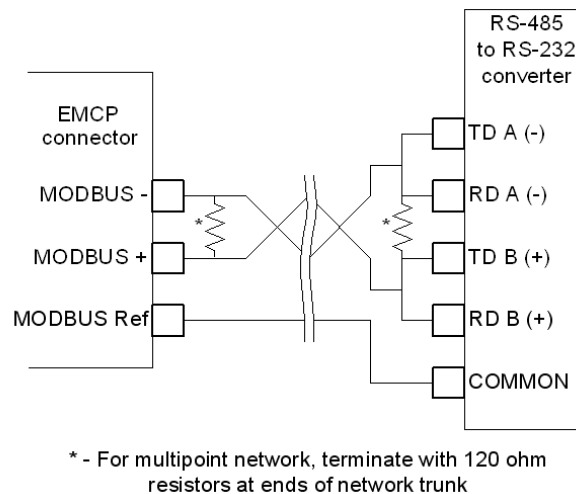


Figure 64: Possible Wiring Configuration To An RS-485 To RS-232 Converter

18.2 LINE TERMINATION AND POLARIZATION

Both ends of the Modbus lines (or the extreme ends of the trunk, for a multipoint network) should have termination between MODBUS+ (B) and MODBUS- (A).

A 0.5W 150Ω resistor may be adequate.

If line polarization is implemented (see Software Configuration, Chapter 18.3), a better choice is a 10 μF capacitor (10V minimum) in series with a 0.25W 120Ω resistor.

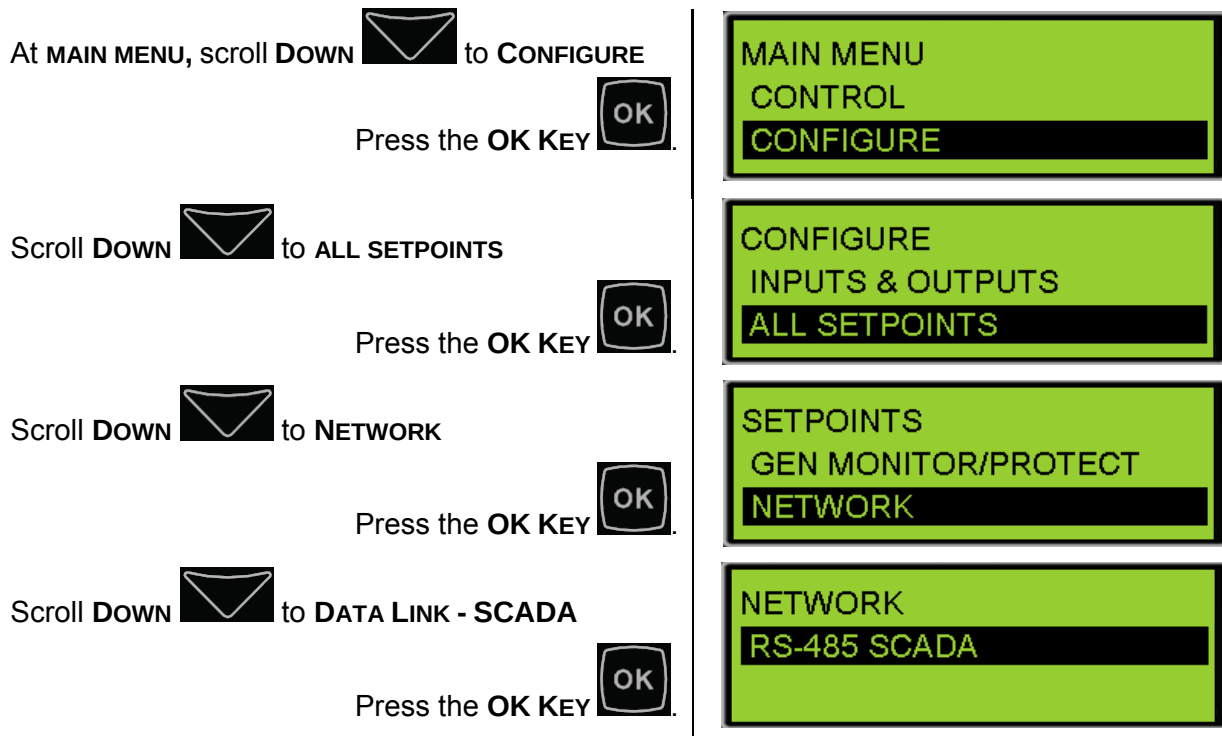
A bias resistor may be used for Line Polarization. Line Polarization is used to keep the network voltages at well-defined levels during silent times to prevent potential false diagnostics and communication failures. This bias resistor is unique from a termination resistor. There should only be one device on the network with bias resistors enabled to polarize the network.

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 18.3 for instructions on enabling line polarization.

18.3 SOFTWARE CONFIGURATION

CONFIGURING THE SCADA DATA LINK USING THE DISPLAY

The **SCADA DATA LINK** may require software configuration. The configuration parameters are accessible on the EMCP 4 via the following menu options:



Press the **OK KEY**  to edit the current **SCADA DATA LINK BAUD RATE**.

Select the **SCADA DATA LINK BAUD RATE** that you want to program

Press the **OK KEY** .

Scroll DOWN  to **SCADA DATA LINK PARITY**

Press the **OK KEY**  to edit the current **SCADA DATA LINK PARITY**.

Select the **SCADA DATA LINK PARITY** that you want to program

Press the **OK KEY** .

Scroll DOWN  to **SCADA DATA LINK SLAVE ADDRESS**

Press the **OK KEY**  to highlight the current **SCADA DATA LINK SLAVE ADDRESS**. Select the **SCADA DATA LINK SLAVE ADDRESS** that you want.

Press the **OK KEY** .

Scroll DOWN  to **RS-485 BIAS RESISTOR ENABLE STATUS**

Press the **OK KEY**  to edit the current **RS-485 BIAS RESISTOR ENABLE STATUS**.

Select the **RS-485 BIAS RESISTOR ENABLE STATUS** that you want to program

Press the **OK KEY** .

SCADA DATA LINK BAUD
RATE
9600 BAUD

SCADA DATA LINK BAUD
RATE
19200 BAUD

SCADA DATA LINK
PARITY
ODD

SCADA DATA LINK
PARITY
EVEN

SCADA DATA LINK
SLAVE ADDRESS
1

SCADA DATA LINK
SLAVE ADDRESS
0 0 1

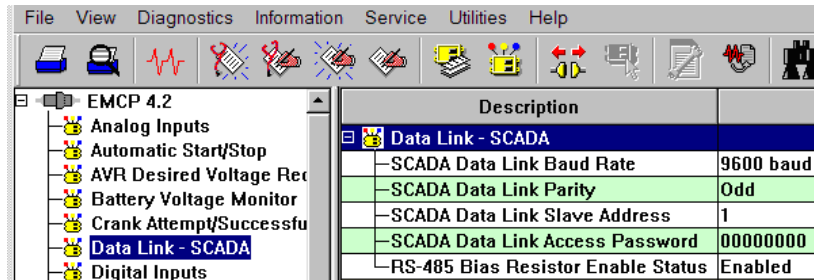
RS-485 BIAS RESISTOR
ENABLE STATUS
ENABLED

RS-485 BIAS RESISTOR
ENABLE STATUS
DISABLED

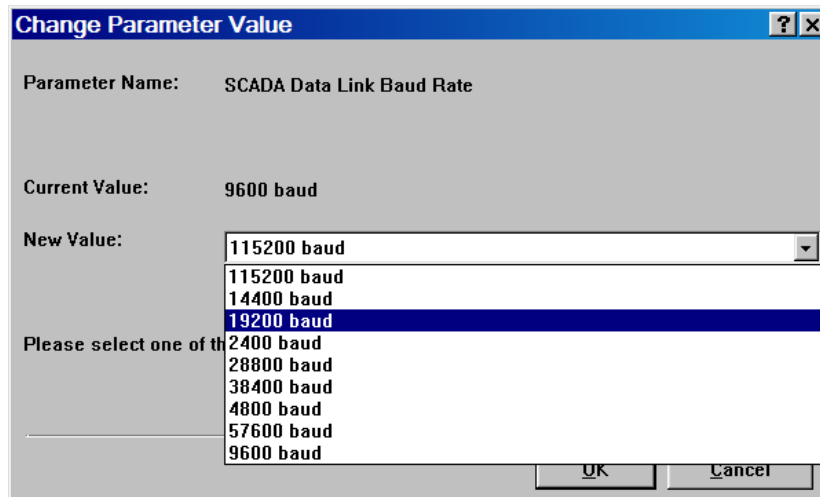
CONFIGURING THE SCADA DATA LINK USING THE CAT SERVICE TOOL

The EMCP 4 SCADA Data Link can be configured using the Cat Service Tool. To program this Data Link, do the following steps:

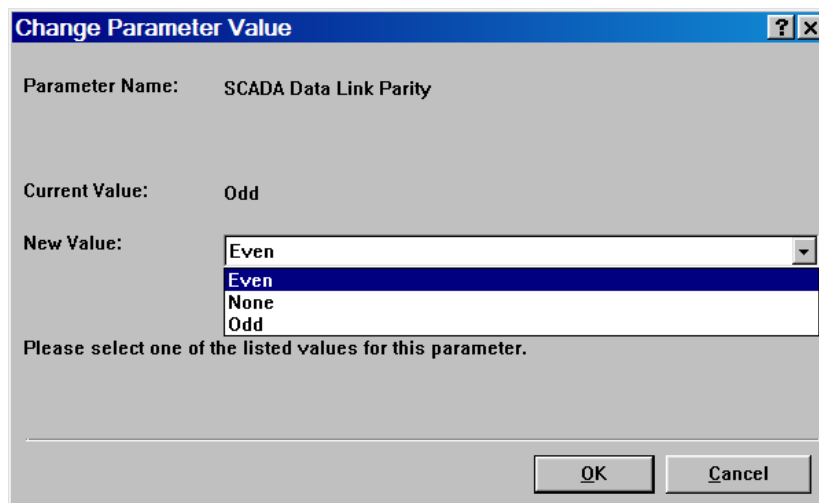
1. Connect to the EMCP 4 using the Cat Service Tool as stated in Chapter 4.2.
2. Select Data Link – SCADA on the left.



3. Double click SCADA Data Link Baud Rate to change this to the desired value from the drop down menu. Click the OK button to program.



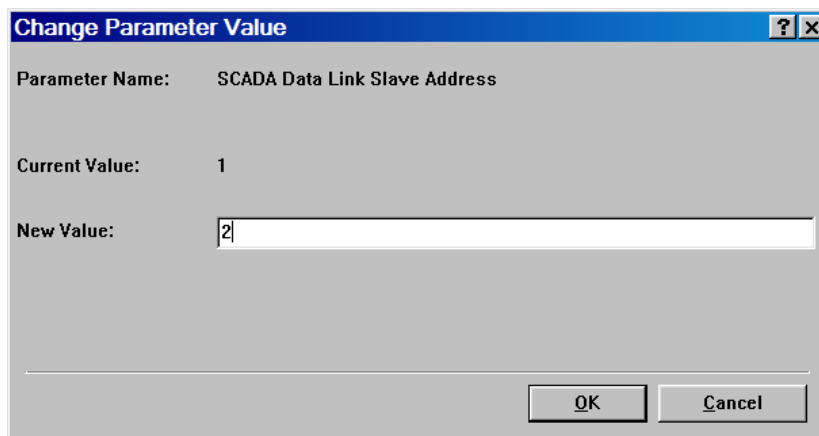
4. Double click SCADA Data Link Parity to change this value from the drop down menu. Click the OK button to program.



The dialog box is titled "Change Parameter Value". It contains the following fields and controls:

- Parameter Name:** SCADA Data Link Parity
- Current Value:** Odd
- New Value:** A dropdown menu with the following options: Even (selected), Even, None, and Odd.
- Text:** Please select one of the listed values for this parameter.
- Buttons:** OK and Cancel.

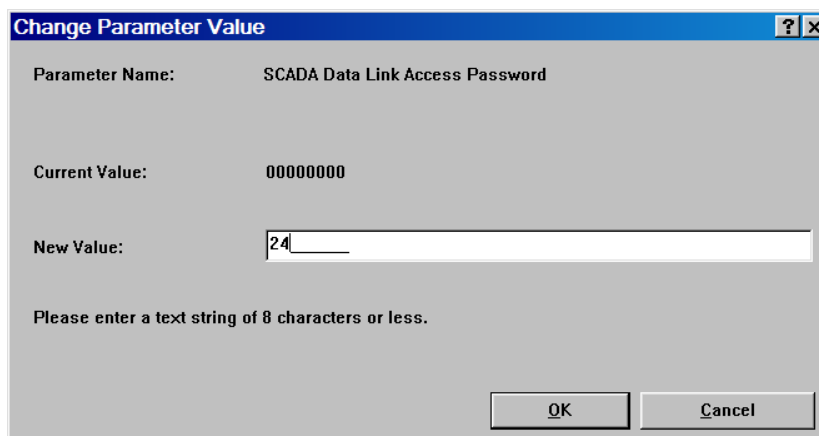
5. Double click SCADA Data Link Slave Address. Change this value by typing a new value. Click the OK button to program.



The dialog box is titled "Change Parameter Value". It contains the following fields and controls:

- Parameter Name:** SCADA Data Link Slave Address
- Current Value:** 1
- New Value:** A text input field containing the value 2.
- Buttons:** OK and Cancel.

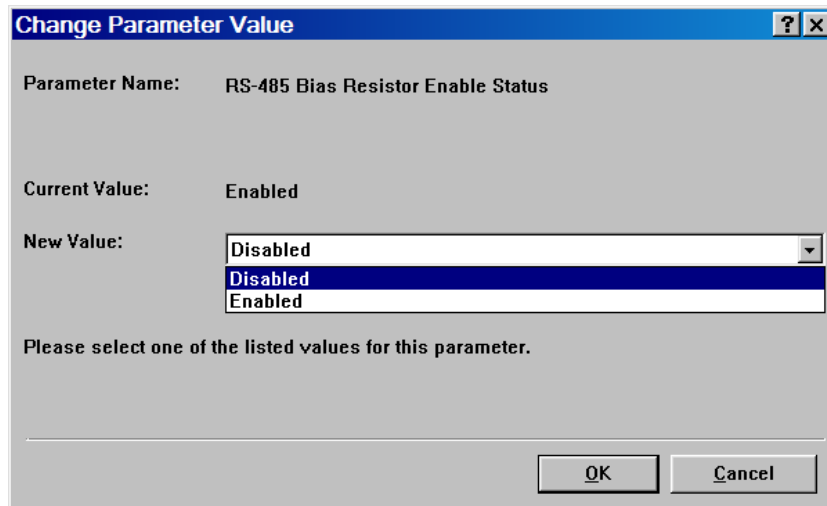
6. Double click SCADA Data Link Access Password. Change this value by typing a new value. Click the OK button to program.



The dialog box is titled "Change Parameter Value". It contains the following fields and controls:

- Parameter Name:** SCADA Data Link Access Password
- Current Value:** 00000000
- New Value:** A text input field containing the value 24.
- Text:** Please enter a text string of 8 characters or less.
- Buttons:** OK and Cancel.

7. Double click RS-485 Bias Resistor Enable Status to change this value from the drop down menu. Keep in mind that the Bias Resistor is not a termination resistor, but polarizes the RS-485 line. Click the OK button to program.



The image shows a Windows-style dialog box titled "Change Parameter Value". It has a blue title bar with a question mark icon and a close button (X). The dialog contains the following fields and controls:

- Parameter Name:** RS-485 Bias Resistor Enable Status
- Current Value:** Enabled
- New Value:** A dropdown menu with a list box showing "Disabled" (highlighted in blue), "Disabled", and "Enabled".
- Text:** "Please select one of the listed values for this parameter."
- Buttons:** "OK" and "Cancel" buttons at the bottom right.

19 INTEGRATED VOLTAGE REGULATOR

The EMCP Integrated Voltage Regulator (IVR) feature is a substitute for a traditional voltage regulator topology consisting of a dedicated controller (CDVR, VR6...etc) for regulating voltage. The EMCP 4 internal controller regulates generator output voltage by sending a command to the Excitation Module (EM10/EM15) that controls generator excitation and therefore generator output voltage.

This feature is available with revised EMCP 4.1 (CAT part number: 435-7931) and EMCP 4.2 (CAT part number 431-1966) controllers with software version 4.3PROD and above. This capability does NOT exist in original EMCP 4.1 and EMCP 4.2 controllers, regardless of software version.

