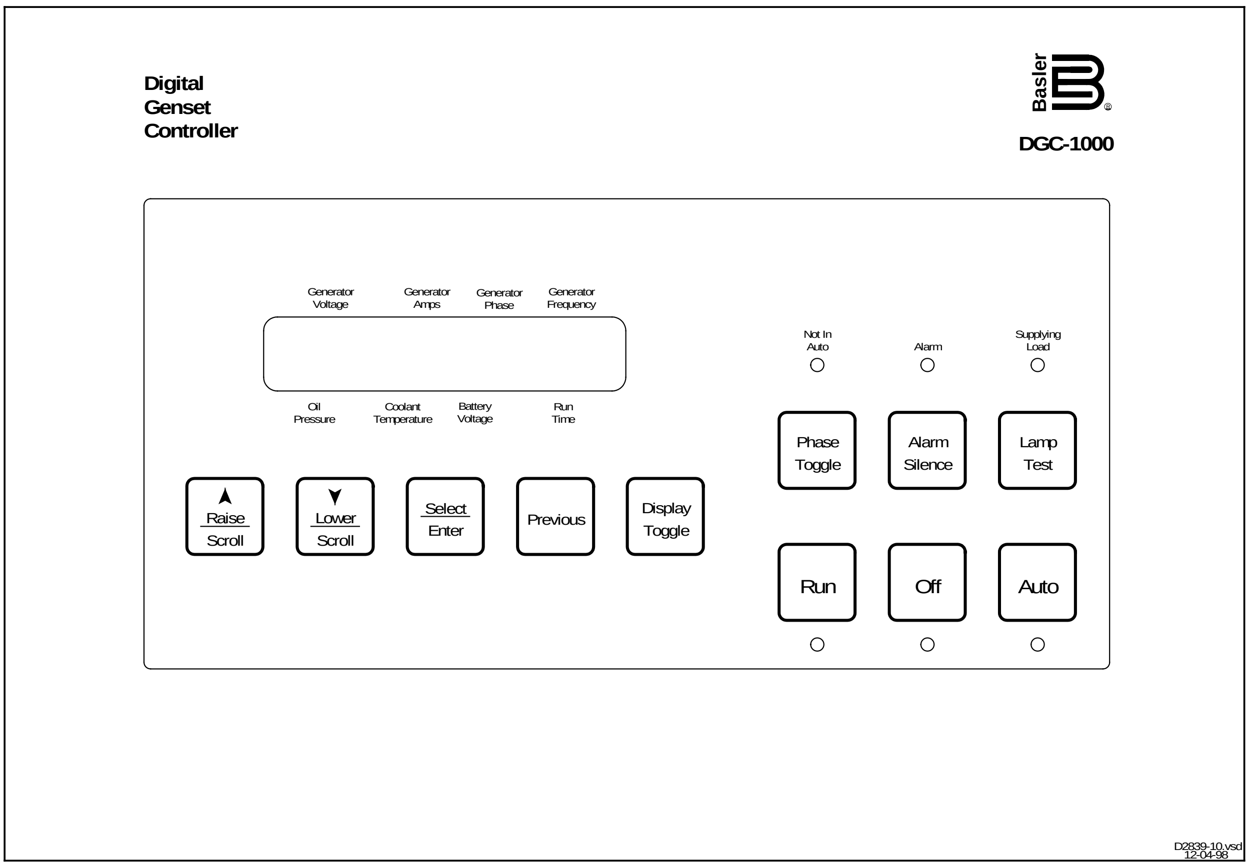
INSTRUCTION MANUAL

FOR

DGC-1000

DIGITAL GENSET CONTROLLER



Basler Electric®

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INTRODUCTION

This instruction manual provides information about the operation and installation of the DGC-1000 Digital Genset Controller. To accomplish this, the following information is provided.

- General Information and Specifications
- Controls and Indicators
- Functional Description
- Communication Software
- Installation
- Test Procedures

WARNING!

To avoid personal injury or equipment damage, only qualified personnel should perform the procedures in this manual.

NOTE

Be sure that the controller is hard-wired to earth ground with no smaller than 12 AWG copper wire attached to the ground terminal on the rear panel. When the controller is configured in a system with other devices, it is recommended to use a separate lead to the ground bus from each unit.

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It is not the intention of this manual to cover all details and variations in equipment, nor does this manual provide data for every possible contingency regarding installation or operation. The availability and design of all features and options are subject to modification without notice. Should further information be required, contact Basler Electric.

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PRODUCT REVISION HISTORY

DGC-1000 Digital Genset Controllers with part number 93589XXXXX incorporate an SAE CAN/J1939 interface to support electronically controlled engine applications and replace earlier versions of the DGC-1000 with part number 93275XXXXX.

The following information provides a historical summary of the changes made to the embedded software (firmware), PC software (BESTCOMS), and hardware of the DGC-1000. The corresponding revisions made to this instruction manual (9358900990) are also summarized. Revisions are listed in chronological order.

Firmware Version	Change
3.04.XX, 06/02	• Initial release
3.05.XX, 09/02	• Increased ECU settling time • Embedded the firmware part number for display on HMI LCD and in BESTCOMS • Maximum value for low fuel alarm threshold was increased to 100%
3.06,XX, 03/03	• Not released for production
3.07.XX, 09/03	• Added capability of Stop/Start control for Volvo Penta EDC
3.08.XX	• Not released to production
3.09.XX, 04/04	• Added access level setting for third-party Modbus programs • Added Event Log capability • Added Volvo Speed Select and Accelerator Position settings
3.11.XX, 10/05	• Added support for MTU MDEC ECUs • Added configurable ECU contact and pulsing disable settings
3.12.XX, 11/05	• Added 4-Wire Delta Auxiliary Input function
3.13.XX, 07/06	• Added communications settings (read-only) to the front-panel LCD menu

BESTCOMS Version	Change
2.01.00, 06/02	• Initial release
2.02.XX, 09/02	• Added display of the firmware part number • Corrected power factor polarity display error
2.03.XX	• Not released to production
2.04.XX, 09/03	• Added support for Volvo Penta EDC
2.05.XX	• Not released to production
2.06.XX, 04/04	• Added access level setting for third-party Modbus programs • Added communication port phone book • Added Event Log selection to menu bar • Added Volvo Speed Select and Accelerator Position settings
2.07.XX, 10/05	• Added support for MTU MDEC ECUs • Required OEM-level password access to change CANBus Interface settings • Added configurable ECU contact and pulsing disable settings
2.08.XX, 11/05	• Added 4-Wire Delta Auxiliary Input function

Hardware Version	Change
C, 06/02	• Initial release
D, 09/02	• Converted capacitors C52 and C64 to non-polarized part
E, 09/02	• Replaced Digital circuit board micro controller with new part programmed with firmware version 3.05.XX
F, 01/03	• Began using anti-static packing materials during shipment
G, 09/03	• Added Volvo engine Stop/Start control via J1939 interface
H, 02/04	• Minor firmware enhancements
J, 04/04	• Implemented firmware version 3.09
K, 08/04	• Modified LCD heater circuitry to compensate for supplier changes in LCD heater control chip
L, 08/04	• Minor firmware and BESTCOMS software enhancements
M, 11/04	• Implemented firmware version 3.10

Manual Revision	Change
—, 01/02	• Initial release
A, 06/02	• Added new BESTCOMS screen images • Added ECU and state machines documentation to Section 3 • Created Appendix A, *DGC-1000 Settings Record*
B, 08/03	• Added material pertaining to DGC-1000 communication with Volvo Penta EDCs • Added rear-panel HMI information and diagram showing the location of the CAN connector to Section 2 • Added information regarding DGC Isolator Kits to Section 4 • Added a table listing CAN terminations and a diagram showing the CAN cable assembly to Section 4 • Replaced the System Settings screen, shown in Section 6, with revised screen containing additional settings • Inserted additional settings of BESTCOMS System Settings screen to the settings record of Appendix A
C, 04/04	*Section 3* • Added single-phase formulas for total kVA, kW to Section 3 • Added oil filter differential pressure, fuel filter differential pressure, and crankcase pressure parameters to Table 3-1 *Section 4* • Added torque specification for mounting hardware to Section 4 • Changed all *Volvo Penta EDC* references in text and illustrations to *Volvo Penta EDC III*. *Section 6* • Incorporated changes to Phone Book and Comm Port screens • Added description of Event Log screen, Metering screen's ECU Data tab, Engine Configuration screen, third party access level, and CAN Bus Speed Select and Accelerator Position settings
D, 08/05	• Added material pertaining to DGC-1000 communication with MTU MDEC ECUs • Added recommendation of a user-supplied serial server for DGC-1000 communication over an Ethernet LAN/WAN • Add information about configurable ECU contact and pulsing disable settings

Manual Revision	Change
E, 11/05	• Added 4-Wire Delta formulas to Section 3, *Functional Description, Microprocessor, Formulas.* • Added 4-Wire Delta information to Section 6, *BESTCOMS Software, Setting Definitions, Input/Output Settings, Programmable Input Contact Setup Tab* • Added Programmable Input Contact Setup chart to the DGC-1000 Settings Record in Appendix A.
F, 07/06	• Added illustration and description of HMI menu 2.5 (communications settings) • Added HMI menu 2.5 to Figure 3-7 (menu 2 illustration) • Corrected Figure 3-9 (wrong menu shown) • Added note to Section 3 regarding the DGC-1000 operating mode at power-up • Added note to Table 3-5 and 3-6 regarding PreStart relay functionality
G, 09/17	• Corrected weak battery voltage pre-alarm description in section 3. • Added nonvolatile memory caution statement to section 6.

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SECTION 1 • GENERAL INFORMATION

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SECTION 1 • GENERAL INFORMATION

DESCRIPTION

The DGC-1000 Digital Genset Controller provides integrated engine/genset control, protection, and metering in a single package. Microprocessor-based technology allows for precise measurement, setpoint adjustment, and timing functions. Front panel controls and indicators provides quick and simple operation. BESTCOMS software allows easy customizing of the DGC-1000 for a specific application. Because of the DGC-1000's low sensing burden, dedicated potential transformers (PTs) and current transformers (CTs) are not required. The backlit liquid crystal display (LCD) can be read under any lighting and temperature condition.

A CANBus interface provides electronic communication with engine control units (ECUs) supporting the SAE J1939 protocol or the MTU MDEC proprietary protocol. The CANBus interface provides direct access to oil pressure, coolant temperature, and engine speed sensors. These parameters can be read directly from the ECU over the J1939 communication interface. When available, engine diagnostic data can also be accessed.

FEATURES

DGC-1000 Digital Genset Controllers have the following features.

- Resistant to moisture, salt fog, dust, and chemical contaminants
- Resistant to the entrance of insects and rodents
- Suitable for mounting in any top-mount enclosure
- Suitable for controlling isolated generating systems or paralleled generating systems
- Easy setup through serial communication and BESTCOMS software
- CANBus interface provides high-speed communication with the ECU on electronically-controlled engines utilizing the SAE J1939 protocol or MTU MDEC protocol

FUNCTIONS

DGC-1000 Digital Genset Controllers perform the following functions.

Protection

- Engine oil pressure
- Fuel level sender
- Coolant temperature
- Overload

Control

- Engine cranking
- Engine cool-down

Monitoring

- Battery condition
- Engine maintenance
- Battery charger failure

Detection

- Fuel leak
- Low coolant level

Metering

- Generator voltage
- Generator current
- Generator frequency
- Engine coolant temperature
- Engine oil pressure
- Engine rpm
- Engine run-time
- Watts
- VA
- Power factor
- Watthours
- Battery voltage
- Fuel level

Reporting

- Engine diagnostics

OUTPUTS

Six sets of isolated, form A output contacts are provided: Start, Fuel Solenoid, Pre-start, Alarm, Pre-alarm, and EPS Supplying Load. An addition eight sets of Form C output contacts are available as an option. See *Specifications, Output Contacts* for contact ratings and terminal assignments.