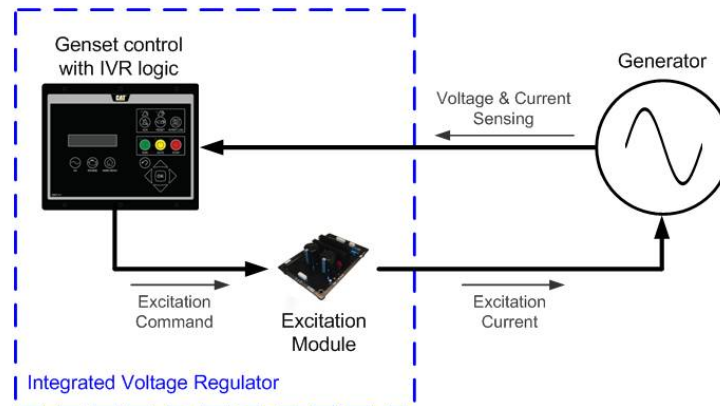


Figure 65: EMCP Integrated Voltage Regulator System

19.1 IVR FEATURES

When used with an Excitation Module the revised EMCP 4.1 and EMCP 4.2 controllers with Integrated Voltage Regulator logic provide:

- Automatic Voltage Regulation (AVR)
- Programmable stability settings
- Soft start control with an adjustable time setting in AVR control mode
- Dual Slope, Configurable Under Frequency (Volts/Hz) regulation
- Three-phase or single-phase generator voltage (RMS) sensing/regulation in AVR mode
- Setpoint configuration adjustment from the EMCP display or CAT ET Service Tool
- Voltage Output Adjustment via Display, Analog Input, Digital Input, or SCADA (Modbus)
- IVR Operating Status and Voltage Bias Overview screens to provide an enhanced level of user interface
- Integrated Voltage Regulator event monitoring

The revised EMCP 4.2 controllers also offer:

- Power Factor Regulation (PF)
- Reactive Droop compensation
- Line drop compensation

19.2 HARDWARE INSTALLATION

EMCP IVR CONNECTIONS

To regulate the generator terminal voltage the EMCP communicates the desired excitation command to the Excitation Module via a PWM signal. It is recommended that twisted pair shielded cable is used for this communication link. Table 31 details the connections to be made between the EMCP and Excitation Module.

EMCP 4.1, EMCP 4.2 70-Pin Connector		Excitation Module 3-Pin Connector	
Digital Output #2 / IVR CS+	68	CS+	P3-2
Battery Negative Splice	60 or 65	CS-	P3-3
Battery Negative Splice	60 or 65	Shield	P3-1

Table 31: EMCP 4.1 & EMCP 4.2 Connections to Excitation Module

IVR EXCITATION MODULE

The Integrated Voltage Regulator consists of an EMCP 4 interfacing with an Excitation Module. There is a range of Excitation Modules available to cover the full range of CAT generator sets.



Figure 66: EM10 Excitation Module & EM15 Excitation Module

Table 32 provides information on the technical specification of the EM10 and EM15 modules. Selection of the appropriate module should be determined by the nominal and maximum generator excitation current at full load (standby, 0.8PF), and the maximum AC voltage input.

Details on nominal field current are available in TMI (Technical Marketing Information) or from the generator datasheet. Care must be taken on Self-Excited (shunt) generators to understand how the connections are being made from the winding to the excitation module in order to understand the maximum AC voltage input. It is recommended that an intermediate, half-phase to Neutral connection is used for Self-Excited generators.

	EM10	EM15
CAT Part Number	398-7247	398-7248
Compatible Generator Excitation Types	Permanent Magnet (PM) Self-Excitation (SE) Internal Excitation (AREP)	
Nominal Field Current Output	6 Amps	7 Amps
Maximum (forcing) Field Current Output	10 Amps	15 Amps
Maximum AC Voltage Input	180 Vrms	240 Vrms
Exciter Field Resistance (recommended)	6 to 16 ohms	

Table 32: EM10 & EM15 Technical Specifications

IVR EXCITATION MODULE PHYSICAL LAYOUT

It is recommended that the Excitation Module should be mounted within the genset control panel or the generator terminal box in landscape orientation in order to achieve optimum cooling from the module heat sink. The module should be fixed in place using 4 M6 x 30mm mounting bolts. The torque applied to the mounting bolts should be 5 N.m $\pm$ 1 N.m. It is recommended that an M6 washer (external diameter 12mm) is used with the mounting bolts to protect the module. A dimensioned diagram of the EM10 module is presented in Figure 67. Note that the same dimensions also apply for the EM15 module.

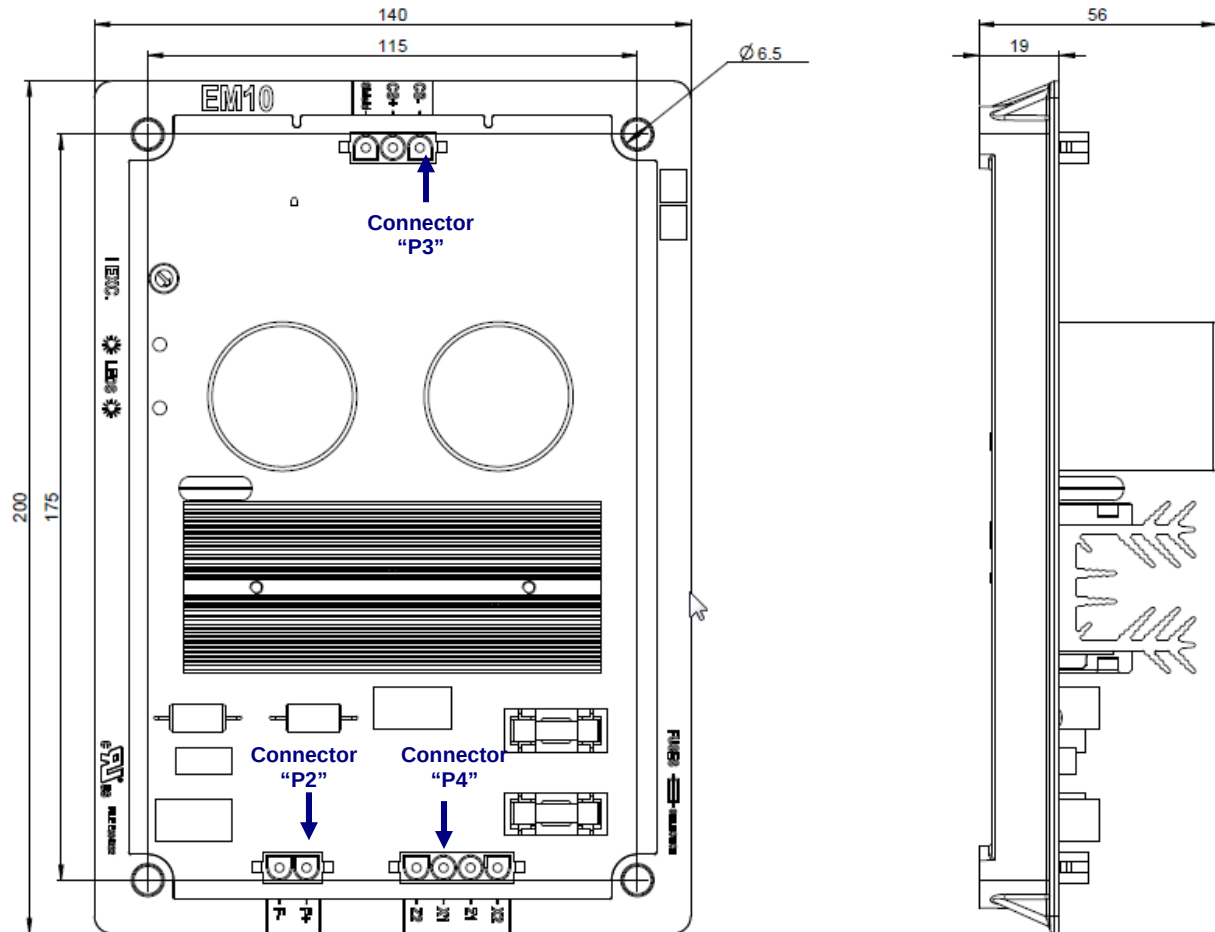


Figure 67: EM10 Excitation Module Dimensions (in millimeters)

IVR EXCITATION MODULE CONNECTIONS

The EM10 and EM15 Excitation Modules have three multiple-pin, Mate-n-Lok plug type connectors. These connectors are labeled “P2”, “P3” and “P4” as shown in Figure 67. Table 33 describes the signal and function of each connector pin.

Terminal	Label	Signal/Function
P2-1	F+	Exciter Field Positive
P2-2	F-	Exciter Field Negative
P3-1	Shield	Excitation Command Control Signal Shield
P3-2	CS+	Excitation Command Control Signal Positive
P3-3	CS-	Excitation Command Control Signal Negative
P4-1	X2	Excitation Power Supply Input X2
P4-2	Z1	Excitation Power Supply Input Z1
P4-3	X1	Excitation Power Supply Input X1
P4-4	Z2	Excitation Power Supply Input Z2

Table 33: Excitation Module Connector Pins

Note that connections X2 and Z1 are internally linked within the Excitation Module, providing a point of common connection for the auxiliary windings where an AREP/IE excitation supply is available. Alternatively, connections X2 and Z1 may be linked external to the Excitation Module, and only three connections made to the device (X1, X2 and Z2). Fully detailed Excitation Module connection diagrams for self-excitation (shunt), auxiliary windings (AREP/IE) and permanent magnet (PM) are provided in Appendix C.

IVR EXCITATION MODULE OVER-EXCITATION PROTECTION

The Excitation Module has a built-in over-excitation protection strategy that is designed to protect the generator from thermal damage. The protection strategy employed is illustrated in Figure 68.

Under normal conditions the excitation current will remain well below the upper limit and the GREEN LED on the Excitation Module will be lit continuously.

In the event of a fault condition, for example during a short-circuit on the generator terminals, the excitation current will increase rapidly, known as 'field forcing'. The Excitation Module will limit the forcing current to the defined upper limit for a fixed period of 10 seconds.

When the Excitation Module is actively limiting the field current a RED LED will flash indicating a fault condition. After the fixed delay time has expired, the Excitation Module will 'limit' the excitation current to a safer level that is 10% of the upper limit.

When the Excitation Module has shut down the excitation current, the RED LED is lit continuously and the GREEN LED is not lit. The RED LED will be lit only while voltage is being supplied to the Excitation Module. In order to reset the excitation current limiting the excitation current, the power supply must be removed from the Excitation Module by shutting down the genset.

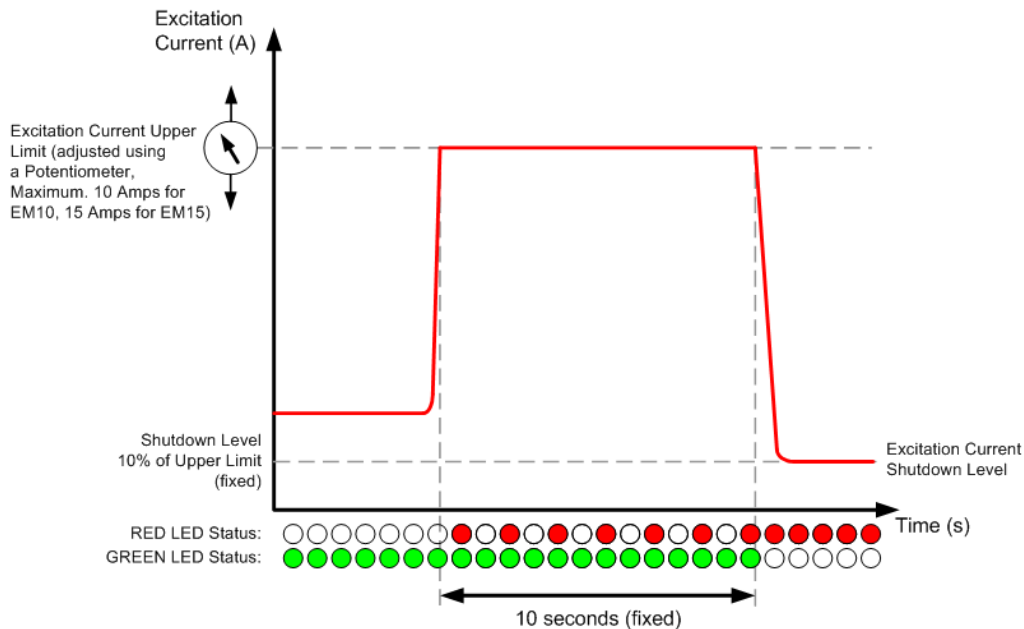
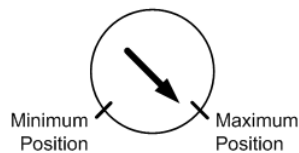


Figure 68: Excitation Module Over-Excitation Protection Strategy

The Excitation Limit Potentiometer on the Excitation Module has 270 degrees of rotation and is used to configure the Excitation Current Upper Limit as shown in Figure 69. Keep in mind that this must be set for maximum forcing current, and not nominal excitation current.



	EM10	EM15
Minimum Position	4 Amps	6 Amps
Maximum Position	10 Amps	15 Amps

Figure 69: Maximum and Minimum Limits of Excitation Current Limit Potentiometer

IVR EXCITATION MODULE FUSING

The EM10 has internal fusing, therefore it is not necessary to fit external fuses on the excitation power supply inputs.

The EM15 requires external fusing to be fitted on inputs X1 and Z2. The recommended fuse for UL listed gensets is a Bussman KTK-10 (Cat part number 6V7802). For non-UL listed gensets an alternative fuse of Bussman AGC-10RX (Cat part number 3K8782) may also be used.

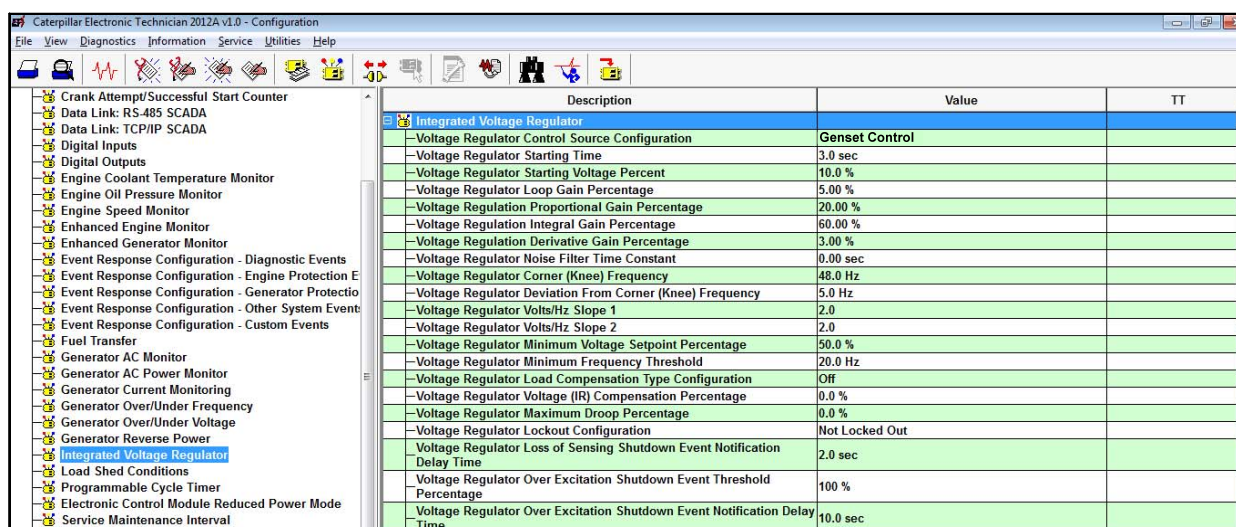
Connection diagrams showing the location of external fusing on the EM15 are provided in Appendix C.

19.3 IVR SOFTWARE CONFIGURATION

The Integrated Voltage Regulator parameters can be accessed using either the CAT ET Service tool, or directly through the EMCP display. Some setpoints are locked at ET only or at Security Level 3 and cannot be changed from the EMCP display or will require a level 3 password. Please note that ET Service Tool version 2012C or later is recommended for accessing and adjusting IVR parameters.

To access the Integrated Voltage Regulator setpoints using the ET Service Tool,

connect to the EMCP Genset Control and click on the 'Configuration Tool' button  (alternatively press F5) to enter the configuration menu. Select 'Integrated Voltage Regulator' from the menu on the left and set Voltage Regulator Control Source Configuration equal to 'Genset Control' to display the following default settings:



Description	Value	TT
Integrated Voltage Regulator		
—Voltage Regulator Control Source Configuration	Genset Control	
—Voltage Regulator Starting Time	3.0 sec	
—Voltage Regulator Starting Voltage Percent	10.0 %	
—Voltage Regulator Loop Gain Percentage	5.00 %	
—Voltage Regulation Proportional Gain Percentage	20.00 %	
—Voltage Regulation Integral Gain Percentage	60.00 %	
—Voltage Regulation Derivative Gain Percentage	3.00 %	
—Voltage Regulator Noise Filter Time Constant	0.00 sec	
—Voltage Regulator Corner (Knee) Frequency	48.0 Hz	
—Voltage Regulator Deviation From Corner (Knee) Frequency	5.0 Hz	
—Voltage Regulator Volts/Hz Slope 1	2.0	
—Voltage Regulator Volts/Hz Slope 2	2.0	
—Voltage Regulator Minimum Voltage Setpoint Percentage	50.0 %	
—Voltage Regulator Minimum Frequency Threshold	20.0 Hz	
—Voltage Regulator Load Compensation Type Configuration	Off	
—Voltage Regulator Voltage (IR) Compensation Percentage	0.0 %	
—Voltage Regulator Maximum Droop Percentage	0.0 %	
—Voltage Regulator Lockout Configuration	Not Locked Out	
Voltage Regulator Loss of Sensing Shutdown Event Notification Delay Time	2.0 sec	
Voltage Regulator Over Excitation Shutdown Event Threshold Percentage	100 %	
Voltage Regulator Over Excitation Shutdown Event Notification Delay Time	10.0 sec	

To access the Integrated Voltage Regulator setpoints through the EMCP display, navigate to the following sub-menu:

MAIN MENU

→ CONFIGURE

→ ALL SETPOINTS

→ VOLTAGE REGULATOR

If replacing a CDVR with IVR, the parameters can be programmed the same as the CDVR (using ET scaling) in order to achieve similar performance. If the IVR is a new installation, or a R450 or VR6 voltage regulator is being replaced, the parameters can be programmed to the default values with a low loop gain starting in the region 1.0%-5.0%. Note that the default parameters should provide stable voltage control for most generator sets, however some optimization and tuning may be required to achieve the desired performance. The following subsections provide further detail on each individual setpoint, including range, resolution and default values.

VOLTAGE REGULATOR CONTROL SOURCE CONFIGURATION

Name	Options	Default Value	Access
Voltage Regulator Control Source Configuration	0 = External Control 1 = Genset Control	0 (External Control)	ET Service Tool Only

The Voltage Regulator Control Source Configuration parameter is used to enable or disable the Integrated Voltage Regulator feature.

- If set to 'External' the Integrated Voltage Regulator feature of the EMCP is disabled and the genset can run with an external voltage regulator, for example, CDVR, R450, VR6, etc.
- If set to 'Genset Control' the Integrated Voltage Regulator feature of the EMCP is enabled and the genset will run using an Excitation Module.

Note that this parameter will only change state if the genset is stopped (stop button pressed and engine speed 0 rpm), and can only be changed via ET, and not directly through the EMCP display.

 WARNING

It is important that the Voltage Regulator Control Source Configuration is correctly programmed BEFORE starting the genset.

In the case where an external voltage regulator is used, if Voltage Regulator Control Source Configuration is set to 'Genset Control', there is a risk of nuisance triggering of IVR-related warning and shutdown events.

In the case where IVR is to be used but the Voltage Regulator Control Source Configuration is set to 'External', there is a risk that the PWM (DO#2) output may float high causing the Excitation Module to force the excitation current to the upper limit and risking damage to the generator set and/or load.

STARTING PROFILE

Name	Min	Max	Resolution	Units	Default Value	Access
Voltage Regulator Starting Voltage Percent	0.0	90.0	0.1	%	10.0	ET Service Tool or EMCP Display
Voltage Regulator Starting Time	0.0	60.0	0.1	seconds	3.0	

The starting profile setpoints defined above are used to determine the slope of the voltage ramp when starting the genset.

If the Voltage Regulator Starting Voltage Percent is zero, the Voltage Regulator Starting Time defines the time to reach the rated voltage setpoint from the point that the frequency exceeds the Voltage Regulator Minimum Frequency Threshold. An example Starting Profile with Voltage Regulator Starting Voltage Percentage set to 0% and Voltage Regulator Starting Time set to 5 seconds is illustrated in Figure 70.

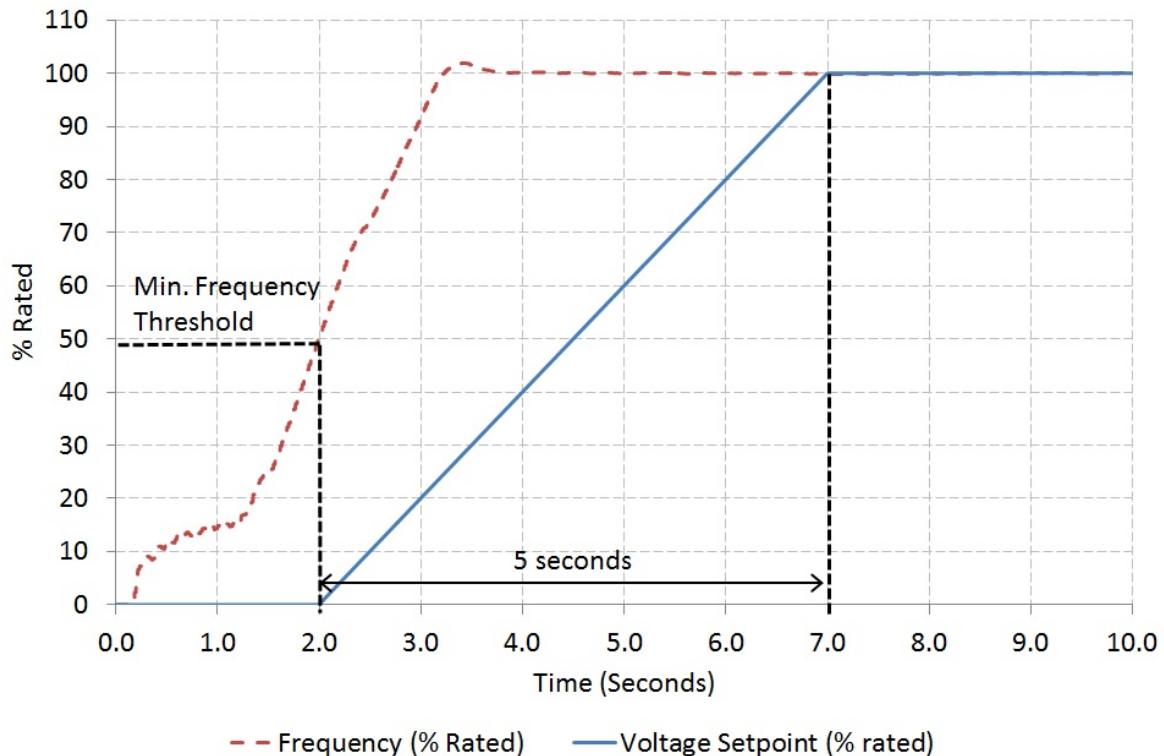


Figure 70: Starting Profile with Voltage Regulator Starting Voltage set to 0% and Voltage Regulator Starting Time set to 5 seconds

If the Voltage Regulator Starting Voltage Percent is non-zero, the Voltage Regulator Starting Time defines the time to get to the rated voltage setpoint from the point that the Voltage Regulator Starting Voltage Percent is reached by following the programmed Volts/Hz slope. An example Starting Profile with Voltage Regulator Starting Voltage Percentage set to 10% and Voltage Regulator Starting Time set to 3 seconds is illustrated in Figure 71.

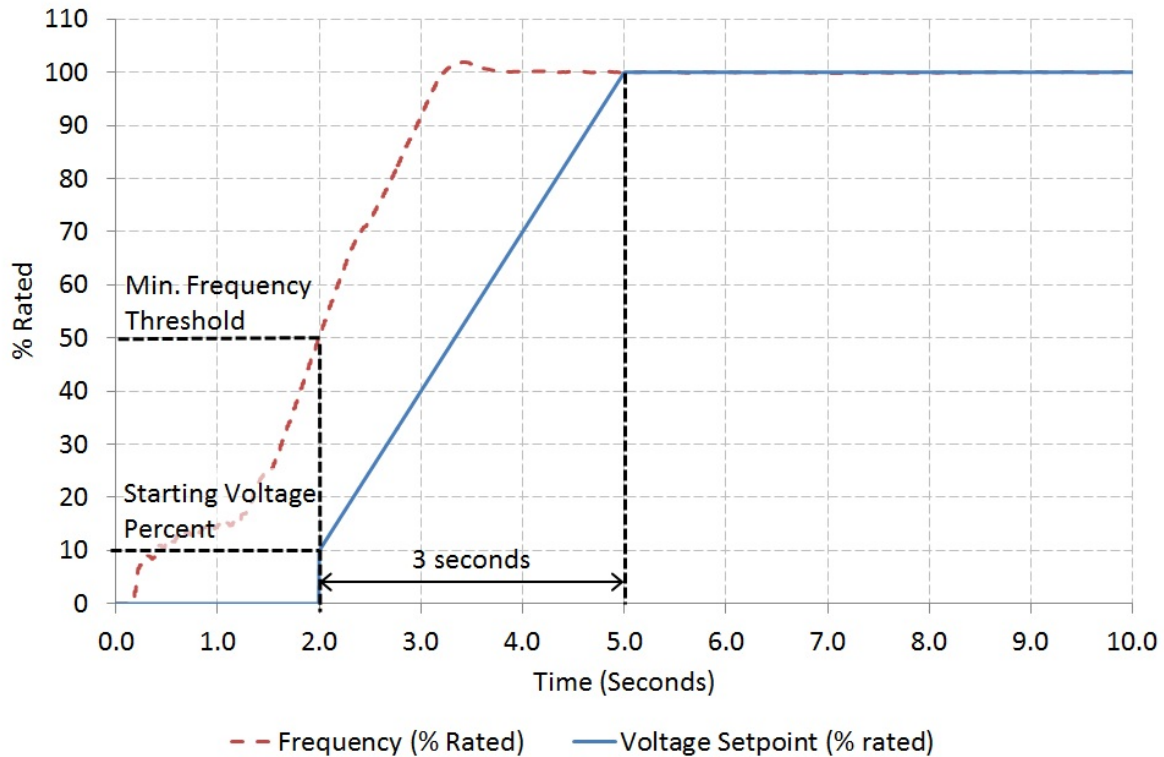


Figure 71: Starting Profile with Voltage Regulator Starting Voltage set to 10% and Voltage Regulator Starting Time set to 3 seconds

A further example with Voltage Regulator Starting Voltage Percentage set to 90% and Voltage Regulator Starting Time set to 3 seconds is illustrated in Figure 72.

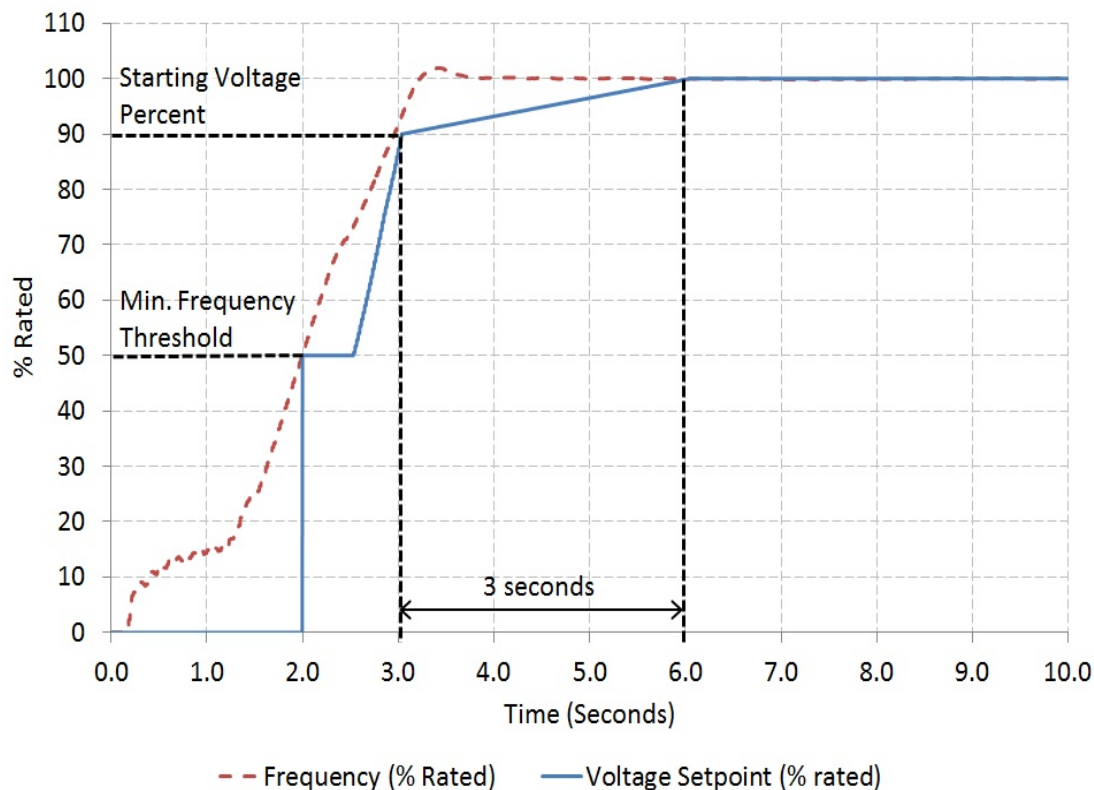


Figure 72: Starting Profile with Voltage Regulator Starting Voltage set to 90% and Voltage Regulator Starting Time set to 5 seconds

If the Voltage Regulator Starting Time is set to zero, or the engine has a slow starting ramp, the Integrated Voltage Regulator will follow the programmed Volts/Hz slopes. The voltage setpoint during starting is therefore the minimum of the Starting Profile setpoint and the Under-Frequency Roll-Off (Loading) Profile setpoint.

In order to avoid a large voltage overshoot during starting, particularly on generators with Shunt or AREP excitation systems, the Excitation Command output from the EMCP is limited to a maximum value of 20% during starting. This prevents integral windup within the PID controller in the case where, during starting, there is insufficient residual voltage at the generator output to build excitation.

Once the frequency exceeds the Voltage Regulator Corner <Knee> Frequency threshold and the nominal voltage setpoint has been reached, the Integrated Voltage Regulator will follow the Under-Frequency Roll-Off (Loading) Profile. The Starting Profile will not be initiated again until the frequency drops below the Voltage Regulator Minimum Frequency Threshold.

IVR PID GAIN SETPOINTS

Name	Min	Max	Resolution	Units	Default Value	Access
Voltage Regulator Loop Gain Percentage	0.00	100.00	0.01	%	5.00	ET Service Tool or EMCP Display
Voltage Regulator Proportional Gain Percentage	0.00	100.00	0.01	%	20.00	ET Service Tool Only (Level 3 Password)
Voltage Regulator Integral Gain Percentage	0.00	100.00	0.01	%	60.00	
Voltage Regulator Derivative Gain Percentage	0.00	100.00	0.01	%	3.00	
Voltage Regulator Noise Filter Time Constant	0.00	1.00	0.01	seconds	0.00	

The PID gain setpoints can be tuned to achieve the desired voltage response depending on the application and genset configuration. The default parameters have been selected to provide stable voltage control on most generators, however some optimization may be required.

If the voltage regulation appears unstable, it may be necessary to reduce the Voltage Regulator Loop Gain Percentage to achieve stability. As a guideline, decreasing in steps of 0.5-1.0% is generally sufficient to observe a noticeable improvement.

If the voltage response appears sluggish, it is recommended to increase the Voltage Regulator Loop Gain Percentage to achieve the desired response. Increasing in steps of 0.5-1.0% is generally sufficient to observe a noticeable improvement.