OPTIONAL EQUIPMENT

Optional equipment available to the DGC-1000 is described in the following paragraphs.

Auxiliary Inputs and Outputs (Style AXX)

An auxiliary I/O assembly, with four sets of input contacts and eight sets of output contacts, is available for applications that require more input and output contacts. The additional input contacts can be assigned to a desired function by using BESTCOMS to label the inputs so that the front panel LCD displays the proper message. The additional output contacts can be programmed through BESTCOMS to perform the desired actions.

Dial-Out Modems (Style X1X and X2X)

Two dial-out modems are available. When an alarm or pre-alarm condition occurs, the modem will dial up to four telephone numbers, in sequence, until an answer is received and the condition is annunciated. The standard modem (style X1X) has an operating temperature range of 0°C to 50°C (32°F to 122°F). The extended operating temperature range modem (style X2X) operates over the range of –40°C to 70°C (–40°F to 158°F). Both modems support the MNP10EC protocol for optimizing data transmission in cellular applications.

Enhanced Communication (Style XXC)

Enhanced communication provides remote start/stop genset control, remote fault viewing and reset, and remote engine/generator parameter metering. This option requires a dial-out modem.

Remote Annunciation Display Panel (RDP-110)

Applications requiring remote annunciation can use the Remote Display Panel, RDP-110. This display panel can annunciate all DGC-1000 alarms, pre-alarms, and operating conditions.

MODEL AND STYLE NUMBER

DGC-1000 electrical characteristics and operating features are defined by a combination of letters and numbers that make up the style number. The DGC-1000 style number identification chart is shown in Figure 1-1.

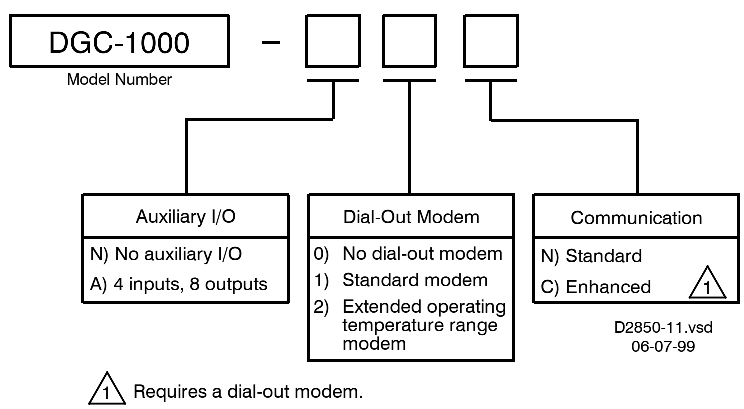

Figure 1-1. DGC-1000 Style Number Identification Chart

The model number and style number appear on a label located on the Analog circuit board. Upon receipt of a unit, be sure to check the style number against the requisition and packing list to ensure that they agree.

Style Number Example

If a style number of A1C were specified, the DGC-1000 would have the following features.

DGC-1000 Digital Genset Controller

- A Auxiliary I/O: 4 contact inputs and 8 contact outputs
- 1 Dial-Out Modem: standard modem
- C Communication: enhanced communication

SPECIFICATIONS

DGC-1000 electrical and physical specifications are listed in the following paragraphs.

Current Sensing

Continuous Rating

1 A Inputs:	0.02 to 1 A
5 A Inputs:	0.1 to 5 A

One Second Rating

1 A Inputs:	2.0 A
5 A Inputs:	10.0 A

Accuracy: ±0.5% of reading or ±1 A, whichever is greater (at 25°C (77°F))

Terminals:

1 A Inputs:	P9, P11 (A-phase), P6, P8 (B-phase), P3, P5 (C-phase)
5 A Inputs:	P10, P11 (A-phase), P7, P8 (B-phase), P4, P5 (C-phase)

Voltage Sensing

Continuous Rating:	12 to 576 V rms, 50/60 Hz
One Second Rating:	720 V rms
Accuracy:	±0.5% or reading or ±1 V, whichever is greater (at 25°C (77°F))
Burden:	1 VA
Terminals:	P34 (A-phase), P35 (B-phase), P36 (C-phase), P37 (neutral)

Frequency

Range:	4 to 70 Hz
Accuracy:	±0.25% of reading or ±0.1 Hz, whichever is greater (at 25°C (77°F))

Contact Sensing

Configuration

Emergency Stop:	NC, dry
Battery Charger Failure:	NO, dry
Automatic Transfer Switch:	NO, dry
Low Coolant Level:	NO, dry
Auxiliary 1 – 4:	NO, dry

Terminals

Emergency Stop:	P17, P18
Battery Charger Failure:	P16, P41
Automatic Transfer Switch:	P15, P41
Low Coolant Level:	P14, P41
Auxiliary 1:	P5, P41
Auxiliary 2:	P9, P41
Auxiliary 3:	P13, P41
Auxiliary 4:	P17, P41

Engine System Inputs *

* Stated accuracies are subject to the accuracy of the senders used.