UNDER-FREQUENCY ROLL-OFF (LOADING) PROFILE

Name	Min	Max	Resolution	Units	Default Value	Access
Voltage Regulator Corner <Knee> Frequency	45.0	65.0	0.1	Hz	48.0	ET Service Tool or EMCP Display
Voltage Regulator Deviation From Corner <Knee> Frequency	0.0	10.0	0.1	Hz	5.0	
Voltage Regulator Volts/Hz Slope 1	0.0	10.0	0.1	Volts/Hz	2.0	
Voltage Regulator Volts/Hz Slope 2	0.0	10.0	0.1	Volts/Hz	2.0	
Voltage Regulator Minimum Voltage <Setpoint> Percentage	30	100	1	%	50	
Voltage Regulator Minimum Frequency Threshold	20	40	1	Hz	20	

The “Voltage Regulator Knee Frequency” needs to be configured for your specific package requirements. The Knee Frequency for 50Hz operation will usually be between 48.0 and 49.8Hz, whereas for 60Hz operation this parameter should be set between 58.0 to 59.8 Hz.

An example Under-Frequency Roll-Off (Loading) Profile is illustrated in Figure 73.

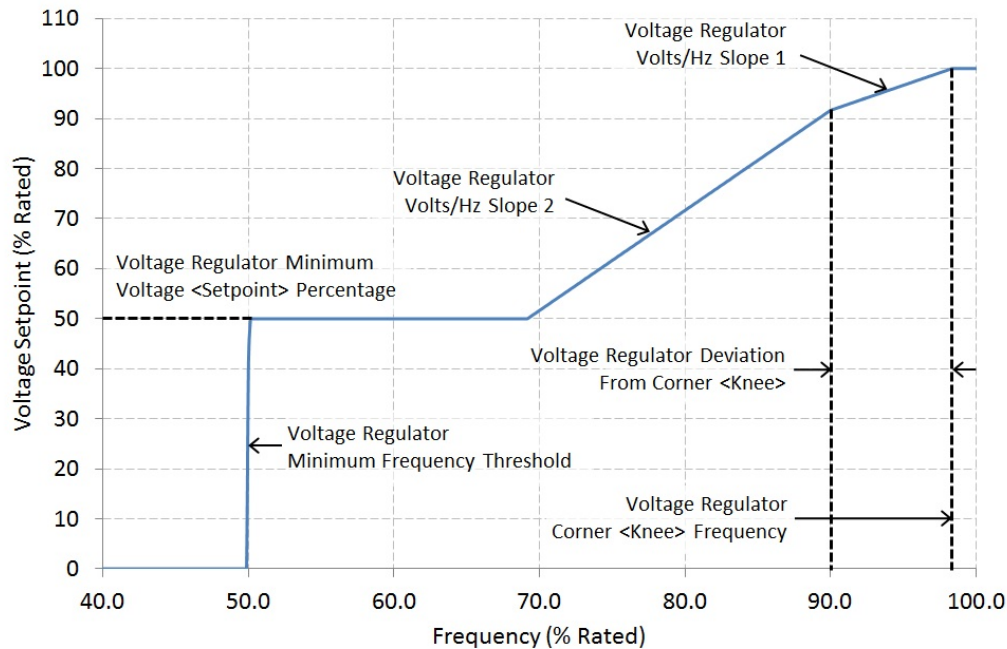


Figure 73: Example Under-Frequency (Loading) Profile, Slope1 = 1.0 V/Hz, Slope2 = 2.0 V/Hz

VOLTAGE REGULATOR LOAD COMPENSATION TYPE CONFIGURATION

Name	Options	Default Value	Access
Voltage Regulator Load Compensation Type Configuration	0 = OFF 1 = IR Compensation 2 = Voltage Droop	0	ET Service Tool or EMCP Display

The load compensation features of IR Compensation and Voltage Droop are explained in sections below.

Note: IR Compensation and Voltage Droop are mutually exclusive features designed for different applications; therefore it is not possible to enable both compensation types at the same time.

LINE LOSS (IR) COMPENSATION

Name	Min	Max	Resolution	Units	Default Value	Access
Voltage Regulator Voltage (IR) Compensation Percentage	0.0	10.0	0.1	%	0.0	ET Service Tool or EMCP Display

In some installations where a single generator is used with long feeder lines to the load, it may be advantageous to provide line loss compensation. Line loss compensation is commonly referred to as IR compensation.

Current flowing through a long conductor causes a voltage drop due to the resistance of the wire. Therefore, the voltage at the load end of the conductor will be lower than the voltage at the generator end due to the voltage drop along the conductor. This condition is commonly referred to as line loss. In order to improve the power quality the IVR can compensate for this phenomenon. As generator load increases, the IVR will increase the output voltage at the generator terminals in order to compensate for line losses. The Voltage Regulator Voltage (IR) Compensation Percentage setpoint controls the quantity of voltage compensation at the rated kVA load. It should be adjusted to yield a constant voltage at the location of the load.

For example, if it is observed that the voltage at the load side of the feeder line has decreased by 5% from rated voltage when the generator is supplying rated kVA load, the Voltage Regulator (IR) Compensation Percentage should be set to 5.0%. In this case, the output voltage measured at the generator terminals will increase from 100% to 105% of rated voltage as the generator load increases from 0% to 100% of rated kVA, as illustrated in Figure 74.

If a bias is applied to the voltage setpoint from an external source, the IR compensation percentage is applied to the nominal setpoint plus the bias percentage. For example, if a +10% or -10% bias were applied to the nominal voltage, the voltage setpoint would increase linearly as shown by the Upper and Lower Bias Limit dashed lines indicated on the diagram presented in Figure 74.

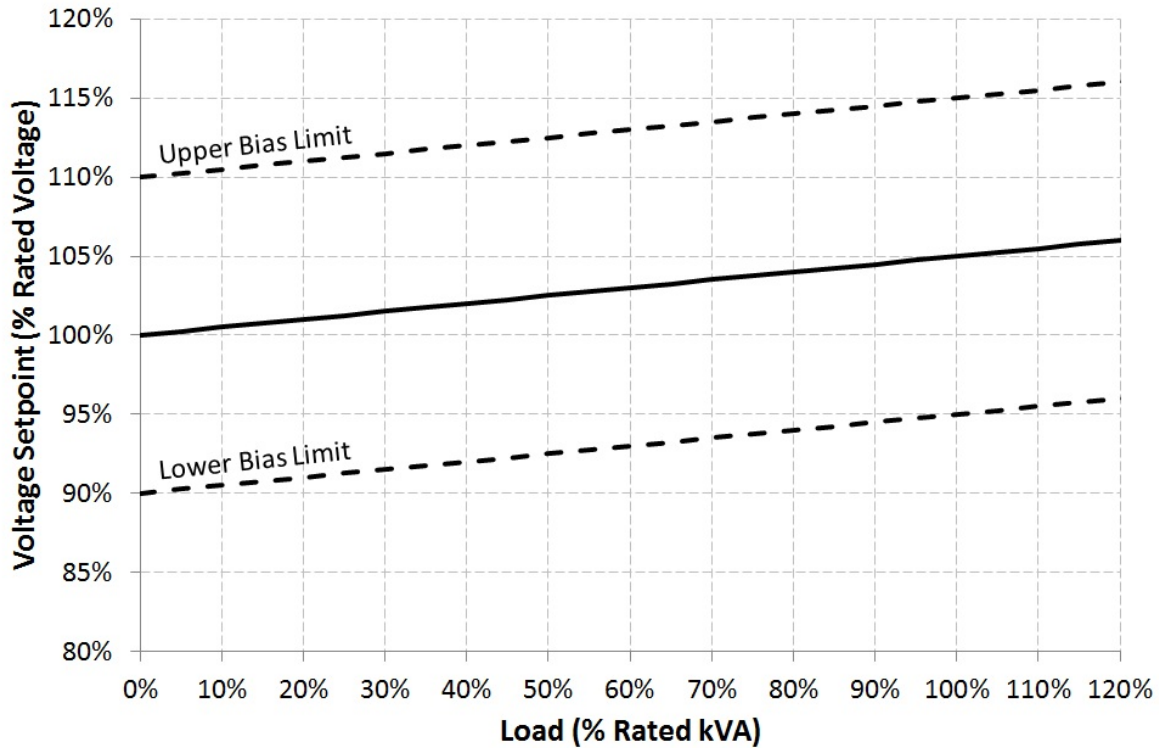


Figure 74: Line Loss voltage setpoint change based on total (kVA) load

Note: It is important that the capability of the machine is not exceeded during operation.

REACTIVE DROOP COMPENSATION

Name	Min	Max	Resolution	Units	Default Value	Access
Voltage Regulator Maximum Droop Percentage	0.0	10.0	0.1	%	0.0	ET Service Tool or EMCP Display

When generators operate in parallel, two primary objectives are for the generators to share both the real power requirements and the reactive power requirements of the system electrical load. The engine governors will control sharing of the real power requirements (kW) and the voltage regulators will control sharing of the reactive power requirements (kVAr) of the total system load. When one or more generators are connected in parallel, the voltage measured at the output terminals of each generator will be the same. However, if the voltage setpoint of one generator is slightly higher than the other generators, it will increase excitation in an attempt to raise the system voltage and in doing so will supply lagging reactive current to the other generators connected in the group. This current will circulate between generators, causing excessive heating of the generator windings and an increased risk of thermal damage.

One method of minimizing this effect is to cause an individual generator's voltage setpoint to sag, or “droop”, in proportion to its’ reactive power output. For proper reactive load sharing, the regulator must know the rated generator reactive power (kVAr), which is calculated from the genset rated kVA and kW, and the desired percentage of output voltage droop when the generator is supplying rated reactive power.

As the reactive power output increases, the IVR will cause the output voltage to droop (reduce the voltage) proportionally. If the measured reactive power output is leading, the output voltage will rise in the same linear fashion. In either case, this action will tend to support better kVAr sharing with other generators. Note that it is important that the generator operation remains within its capability.

The Voltage Regulator Maximum Droop Percentage setpoint controls how much the generator output voltage will vary for a given amount of reactive power output. For example, if the Maximum Droop Percentage is set to 5.0%, the voltage setpoint will drop from 100% to 95% of rated voltage as the reactive power output increases from 0% to 100% of rated kVAr (lagging). This is illustrated in the diagram presented in Figure 75.

If a bias is applied to the voltage setpoint from an external source, the reactive droop percentage is applied to the nominal setpoint plus the bias percentage. For example, if a +10% or -10% bias were applied to the nominal voltage, the voltage setpoint would droop as shown by the Upper and Lower Bias Limit dashed lines indicated on the diagram presented in Figure 75.

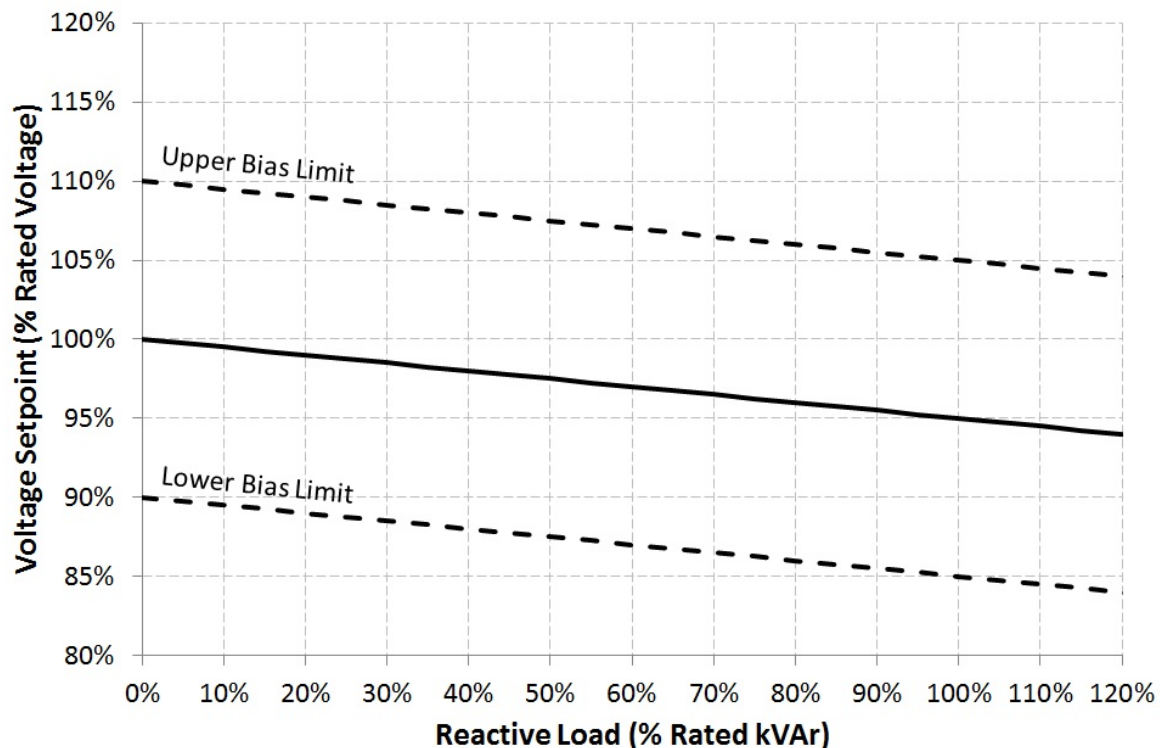


Figure 75: Reactive Droop voltage setpoint change based on reactive (kVAr) load

Note: It is important that the capability of the machine is not exceeded during operation.

VOLTAGE REGULATOR LOCKOUT CONFIGURATION

Name	Options	Default Value	Access
Voltage Regulator Lockout Configuration	0 = Not Locked Out 1 = Locked Out	0.0	ET Service Tool Only

When Voltage Regulator Lockout Configuration is set to 'Not Locked Out', the Integrated Voltage Regulator will operate normally and control the generator voltage output to the reference setpoint.

When Voltage Regulator Lockout Configuration is set to 'Locked Out', the Integrated Voltage Regulator will be prevented from controlling the generator voltage output and the Excitation Command output will remain at zero. Excitation is therefore disabled in this scenario, and the generator will only produce residual voltage.

The Voltage Regulator Lockout Configuration setpoint can only be changed when the genset is STOPPED (EMCP stop button pressed) and engine speed equals zero.

LOSS OF SENSING SHUTDOWN EVENT

Name	Min	Max	Resolution	Units	Default Value	Access
Voltage Regulator Loss Of Sensing Shutdown Event Notification Delay Time	0.0	25.0	0.1	Seconds	2.0	ET Service Tool or EMCP Display

The Voltage Regulator Loss Of Sensing Shutdown Event Notification Delay Time determines the time delay between when a loss of sensing voltage is recognized and when a Loss of Sensing Shutdown event (SPN-FMI: 611-0) is generated. Based on average line-to-line voltage monitoring, loss of sensing is triggered under the following conditions:

For Single Phase configuration: Average line-to-line voltage < 8% of rated

For Three Phase configuration:

Balanced three phase average < 8% of rated OR

Imbalance between a line quantity and three phase average > 20% of rated OR

Loss of a phase (line-to-neutral voltage < 8% of rated).

The Loss of Sensing Shutdown event is inhibited when a generator short circuit condition is detected (any phase current exceeds 300% of rated) during voltage starting profile (IVR operating mode equals SOFT START) for 5 seconds after frequency increases above the Voltage Regulator Minimum Frequency Threshold setpoint when excitation is disabled (Voltage Regulator Lockout Configuration is set to 'Locked Out')

OVER EXCITATION SHUTDOWN EVENT

Name	Min	Max	Resolution	Units	Default Value	Access
Voltage Regulator Over Excitation Shutdown Event Threshold	10	100	1	%	100.0	ET Service Tool or EMCP Display
Voltage Regulator Over Excitation Shutdown Event Notification Delay Time	0.1	20.0	0.1	Seconds	10.0	

The Over Excitation Shutdown Event Threshold configuration determines the percentage of excitation command that will cause an Over Excitation Shutdown event. If the excitation command percentage exceeds the Over Excitation Shutdown Event Threshold for longer than the Over Excitation Shutdown Event Notification Delay Time an Over Excitation Shutdown event (SPN-FMI: 3381-0) will be generated.

Note: The Over Excitation Shutdown event monitors and triggers an event based on Excitation Command Percentage and does NOT trigger based on measured excitation current. See the section on Excitation Module Over-Excitation Protection for a description of the Excitation Module over-excitation protection feature that is based on measured excitation current.

19.4 IVR VOLTAGE ADJUSTMENT

Voltage adjustments are categorized into two types: Manual biasing and Analog biasing. Manual voltage adjustment includes fine tuning the generator output voltage via digital input, EMCP display or SCADA (Modbus). Analog voltage adjustment is performed via programmable analog inputs to the EMCP and provide a voltage control interface for external potentiometers or external control systems (such as switchgear).