Fuel Level Sensing

Input Range:	240 to 33 Ω nominal
Accuracy:	±1% at 25°C (77°F)
Default Transducer:	Isspro R-8925 or equivalent

Fuel Leak Sensing

Detection Level:	<5 Ω across fuel level input

Coolant Temperature Sensing

Input Range:	637.5 to 62.6 Ω (corresponds to 100 to 300°F (37 to 149°F))
Accuracy at 25°C (77°F):	±0.5% of reading or ±1°, whichever is greater for measurement range of 37 to 115°C (99 to 239°F)
Default Transducer:	Stewart Warner 334-P

Oil Pressure Sensing

Input Range:	240 to 33.5Ω (corresponds to 1 to 100 psi)
Accuracy at 25°C (77°F)	
0 to 100 psi:	±0.5% of reading or ±1 psi, whichever is greater
0 to 690 kPa:	±0.5% of reading or ±7 kPa, whichever is greater
Default Transducer:	Stewart Warner 411-K

Battery Voltage Sensing

Nominal:	12 or 24 Vdc
Range:	8 to 32 Vdc
Battery Dip Ride-Through:	6 Vdc for 0.75 s
Accuracy:	±0.5% of reading or ±0.1 Vdc, whichever is greater at 25°C (77°F)
Burden:	16 W maximum

Magnetic Pickup Sensing

Voltage Range:	3 V peak (during cranking) to 35 V peak continuous into 10 kΩ
Frequency Range:	32 to 10,000 Hz

Engine Speed Sensing

Range:	750 to 3,600 rpm
Accuracy:	±0.5% of reading or ±2 rpm, whichever is greater at 25°C (77°F)

Output Contacts

Configuration

Start:	SPST, NO
Fuel Solenoid:	SPST, NO
Pre-Start:	SPST, NO
Alarm:	SPST, NO
Pre-Alarm:	SPST, NO
EPS Supplying Load:	SPST, NO
Auxiliary 1 – 8:	SPDT

Ratings

Start:	10 A at 24 Vdc, make, carry, and break
Fuel Solenoid:	10 A at 24 Vdc , make, carry, and break
Pre-Start:	2 A at 30 Vdc, make, carry, and break
Alarm:	2 A at 30 Vdc, make, carry, and break
Pre-Alarm:	2 A at 30 Vdc, make, carry, and break
EPS Supplying Load:	2 A at 30 Vdc, make, carry, and break
Auxiliary 1 – 8:	2 A at 30 Vdc, make, carry, and break

Terminals

Start:	P25, P26
Fuel Solenoid:	P19, P20
Pre-Start:	P21, P22
Alarm:	P23, P24
Pre-Alarm:	P27, P28
EPS Supplying Load:	P29, P30
Auxiliary 1:	P4 (NO), P2 (NC), P3 (COM)
Auxiliary 2:	P8 (NO), P6 (NC), P7 (COM)
Auxiliary 3:	P12 (NO), P10 (NC), P11 (COM)
Auxiliary 4:	P16 (NO), P14 (NC), P15 (COM)
Auxiliary 5:	P20 (NO), P18 (NC), P19 (COM)
Auxiliary 6:	P23 (NO), P21 (NC), P22 (COM)
Auxiliary 7:	P26 (NO), P24 (NC), P25 (COM)
Auxiliary 8:	P29 (NO), P27 (NC), P28 (COM)

Horn Output

Compatible Devices:	Basler 29760, Mallory SC628NL
Terminals:	P31 (–), P45 (+)

Calculated Data

Power Factor

Range:	+1.0 to –1.0, both leading and lagging
Accuracy:	±0.01 PF at 25°C (77°F)

Kilovoltamperes

Range:	0 to 9,999 kVA
Accuracy:	±0.5% of reading or ±0.1 kVA, whichever is greater at 25°C (77°F)

Kilowatts

Range:	0 to 9,999 kW
Accuracy:	±0.5% of reading or ±0.1 kW, whichever is greater at 25°C (77°F)

Kilowatthours

Range:	0 to 999,999,999 kWh
Accuracy:	±0.5% of reading or ±1 kWh, whichever is greater at 25°C (77°F)

Engine Run Time

Range:	0 to 99,999 h
Accuracy:	±0.5% of reading or ±1 h, whichever is greater at 25°C (77°F)

Maintenance Interval

Range:	0 to 5,000 h
Accuracy:	±0.5% of reading or ±1 h, whichever is greater at 25°C (77°F)

Communication Interface

Full Duplex RS-232 Port

Connection:	Female DB-9 connector (COM1)
Baud:	1200, 2400, or 9600
Data Bits:	8
Parity:	None, Odd, or Even
Stop Bits:	1

Telephone Modem (FCC, part 68 approved modem)

Operating Temperature Range

Standard (style X1X):	0 to 50°C (32 to 122°F)
Extended (style X2X):	–40 to 70°C (–40 to 158°F)

CANBus Interface

Differential Bus Voltage:	1.5 to 3 Vdc
Maximum Voltage:	–32 to 32 Vdc with respect to negative battery terminal
Communication Rate:	250 kb/s maximum

Environment

Temperature Range

Operating:	–40 to 70°C (–40 to 158°F)
Storage:	–40 to 85°C (–40 to 185°F)

Type Tests

Shock:	Withstands 15 G in each of three mutually perpendicular planes
Vibration:	Withstands 2 G, in each of three mutually perpendicular planes, without structural damage or degradation of performance. Device was swept over the range of 10 to 500 Hz for a total of six 15-minute sweeps.
Salt Fog:	Qualified to ASTM-117B-1989

Radio Interference:	Type tested using a 5 W, handheld transceiver operating at random frequencies centered around 144 and 440 MHz with the antenna located within 150 mm (6”) of the device in both vertical and horizontal planes.
Dielectric Strength:	2,352 Vac at 50/60 Hz for 1 second between voltage sensing inputs and all other circuits. 500 Vac at 50/60 Hz for 1 minute between any of the following groups. Current Sensing Inputs: 8 mA RS-232 Port (COM1): 6 mA

UL Recognition

All DGC-1000 controllers are UL recognized per Standard 508, *Standard for Industrial Control Equipment* (UL file E97035).

CSA Certification

All DGC-1000 controllers are CSA certified per Standard CAN/CSA-C22.2, Number 14-95, CSA file LR 23131.

Physical

Weight:	907 g (2.0 lb)
Dimensions:	See Section 4, *Installation* for device dimensions and panel cutout requirements.

SECTION 2 • HUMAN-MACHINE INTERFACE

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SECTION 2 • HUMAN-MACHINE INTERFACE

INTRODUCTION

The DGC-1000 human-machine interface (HMI) consists of controls and indicators accessed at the front panel and terminals and connectors accessed at the rear panel.

FRONT PANEL

Figure 2-1 shows the HMI components of the front panel. Table 2-1 lists the locators of Figure 2-1 along with a description of each HMI component.

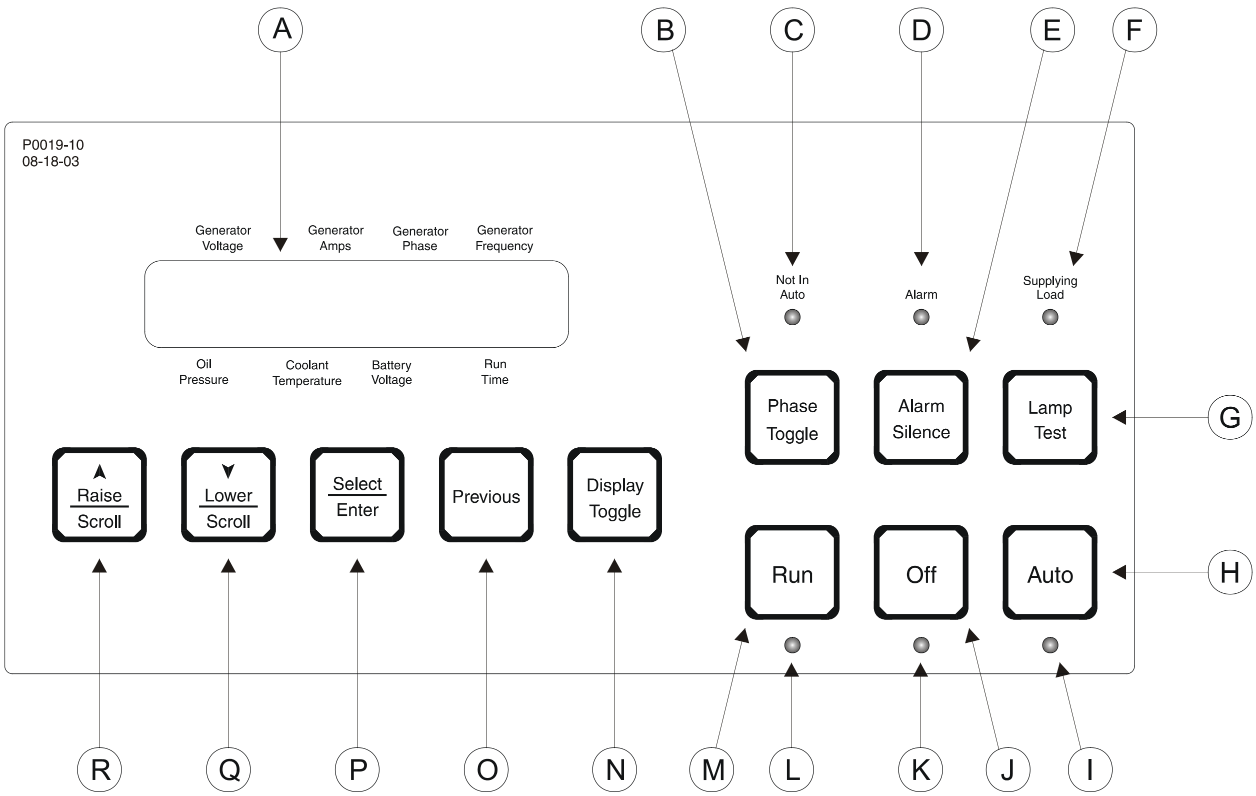

Figure 2-1. Front Panel HMI Components

Table 2-1. Front Panel HMI Descriptions

Locator	Description
A	*Display*. The two line by 20 character liquid crystal display (LCD) is the primary interface for metering, alarms, pre-alarms, and protective functions. The LCD has three display modes: Normal, Alternate, and Menu. In Normal mode, the displayed parameters correspond to one of the eight labels surrounding the display. In Alternate mode, the LCD displays parameters and the corresponding labels. In Menu mode, the LCD scrolls through the DGC-1000 parameters.
B	*Phase Toggle Pushbutton.* Pressing this control scrolls through the parameters available in Normal display mode.
C	*Not in Auto Indicator.* This red LED lights when the DGC-1000 is not operating in Auto mode.
D	*Alarm Indicator.* This red indicator lights continuously during alarm conditions and flashes during pre-alarm conditions.
E	*Alarm Silence Pushbutton.* Pressing this control resets the DGC-1000 audible alarm.
F	*Supplying Load Indicator.* This green indicator lights when the generator is supplying more than two percent of rated current.
G	*Lamp Test Pushbutton.* Pressing this control tests the DGC-1000 indicators by exercising all LCD segments and lighting all LEDs.

Locator	Description
H	*Auto Pushbutton.* Pressing this control places the DGC-1000 in Auto mode.
I	*Auto Mode Indicator.* This green LED lights when the DGC-1000 is operating in Auto mode.
J	*Off Pushbutton.* Pressing this control places the DGC-1000 in Off mode.
K	*Off Mode Indicator.* This red LED lights when the DGC-1000 is in Off mode.
L	*Run Mode Indicator.* This green LED lights when the DGC-1000 is operating in Run mode.
M	*Run Pushbutton.* Pressing this control places the DGC-1000 in Run mode.
N	*Display Toggle Pushbutton.* Pressing this control scrolls through the display modes.
O	*Previous Pushbutton.* Pressing this control scrolls through LCD display modes.
P	*Select/Enter Pushbutton.* This control is pressed to enter menu sublevels and select setpoints.
Q	*Lower/Scroll Pushbutton.* This control is pressed to scroll backward through menus or decrement setpoints.
R	*Raise/Scroll Pushbutton.* This control is pressed to scroll forward through menus or increment setpoints.