It is important to note that the setpoint Gen Maximum Voltage Bias Percentage must be correctly configured to be greater than the expected bias range, otherwise it may not be possible to achieve the required voltage bias. The parameter Gen Maximum Voltage Bias Percentage is accessed within the CAT ET Service Tool configuration menu under Generator AC Monitor, or can be accessed from the EMCP display by navigating to the following sub-menu:

```

MAIN MENU
  → CONFIGURE
    → ALL SETPOINTS
      → GEN AC MONITOR

```

Note: All manual voltage biasing is removed and reset to zero when the engine is stopped. Manual voltage bias levels are not carried over to the next start up after an engine shutdown.

DIGITAL INPUTS

Remote voltage adjustment toggle switches may be used to fine tune the generator output voltage by programming an EMCP digital input for Raise Voltage and Lower Voltage. Each activation of the digital input raises or lowers the voltage by 0.2% of rated. When the digital input is activated continuously, the voltage bias is raised or lowered by 0.2% of rated approximately every 400ms.

Refer to Chapter 8 for further details on programming digital inputs on EMCP 4 controllers.

VOLTAGE/HZ CONTROL (EMCP DISPLAY)

The EMCP display may be used to fine tune the generator output voltage. Each press of the voltage raise or voltage lower key raises or lowers the voltage by 0.2% of rated voltage. When the voltage raise or voltage lower key is pressed and held continuously, the voltage bias is raised or lowered by 0.2% of rated approximately every 400ms.

The Voltage/Hz Control screen can be found on the EMCP display by navigating to the following sub-menu:

MAIN MENU
→ CONTROL
→ VOLTAGE/Hz CONTROL

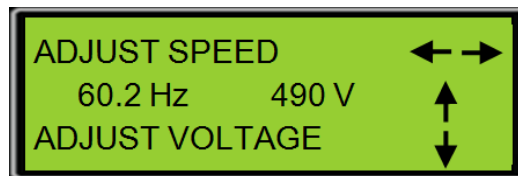


Figure 76: EMCP 4.1 & EMCP 4.2 Volts/Hz Control Screen

SCADA MODBUS (EMCP 4.2 ONLY)

EMCP 4.2 SCADA data link also provides a means for adjusting voltage remotely. EMCP 4.2 Modbus registers are defined for reading and controlling the target output voltage of the generator. Refer to EMCP 4 SCADA Data Links Application and Installation Guide (LEBE0010) for more details on EMCP 4.2 dedicated SCADA data links.

ANALOG INPUTS

Analog voltage adjustment is done via a programmable analog input to the EMCP configured for Generator Voltage Control. Analog inputs provide a voltage control interface for external potentiometers or external control systems (such as switchgear). The following analog input types can be configured on an EMCP 4.1 or EMCP 4.2 to adjust the generator voltage setpoint:

- Resistive (a range of input maps are available depending on the potentiometer size)
- Voltage
 - o 0 to 5 V
 - o 1 to 5 V
 - o 0.5 to 4.5 V

The Generator Voltage Control analog input signal is interpreted and converted by the EMCP into a voltage bias percentage of (nominal) rated voltage. For example, consider an analog input configured for a signal range of -10 to +10 V and a data range of -10% to 10%. When this analog input signal value equals +2 V, a voltage bias percentage of +2.0 % of rated will be applied to the generator output voltage.

Refer to Chapter 9 for further details on programming analog inputs on EMCP 4 controllers.

19.5 IVR DISPLAY SCREENS

The Integrated Voltage Regulator Overview and Voltage Bias Overview can be accessed directly through the EMCP display. To access the IVR Overview and Voltage Bias Overview through the EMCP display, navigate to the following sub-menus:

MAIN MENU

→ VIEW

→ IVR OVERVIEW

→ VOLTAGE BIAS OVERVIEW

The IVR Overview screen provides IVR operating mode, target voltage, excitation command and voltage compensation information. The Voltage Bias Overview screen provides information on all active voltage biasing on the generator system.

Note: Excitation command percentage is NOT a measurement of excitation current, but rather a commanded excitation operating point. A non-zero excitation command percentage MAY be displayed on screen during a fault scenario even though zero excitation current output is present.

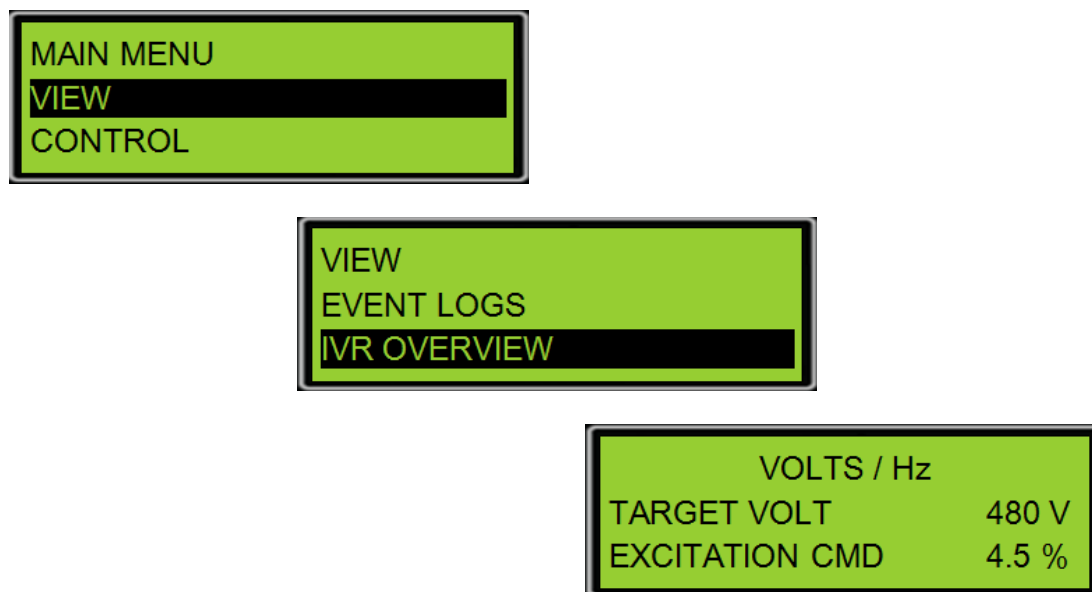


Figure 77: EMCP 4.1 & EMCP 4.2 IVR Overview Screens

The IVR operating modes for EMCP 4.1 and EMCP 4.2 are described below:

- **VOLTS/Hz** – voltage is regulated according to the under frequency roll off (Volts/Hz) profile.
- **V/Hz + DROOP** – voltage is regulated according to the under frequency roll off (Volts/Hz) profile .
- **V/Hz + LINE LOSS** - voltage is regulated according to the under frequency roll off (Volts/Hz) profile in addition to any line loss (IR) compensation bias.
- **SOFT START** – voltage is ramped during start up from 0 voltage to rated voltage according to the starting profile.
- **IVR LOCKED OUT** – voltage regulation is locked out and the excitation command is disabled (forced to 0 %). Generator output voltage will not build beyond residual voltage.
- **PF CONTROL** – voltage regulation is performed in order to control power factor to a desired level (EMCP 4.2 only)
- **STOPPING** – voltage is ramped down in proportion to engine speed during shutdown.

The Voltage Bias Overview screen on the EMCP 4.1 and EMCP 4.2 displays manual, analog, load compensation and total voltage bias percentages applied to the generator output.

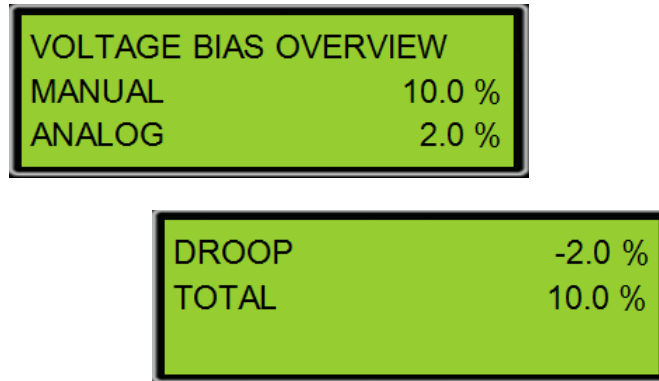


Figure 78: EMCP 4.1 & EMCP 4.2 Voltage Bias Overview Screens

The voltage biasing information for EMCP 4.1 and EMCP 4.2 is described below:

- **MANUAL** – summation of any voltage bias applied via programmable digital input, Voltage/Hz Control screen on the EMCP display or SCADA (Modbus) voltage bias.
- **ANALOG** – any voltage bias applied via a programmable analog input described in Chapter 9.
- **DROOP** or **LINE LOSS** – any voltage bias applied as a result of reactive droop or line loss load compensation. (EMCP 4.2 only)
- **TOTAL** – total voltage bias applied to the generator system. This total percentage bias is the summation of any manual, analog, or compensation (droop or line loss) biasing in the system.

Note: The total percentage bias that can be applied to the generator system is limited by the Maximum Generator Voltage Output Bias Percentage setpoint configured in the EMCP.

20 INSTALLING & UPGRADING SOFTWARE

The EMCP 4 supports field-programming (called flashing) of software for all of the modules. This is done by using the Cat Service Tool software and a Cat Communication Adapter. The Primary Data Link (CAN 1) service connector must be used for modules connected to the Primary Data Link. The Accessory Data Link (CAN 2) service connector must be used for modules connected to the Accessory Data Link. Refer to your generator set package documentation for the location of the service connectors.

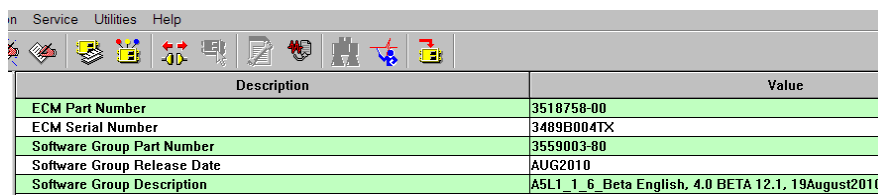
To flash the EMCP 4 requires the following hardware and software:

SOFTWARE AND HARDWARE REQUIRED

- ☒ The Cat Service Tool software installed and licensed on a PC
- ☒ A Cat Communication Adapter
- ☒ A 9-pin Deutsch service connection to the Primary Data Link (CAN 1)
- ☒ The new application software flash file for the EMCP 4

In order to install software into the EMCP 4, the genset must be stopped. If upgrading software, it may be important to back up the current configuration (see Chapter 4.2). Flashing application software does not affect the setpoints. However, if a problem occurs during flashing, this backup can be used to quickly configure a replacement module.

Record the current software version information. This is seen in the ECM Summary screen. See Figure 79. This information is useful to obtain the correct flash file if it is desired to return to the previous version of software after flashing.



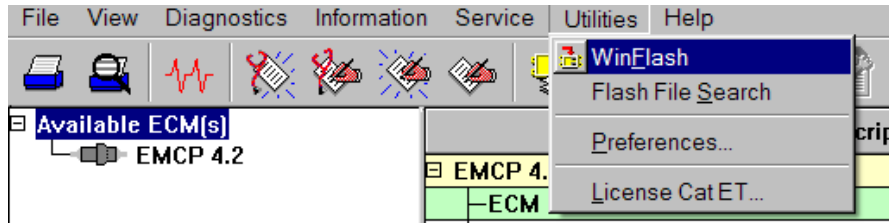
Description	Value
ECM Part Number	3518758-00
ECM Serial Number	3489B004TX
Software Group Part Number	3559003-80
Software Group Release Date	AUG2010
Software Group Description	A5L1_1_6_Beta English, 4.0 BETA 12.1, 19August2010

Figure 79: ECM Summary Information

Flashing of modules other than the EMCP 4 follow similar steps as the ones outlined below.

In order to flash an EMCP 4 module, do the following steps:

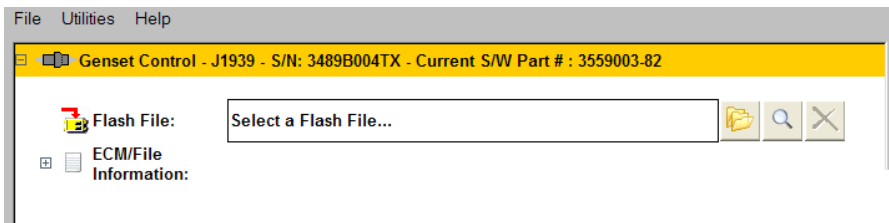
1. Connect to the EMCP 4 using the Cat Service Tool as stated in Chapter 4.2.
2. Enter the WinFlash Utility by selecting Utilities > WinFlash,



or by clicking the WinFlash Icon.

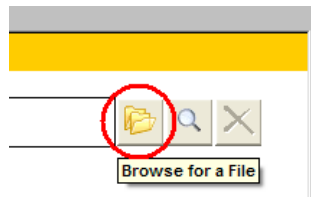


3. The WinFlash screen will appear.

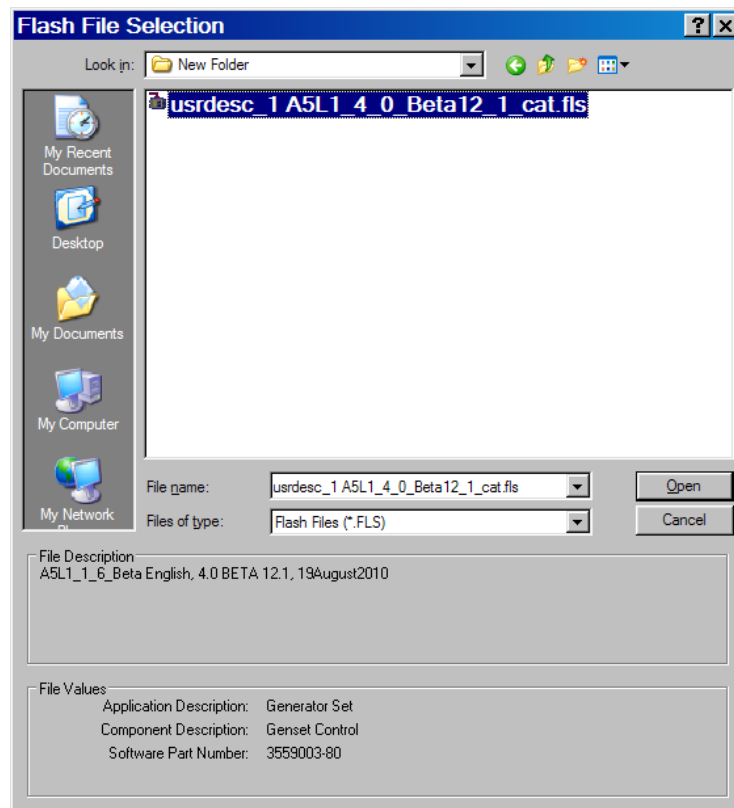


Note: If WinFlash does not find all of the modules on the CAN J1939 data link to which it is connected, re-scan the data link by pressing F8 (or selecting File > Update ECM List).

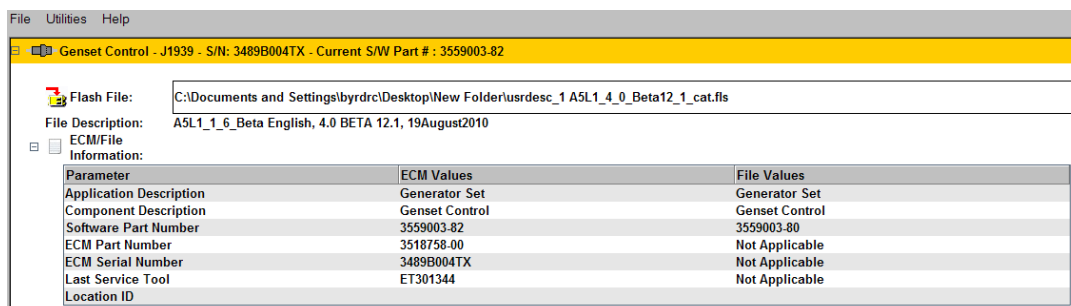
4. Select the Genset Control if multiple modules are listed, then click the “Browse for a File” button on the right hand side.



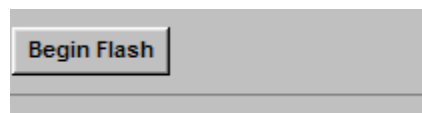
- Browse to the appropriate file and click “Open”.