REAR PANEL

All DGC-1000 terminals and connectors are accessed at the rear panel. Figure 2-2 shows the HMI components (except the CAN interface connector) of the rear panel HMI. Table 2-2 lists the locators of Figure 2-2 along with a description of each rear panel HMI component.

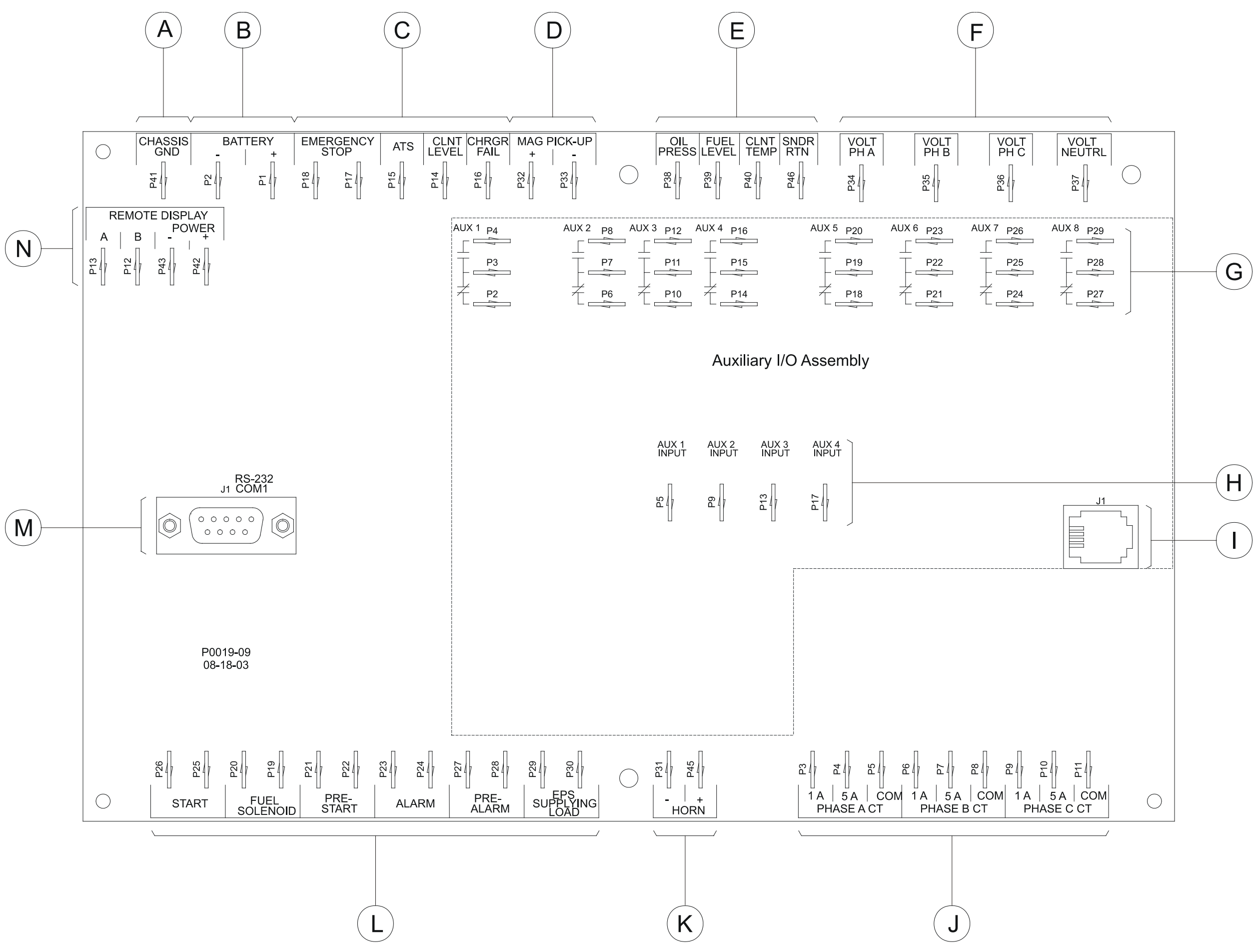

Figure 2-2. Rear Panel HMI Components

Table 2-2. Rear Panel HMI Descriptions

Locator	Terminals	Description
A	P41	*Chassis Ground.* This terminal provides the chassis ground connection. The DGC-1000 must be hard-wired to earth ground with no smaller than 12 AWG copper wire.
B	P1 (+), P2 (–)	*Battery.* DGC-1000 operating power is applied to these terminals. The DGC-1000 accepts a nominal input of 12 Vdc or 24 Vdc.
C		<u>*Contact Sensing Inputs*</u>
	P17, P18	*Emergency Stop.* An open circuit at this input initiates an emergency stop. During an emergency stop, the DGC-1000 removes power from all output relays.
	P15, P2	*Automatic Transfer Switch.* A closed circuit at this input starts the engine when the DGC-1000 is operating in Auto mode.
	P14, P2	*Coolant Level.* When the voltage sensed at this input decreases to zero, the DGC-1000 annunciates a low coolant level condition.
	P16, P2	*Battery Charger Fail.* When the voltage sensed at this input decreases to zero, the DGC-1000 annunciates a battery charger failure.
D	P32 (+), P33 (–)	*Magnetic Pickup.* Voltage received at this input is scaled and conditioned for use as a speed signal. This input is not used when the CAN interface is enabled.
E		<u>*Transducer Inputs*</u>
	P38, P46	*Oil Pressure.* This input connects to a user-supplied oil pressure transducer. The default oil pressure transducer is Stewart Warner 411-K or equivalent.
	P39, P46	*Fuel Level.* This input connects to a user-supplied fuel level transducer. The default fuel level transducer is Isspro R-8925 or equivalent.
	P40, P46	*Coolant Temperature.* This input connects to a user-supplied coolant temperature transducer. The default coolant temperature transducer is Stewart Warner 334-P or equivalent.
F		<u>*Voltage Sensing Inputs*</u>
	P34	*A-phase.* This input connects to phase A of the generator output.
	P35	*B-phase.* This input connects to phase B of the generator output.
	P36	*C-phase.* This input connects to phase C of the generator output.
	P37	*Neutral.* This input connect to the generator neutral in phase-to-neutral sensing applications.
G		<u>*Auxiliary Output Contacts (style AXX)*</u>
	<u>*NO, COM, NC*</u>	These eight sets of programmable, SPDT output contacts can be programmed to close when any one of the selected inputs is active.
	P4, P3, P2	*Auxiliary 1 Output*
	P8, P7, P6	*Auxiliary 2 Output*
	P12, P11, P10	*Auxiliary 3 Output*
	P16, P15, P14	*Auxiliary 4 Output*
	P20, P19, P18	*Auxiliary 5 Output*
	P23, P22, P21	*Auxiliary 6 Output*
	P26, P25, P24	*Auxiliary 7 Output*
	P29, P28, P27	*Auxiliary 8 Output*
H		<u>*Auxiliary Contact Inputs (style AXX)*</u>
		These four sets of contact inputs are designed for use with normally-open contact inputs. Each input can be programmed as an alarm, pre-alarm, or neither.
	P5, P2	*Auxiliary 1 Input*
	P9, P2	*Auxiliary 2 Input*
	P13, P2	*Auxiliary 3 Input*
	P17, P2	*Auxiliary 4 Input*

Locator	Terminals	Description
I	J1	*Modem (style X1X or X2X).* USOC RJ-11C four-terminal telephone jack provides dial-in and dial-out capability.
J	*1 A/5A, COM*	*Current Sensing Inputs*
	P3/P4, P5	*A-phase.* This input connects to a CT monitoring the generator phase A current.
	P6/P7, P8	*B-phase.* This input connects to a CT monitoring the generator phase B current.
	P9/P10, P11	*C-phase.* This input connects to a CT monitoring the generator phase C current.
K	P31 (–), P45 (+)	*Horn.* This output supplies power to an external horn. Recommended devices are Basler 29760 and Mallory SC628NL.
L		*Output Contacts*
	P25, P26	*Start.* This normally-open set of contacts connects to the start solenoid and closes when the DGC-1000 initiates engine cranking.
	P19, P20	*Fuel Solenoid.* This normally-open set of contacts connects to the fuel solenoid. The fuel solenoid output closes when engine cranking is initiated and opens when a stop command is received by the DGC-1000.
	P21, P22	*Pre-Start.* This normally-open set of contacts closes to energize the glow plugs prior to engine cranking. Depending on system setup, the Pre-Start output may open upon engine startup or stay closed during engine operation.
	P23, P24	*Alarm.* This normally-open set of contacts closes when an alarm condition is detected. Section 3, *Functional Description, Software, Alarms* provides information about alarm conditions.
	P27, P28	*Pre-Alarm.* This normally-open set of contacts closes when a pre-alarm condition is detected. Section 3, *Functional Description, Software, Pre-Alarms* provides information about alarm conditions.
	P29, P30	*EPS Supplying Load.* This set of normally-open output contacts closes when the controlled generator is supplying power to the load.
M	COM1	*RS-232 Communication Port.* This female DB9 connector uses serial communication to enhance DGC-1000 setup. A standard serial cable connects the DGC-1000 to a PC.
N	P13 (A), P12 (B), P42 (+), P43 (–)	*Remote Display Connections.* Remote Display Panel, RDP-110, connects to these terminals. The RDP-110 annunciates all DGC-1000 alarms, pre-alarms, and operating conditions in accordance with NFPA specifications.

CAN INTERFACE CONNECTOR

The CANBus interface enables the DGC-1000 to communicate with the genset's ECU and gather engine parameters, battery voltage, and other information. Using the ECU to obtain engine information eliminates the need to use transducers and the associated wiring.

The location of the CAN interface connector is shown in Figure 2-3.

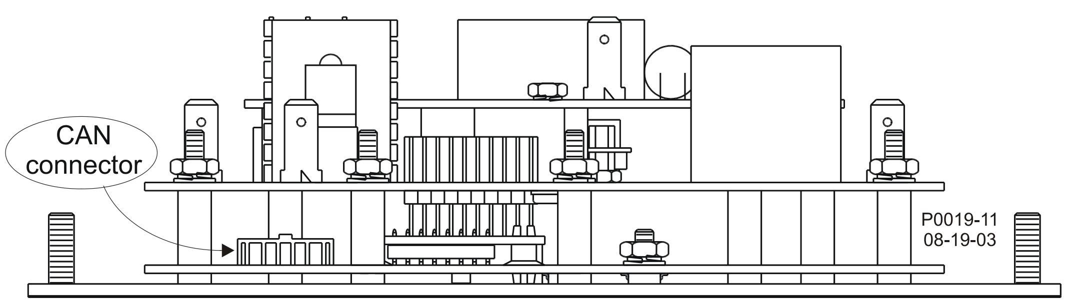

Figure 2-3. CAN Interface Connector Location

SECTION 3 • FUNCTIONAL DESCRIPTION

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SECTION 3 • FUNCTIONAL DESCRIPTION

GENERAL

DGC-1000 Digital Genset Controllers use microprocessor based technology to provide integrated engine-generator set control, protection, and metering in a single package. Microprocessor based technology allows for exact measurement, setpoint adjustment and timing functions. Refer to the following paragraphs for the DGC-1000 functional description.

Circuit functional description is divided into *Inputs*, *Microprocessor*, *Outputs*, *Phone Modems* and *Software*. Circuit functions illustrated in Figure 3-1 are described in the following paragraphs.