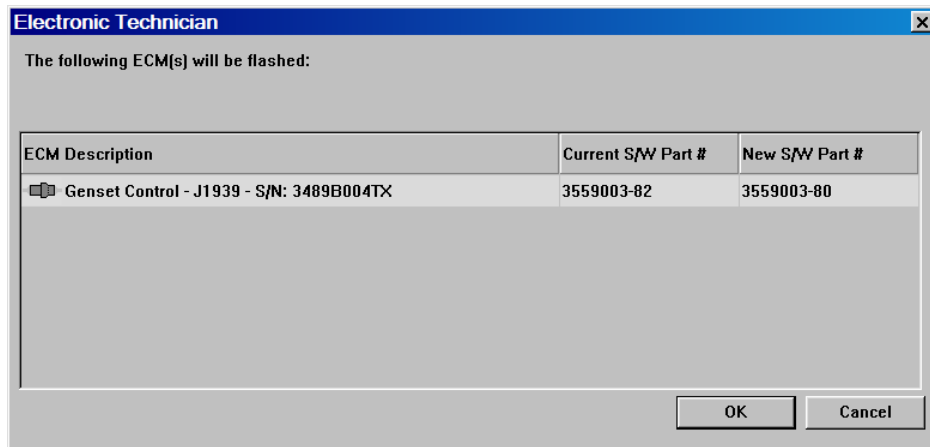
- The new file information will be displayed.



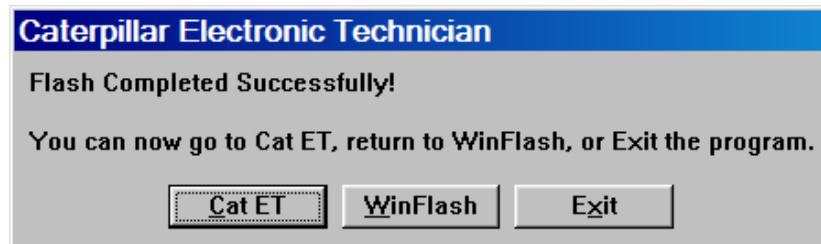
- Click “Begin Flash” in the lower left corner.



8. A confirmation screen will appear. Click "OK".



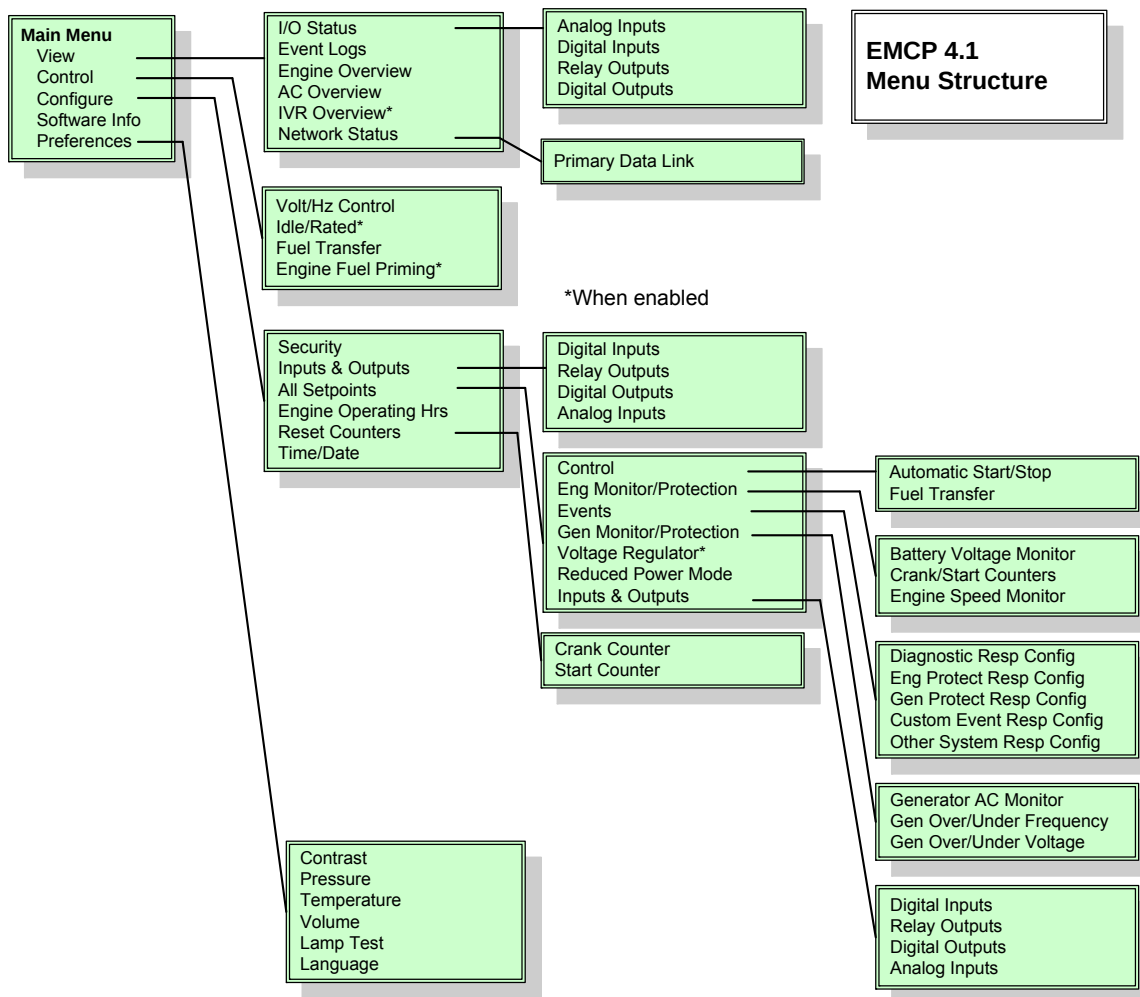
9. A progress meter will show the status of the flash and the EMCP display will show that software installation is occurring.
10. When the flashing process is complete, the ECM that was flashed will reboot. Also, WinFlash will bring up a window giving options for what to do next. This indicates that the software has finished flashing, and is ready to use.

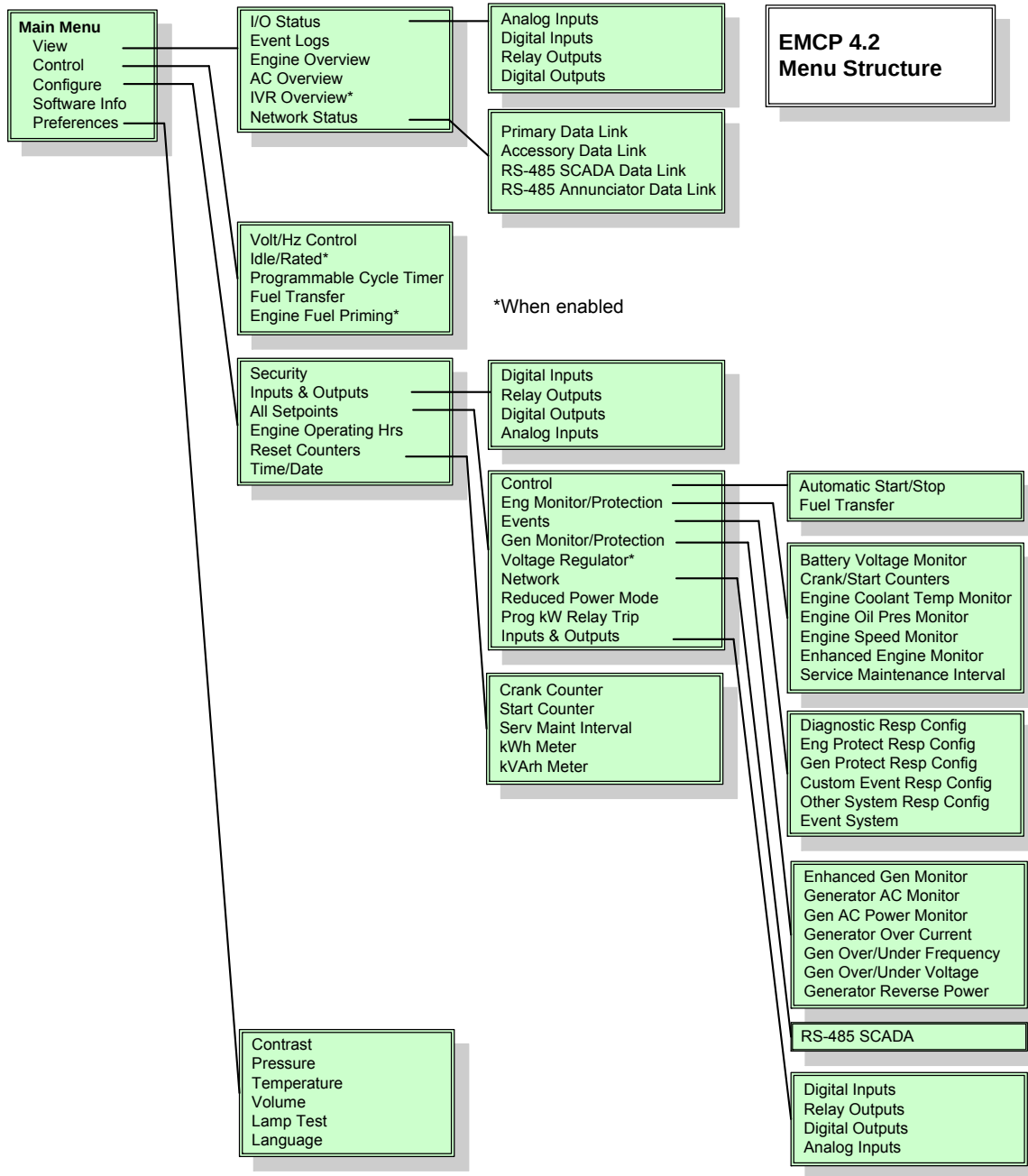


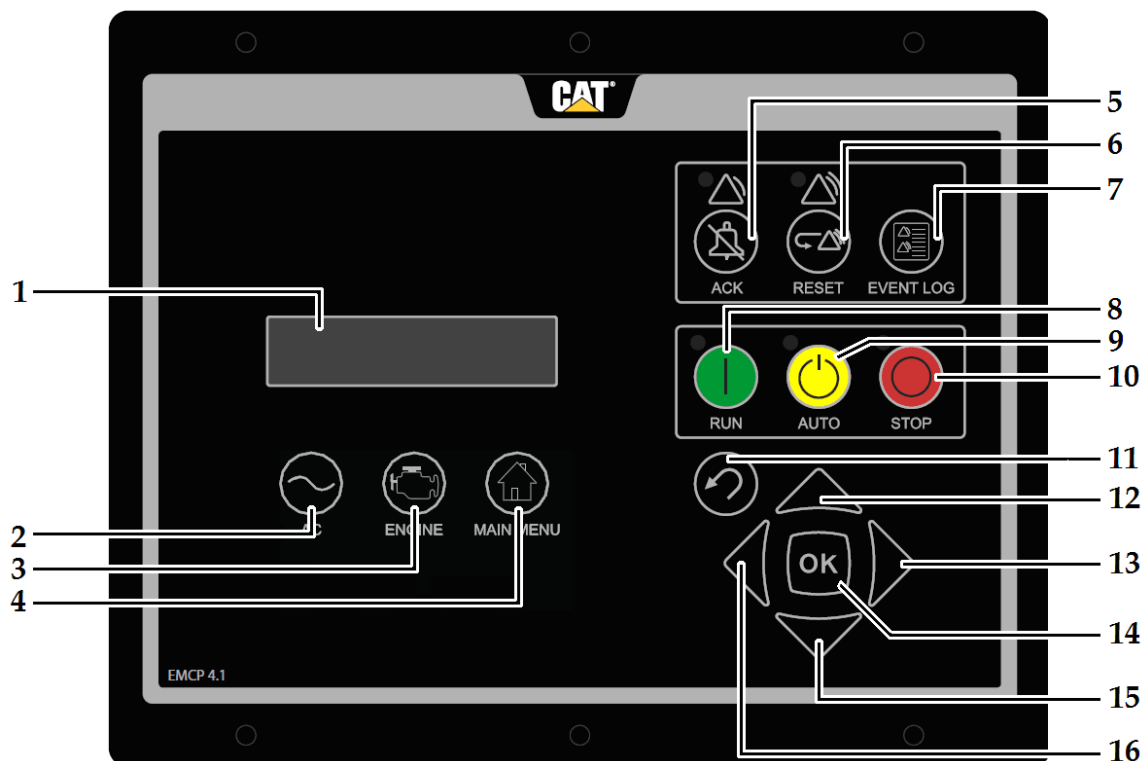
11. On startup, the EMCP 4 shows the software part number. Verify the software part number matches the new application software that was flashed.

APPENDIX A MENU STRUCTURES

For details on the setpoints available within each submenu, refer to the appropriate section above.





APPENDIX B EMCP 4 FRONT VIEW & NAVIGATION KEYS**EMCP 4.1 AND 4.2****(1) Display Screen****(2) AC Overview Key****(3) Engine Overview Key****(4) Main Menu Key****(5) Alarm Acknowledge/Silence Key with Amber Warning Lamp****(6) Event Reset Key with Red Shutdown Lamp****(7) Event Log Key****(8) Run Key****(9) Auto Key****(10) Stop Key****(11) Escape Key****(12) Scroll Up Key****(13) Scroll Right Key****(14) OK Key****(15) Scroll Down Key****(16) Scroll Left Key****(1) SCREEN**

Displays various genset information and parameters.

(2) AC OVERVIEW

The AC Overview Key will navigate the display to the first screen of AC information. The AC Overview Key information contains various AC parameters that summarize the electrical operation of the generator set.

(3) ENGINE OVERVIEW

The Engine Overview Key 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.

- (4) MAIN MENU** The Main Menu key will navigate the display to the main menu directly without having to navigate out of menus.
- (5) ALARM ACKNOWLEDGE/SILENCE** Pressing the Alarm Acknowledge/Silence Key will cause the horn Relay Output to turn off and silence the horn. Pressing the key will also cause any amber 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 CAN Data Link which will silence horns on Annunciators, if the CAN Annunciator is configured to respond.
- (6) EVENT RESET** The Event Reset button will clear all inactive fault conditions.
- (7) EVENT LOG** The Event Log button will navigate the display to the list of event logs.
- (8) RUN** Pressing the RUN Key will cause the EMCP to enter the RUN mode.
Note: If a Digital Input is programmed for ECS in Auto, or Stop, and a maintained switch latches that input to make it active, the front panel RUN key will not have any effect.
- (9) AUTO** Pressing the AUTO Key will cause the EMCP to enter the AUTO mode.
Note: If a Digital Input is programmed for ECS in RUN, or Stop, and a maintained switch latches that input to make it active, the front panel AUTO key will not have any effect.
- (10) STOP** Pressing the STOP Key will cause the EMCP to enter the STOP mode.
Note: If a Digital Input is programmed for ECS in Auto, or RUN, and a maintained switch latches that input to make it active, the front panel STOP key will not have any effect.
- (11) ESCAPE** The Escape Key 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. Pressing this key will bring the user back one menu/submenu.
- (12) SCROLL UP** The Scroll Up Key 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.
- (13) SCROLL RIGHT** The Scroll Right Key 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.

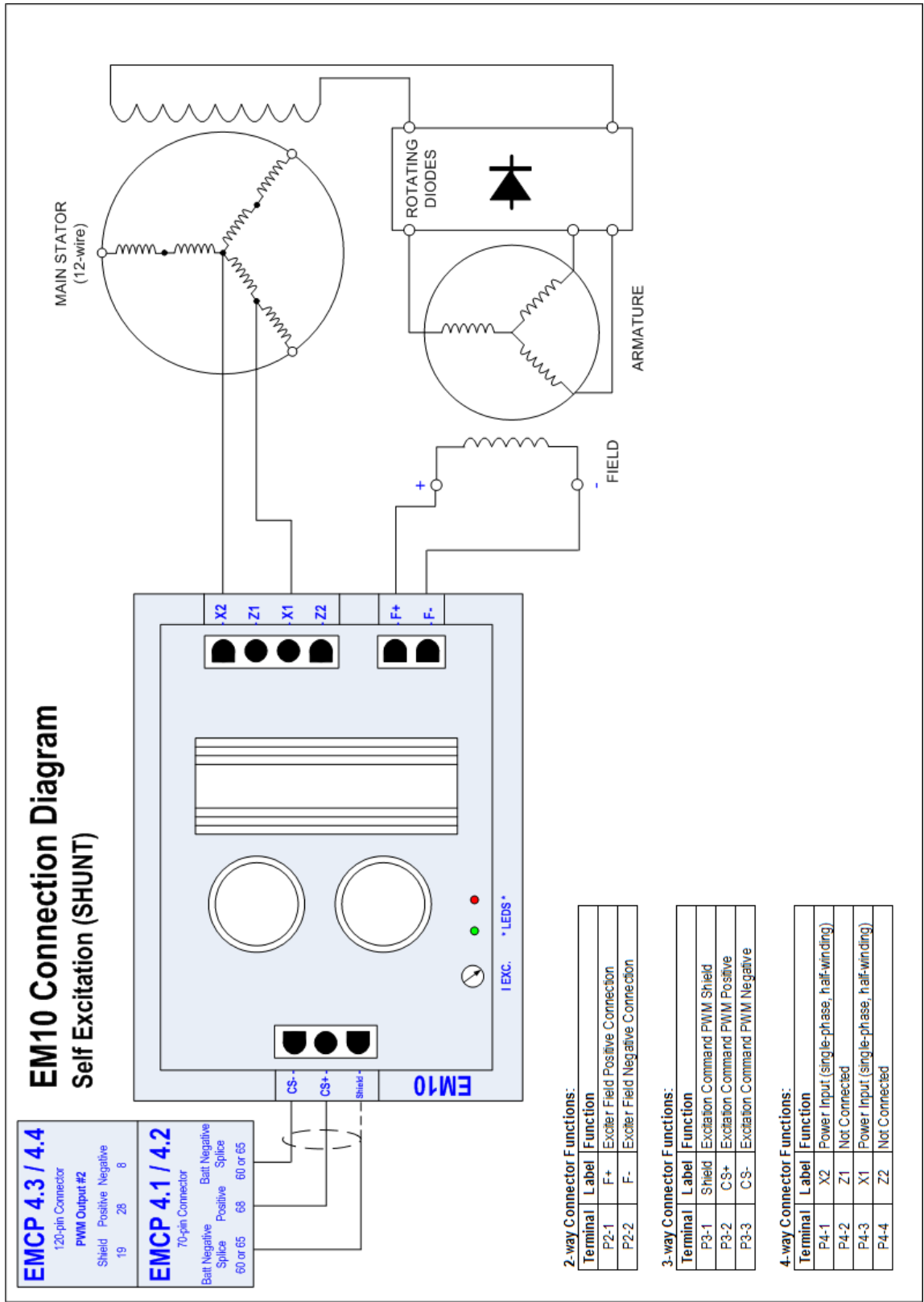
- (14) OK** The OK Key is used during menu navigation to select menu items in order to navigate forward/downward in the menu/sub-menu structure. The OK Key is also used during setpoint programming in order to save setpoints changes. Pressing the OK Key during setpoint programming causes setpoint changes to be saved to memory.
- (15) SCROLL DOWN** The Down Key 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.
- (16) SCROLL LEFT** The Scroll Left Key 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

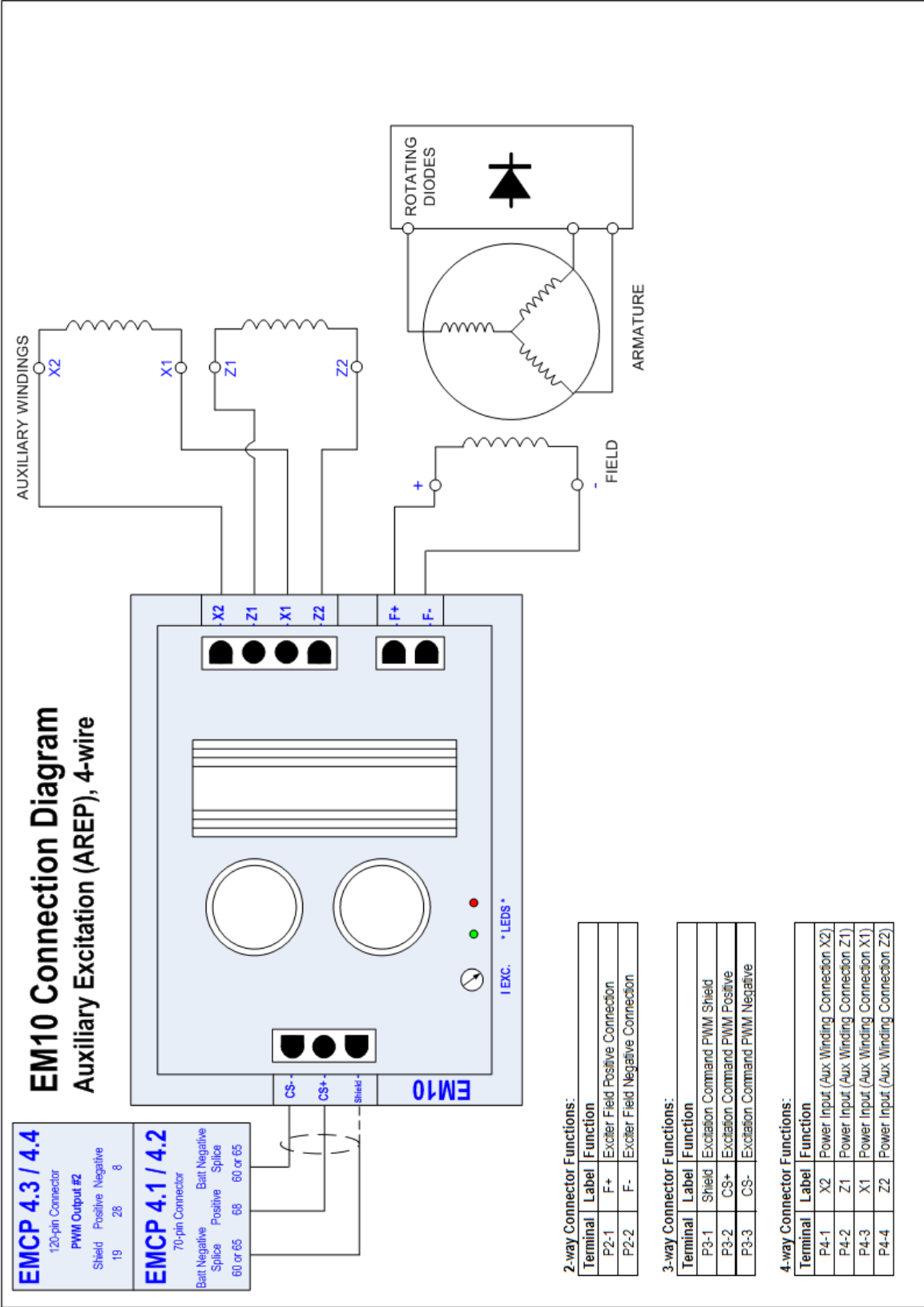
- AMBER WARNING LIGHT** The Amber Warning Light is located directly above the Alarm Acknowledge/Silence Key (5). A flashing amber light indicates that there are unacknowledged active warnings. A solid amber light indicates that there are acknowledged warnings active. If there are any active warnings, the amber light will change from flashing yellow to solid amber after the Alarm Acknowledge/Silence Key (5) is pressed. If there are no longer any active warnings, the amber light will turn off after the Alarm Acknowledge/Silence Key (5) is pressed.
- RED SHUTDOWN LIGHT** The Red Shutdown Light is located directly above the Event Reset Key (6). 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 (5) is pressed. Any condition that has caused an EMCP shutdown event must be manually reset. If there are no longer any active shutdown events, the red light will turn off.

APPENDIX C IVR EXCITATION MODULE CONNECTION DIAGRAMS

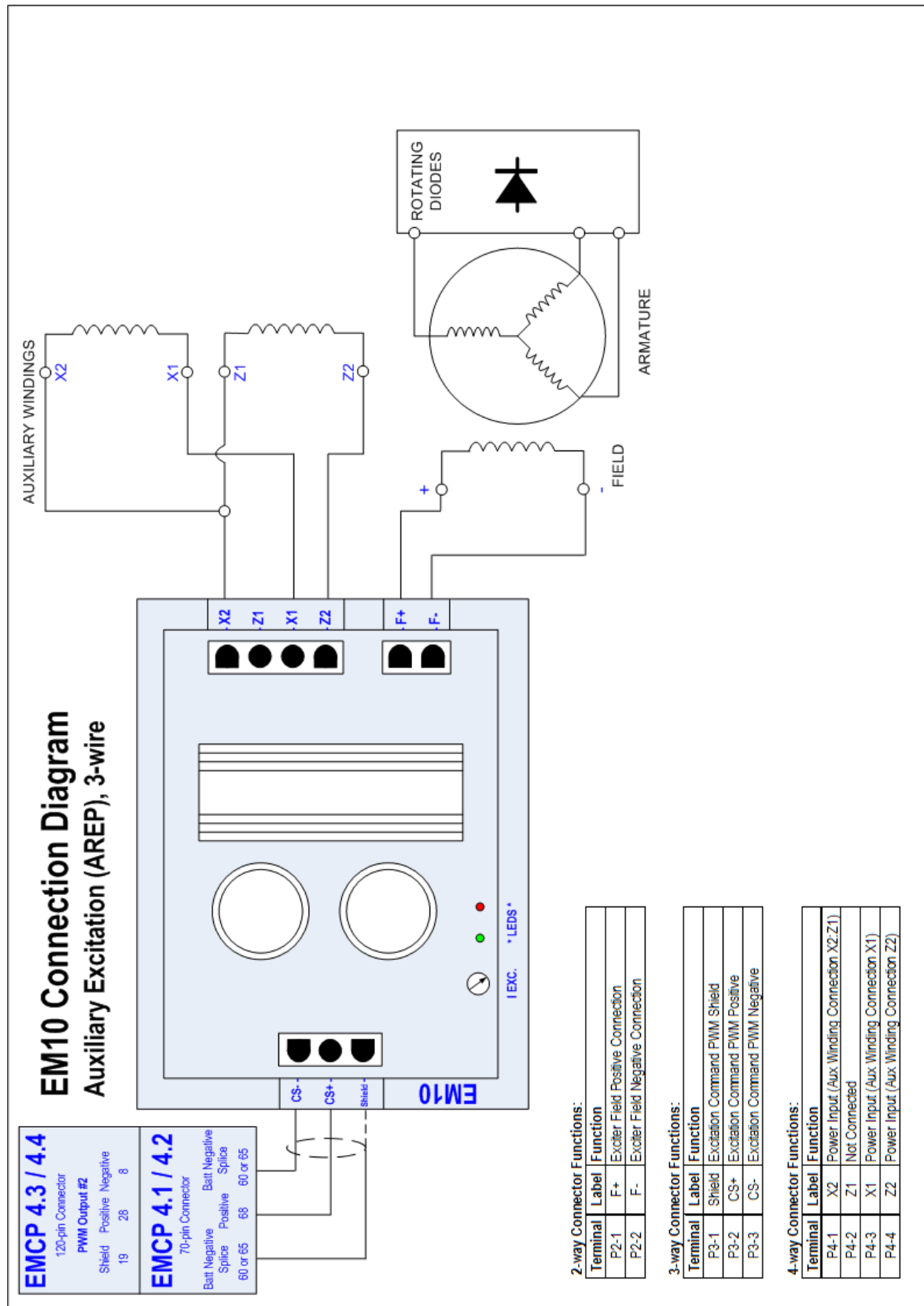
EM10 – Self-Excitation (SHUNT)



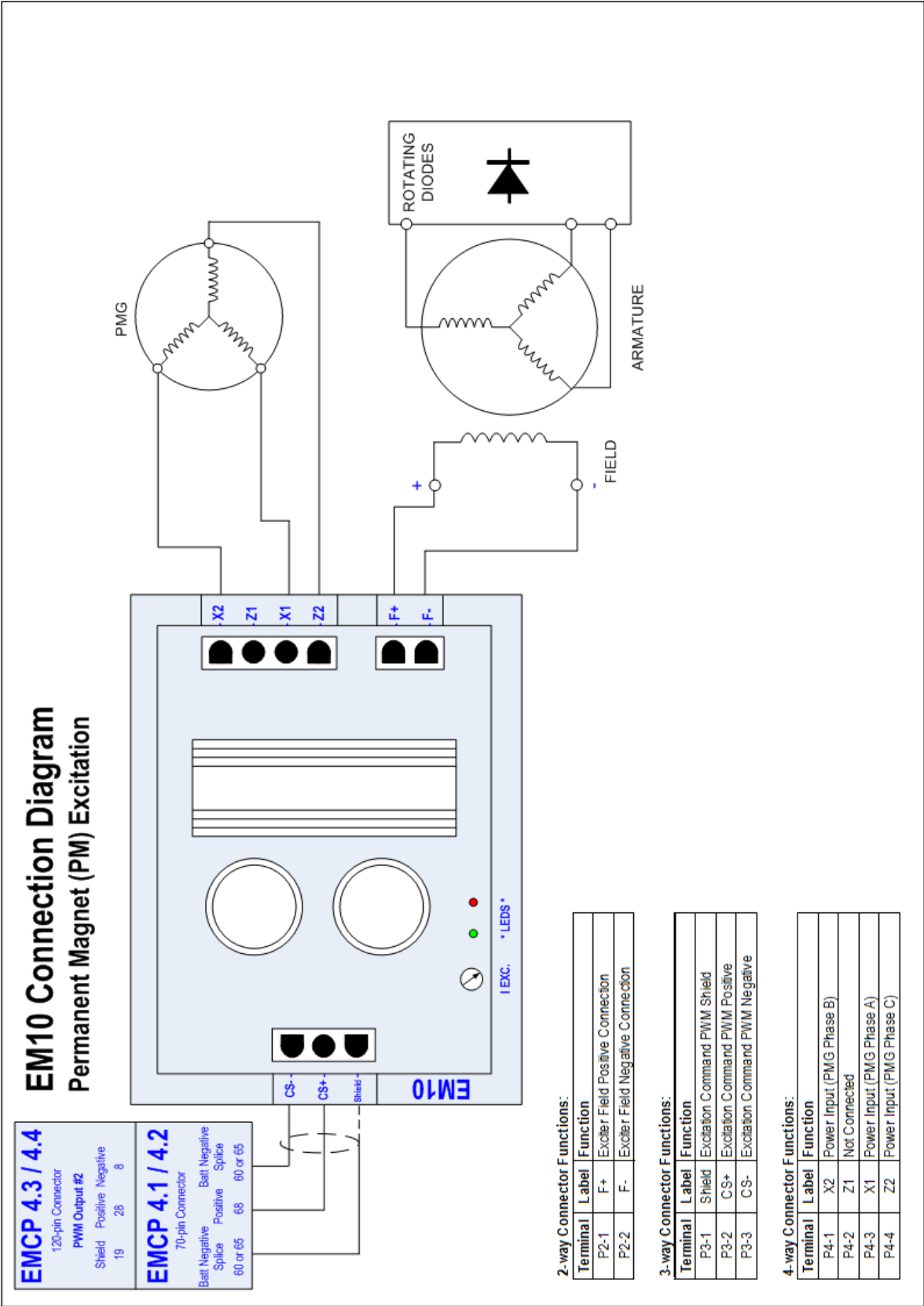
EM10 – Auxiliary Winding (Internal) Excitation (AREP / IE), 4-wire



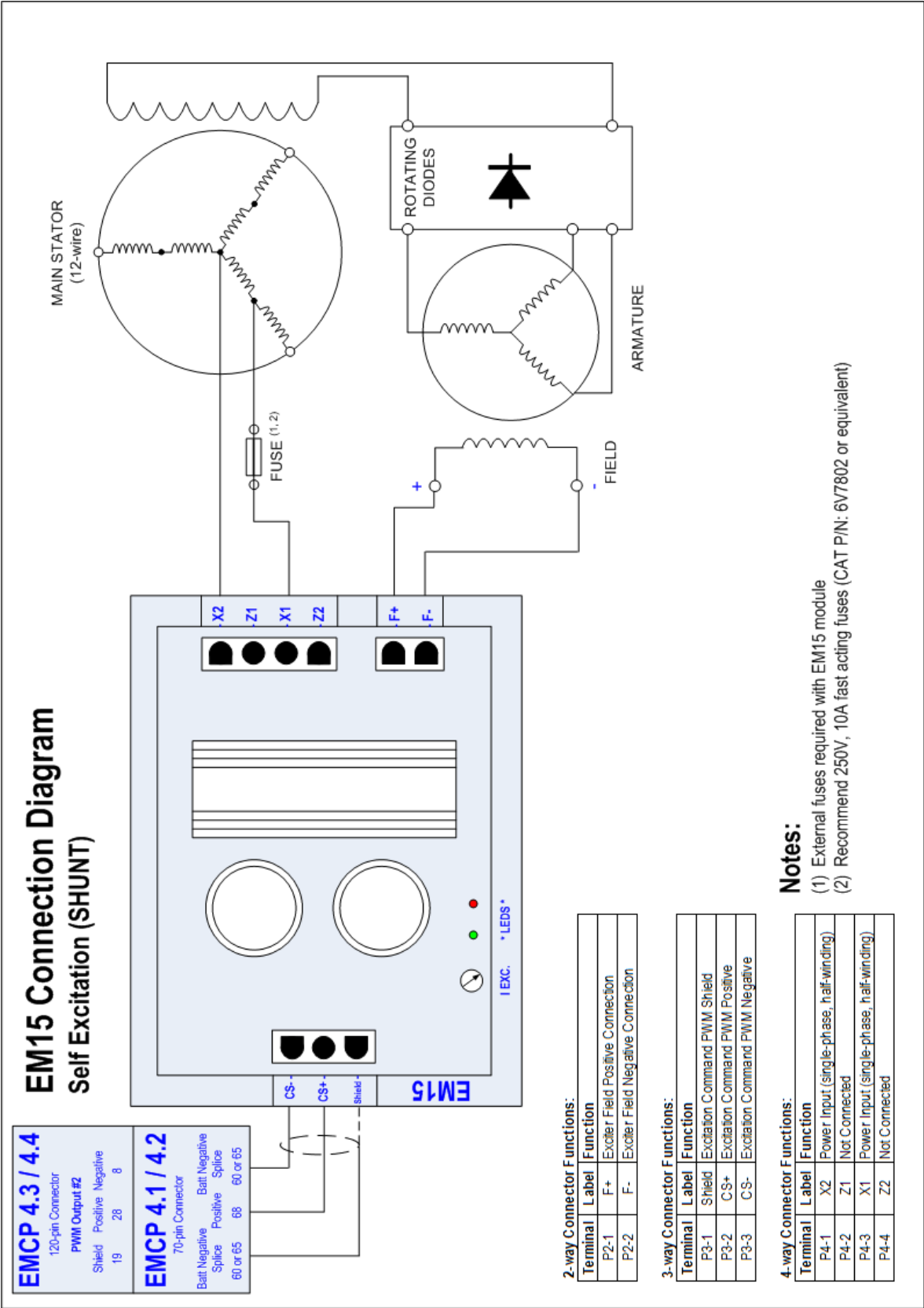
EM10 – Auxiliary Winding (Internal) Excitation (AREP / IE), 3-wire



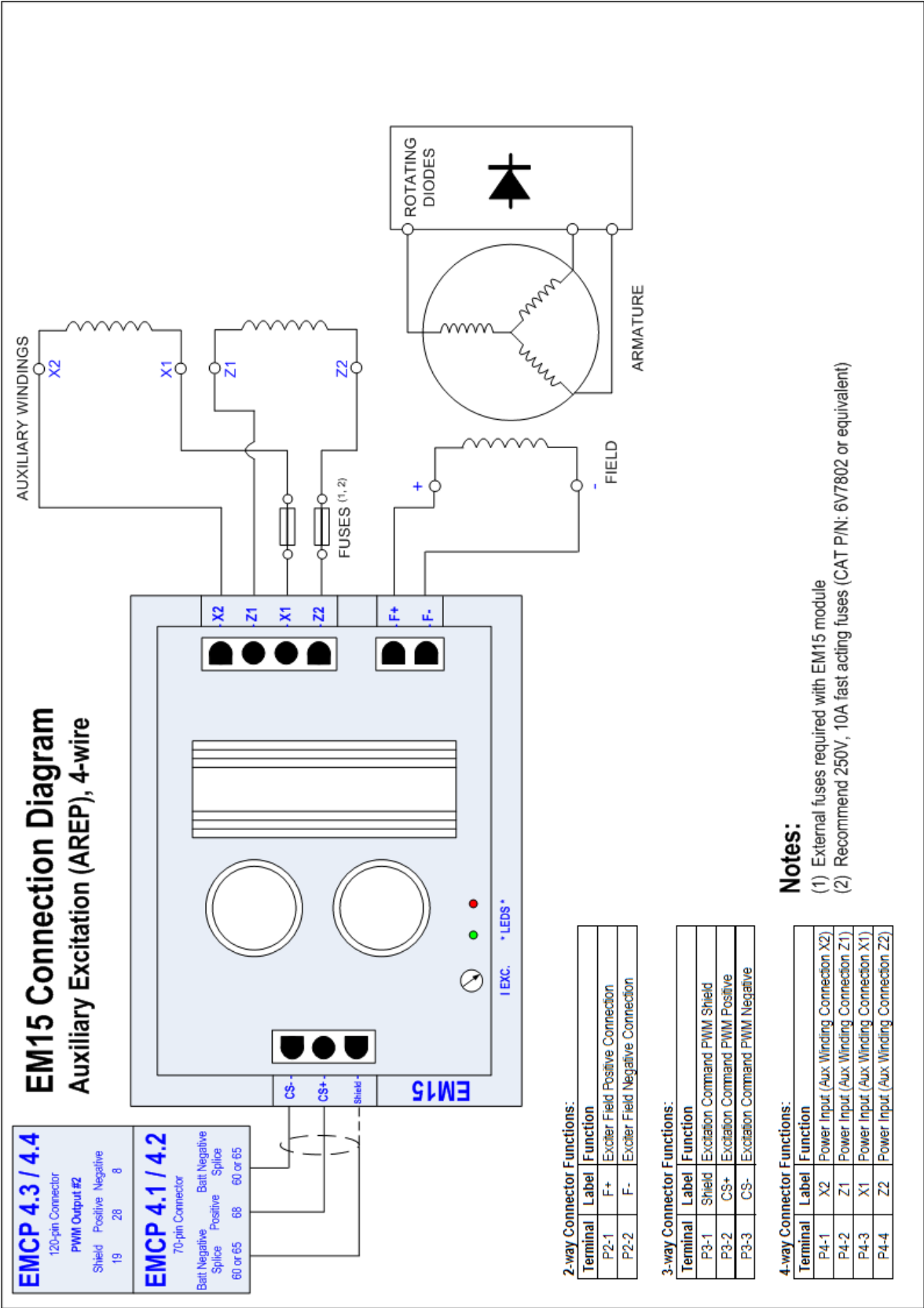
EM10 – Permanent Magnet Excitation (PM)



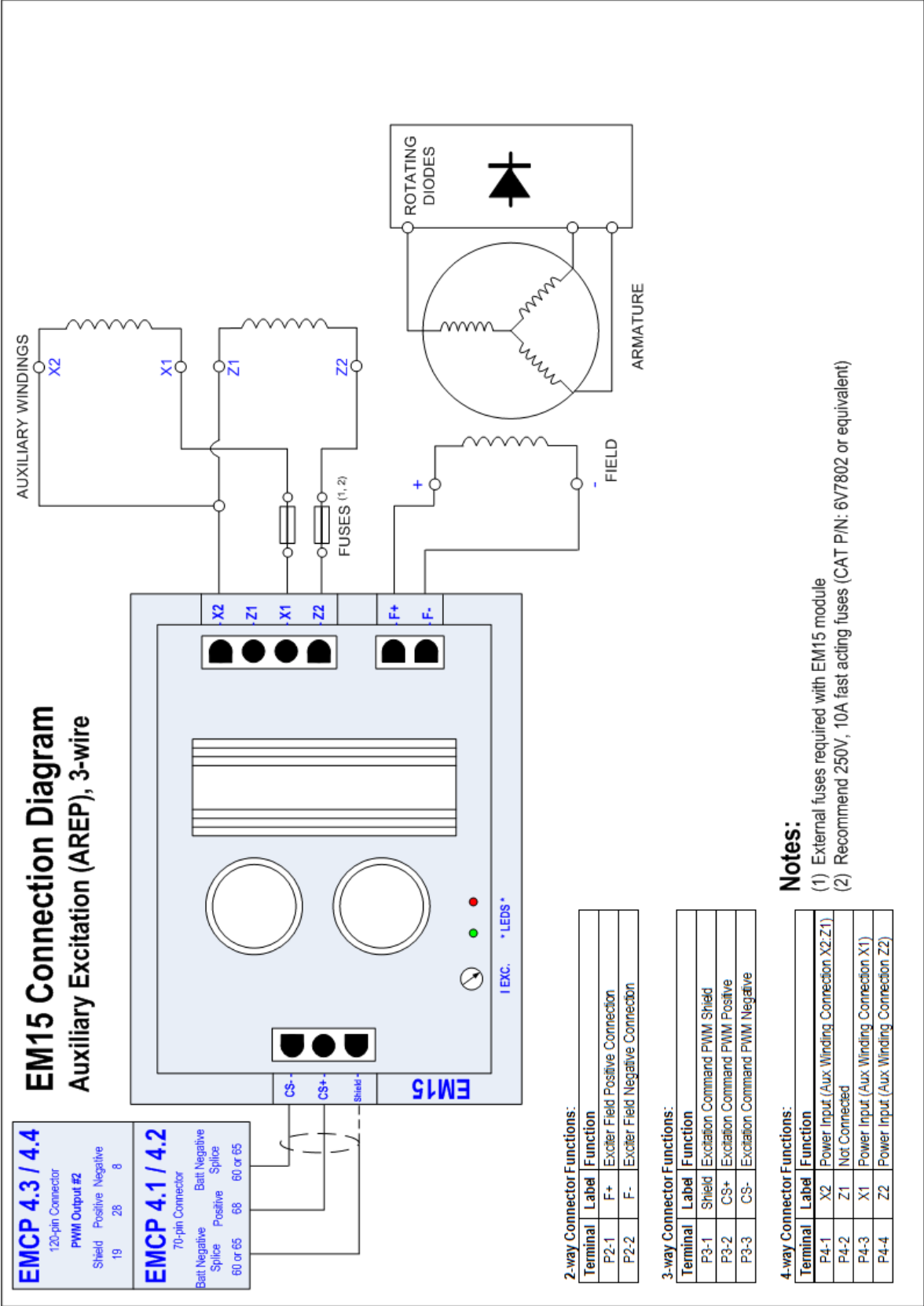
EM15 – Self Excitation (SHUNT)



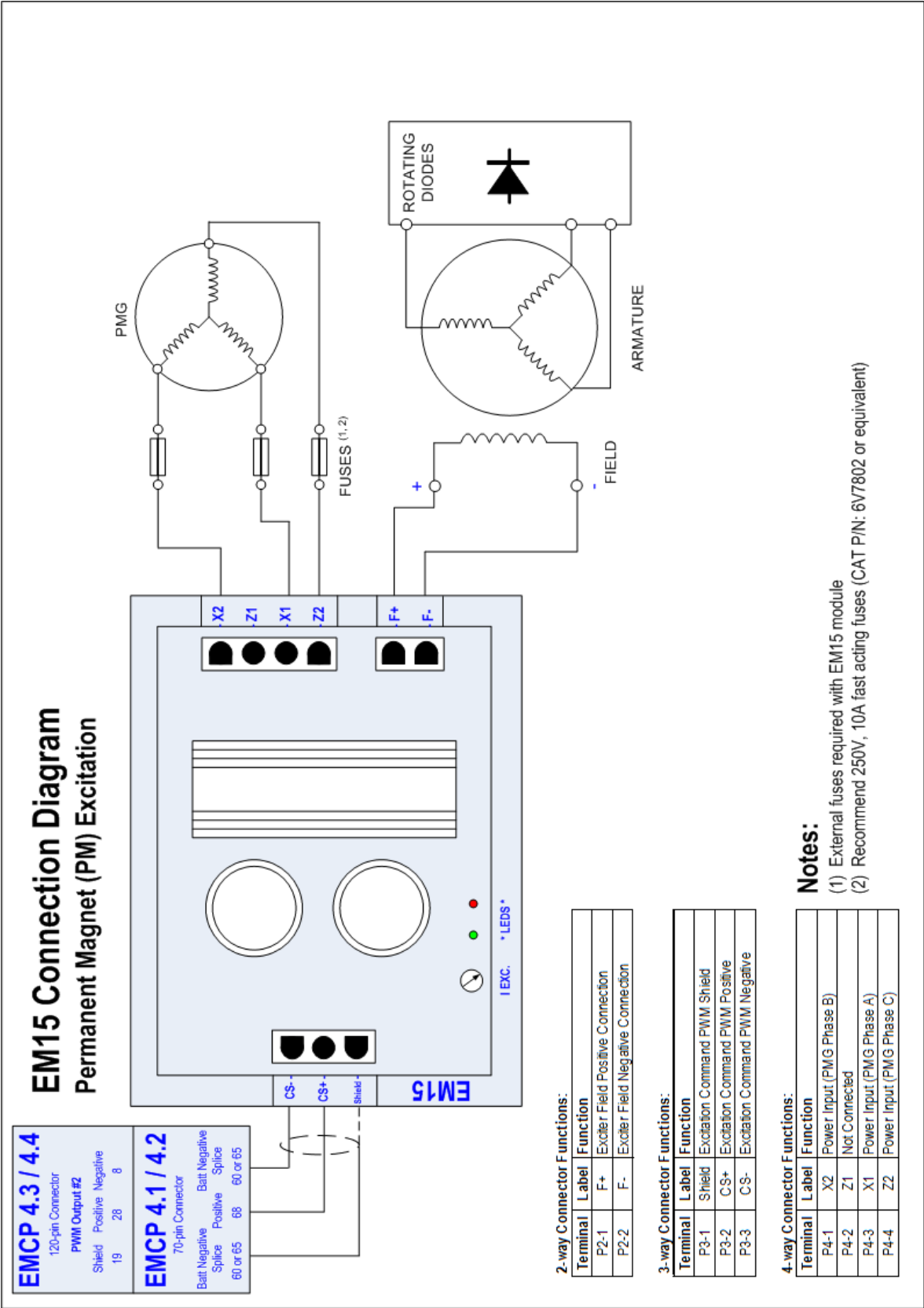
EM15 – Auxiliary Winding (Internal) Excitation (AREP / IE), 4-wire



EM15 – Auxiliary Winding (Internal) Excitation (AREP / IE), 3-wire



EM15 – Permanent Magnet Excitation (PM)



Glossary of Terms

ACK	Acknowledge
AGSM	Alarm Group Selection Mode. The mode in which group of alarms the RS-485 annunciator will respond is selected in.
CAN	Controller Area Network. This will often refer to our CAN J1939 Communications between ECMs.
CDVR	Cat Digital Voltage Regulator. A microprocessor based digital voltage regulator which communicates with the EMCP and controls excitation current to control generator voltage.
DIO	Discrete Input/Output Module
EMCP 4	Electronic Modular Control Panel 4. This is the Cat generator set control panel, consisting of a generator set control (GSC).
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.
ECS	Engine Control Switch
ECU	Engine Control Unit. Another name for an ECM (Electronic Control Module).
EM	Excitation Module. This is the excitation power converter component required for use with the Integrated Voltage Regulator (IVR).
EUI	Electronic Unit Injector. A type of Fuel Injector.
FMI	Failure Mode Indicator. The CAN 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.
FPT	Fault Protection Timer. A time delay that suppresses some events for a configurable amount of time after the generator set starts to allow values to settle before taking action on the event.
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.
IVR	Integrated Voltage Regulator. This is a voltage regulating system integrated into EMCP controls. Requires an Excitation Module component.
MUI	Mechanical Unit Injector. A type of fuel injector.
NFPA	National Fire Protection Association. A n American standards body responsible for creation of various codes.
PCT	Programmable Cycle Timer. A timer which supports starting a generator set for exercise on a 7 day basis.

Glossary of Terms

RMS	A mathematical approach of representing a useful average for varying quantities; this is useful to indicate AC quantities.
RPM	Revolutions per minute
RPM	Reduced Power Mode. A mode to reduce the power consumption of an EMCP controller when a battery charger is not fitted to the generator set.
RS-232	Recommended Standard 232, maintained by the Electronics Industries Alliance (EIA). Also known as EIA-232.
RS-485	Recommended Standard 485, maintained by the Electronics Industries Alliance (EIA). Also known as EIA-485.
RTD	Resistive Temperature Device. A temperature sensor that changes resistance based on temperature.
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 4.2 can function as an RTU on a SCADA system via the RS-485 SCADA port.
SCR	Selective Catalyst Reduction. This is a form of emission treatment.
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 4, 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).
SPN	Suspect Parameter Number. The CAN term for any parameter whose data is transmitted over a CAN network, such as the EMCP 4 primary or accessory data link. For a complete list of SPNs supported by the EMCP 4, refer to the Diagnostic Trouble Code List in the Systems Operation Troubleshooting Testing and Adjusting guide.