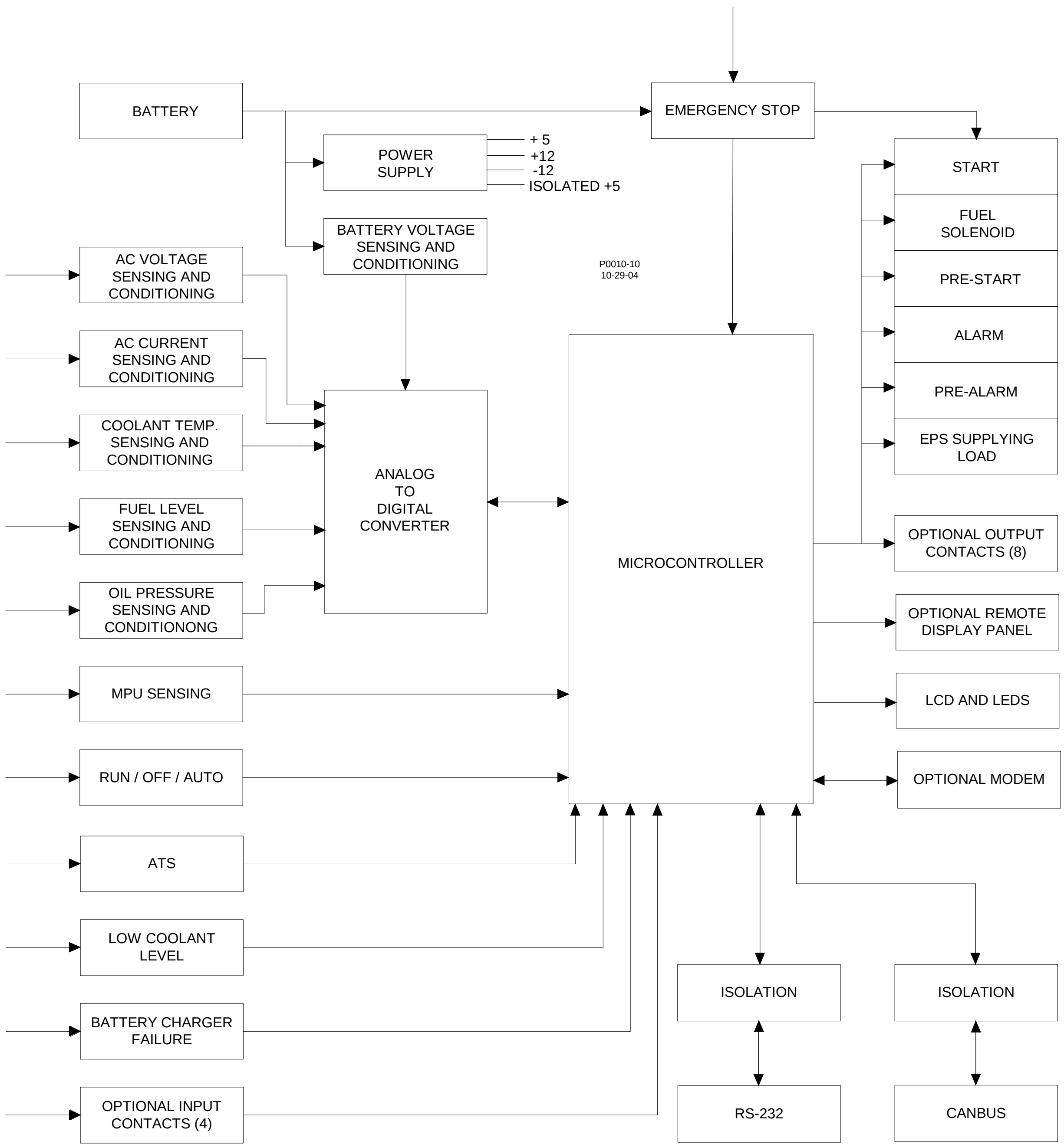

Figure 3-1. DGC-1000 Function Block Diagram

INPUTS

There are nine types of inputs to the DGC-1000 Controller. They are:

- Battery operating voltage
- Contact sensing inputs
- Transducer inputs
- Speed signal inputs
- Voltage inputs
- Current inputs
- RS-232 serial communication
- CAN interface for ECU communication
- Programmable contact sensing inputs

The following paragraphs describe these inputs.

Battery Operating Voltage

Required operating voltage is a nominal 12 or 24 Vdc. Operating voltage may be in the range of 8 to 32 Vdc. An internal switching power supply uses the battery voltage to generate a +12 Vdc, -12 Vdc, +5 Vdc, a stable +5 Vdc reference and an isolated +5 Vdc. The isolated +5 Vdc supply is for the RS-232 serial communications port. The dc reference voltage is for internal use.

Battery operating voltage is conditioned (filtered and reduced to a level suitable for microprocessor input) and sensed by the microprocessor.

Contact Sensing Inputs

Four external contact sensing inputs (Emergency Stop, Automatic Transfer Switch, Low Coolant Level, and Battery Charger Failure) provide external stimulus to the DGC-1000 Controller.

Emergency Stop

This input is continuously monitored. An open circuit indicates an Emergency Stop. Opening this circuit removes power from all output relays.

Automatic Transfer Switch

This input is continuously monitored by the microprocessor and is used to start the engine when in the auto mode. A closed contact initiates the start sequence.

Low Coolant Level

This input is continuously monitored by the microprocessor. When battery (–) potential is connected to this input, a low coolant level is indicated.

Battery Charger Failure

This input is continuously monitored by the microprocessor. When battery (–) potential is connected to this input, a battery charger failure is indicated.

Transducer Inputs

The DGC-1000 transducer inputs are programmable. This gives the user the flexibility to choose the transducer to be used in a particular application. For details on programming, see Section 6, *BESTCOMS Software, Programmable Senders*.

Coolant Temperature

A current of less than 20 milliamperes is provided to the coolant temperature transducer (sending unit). The developed voltage is measured and scaled for use by the internal circuitry. This input is not used when the CAN interface is enabled.

Oil Pressure

A current of 30 milliamperes is provided to the oil pressure transducer. The developed voltage is measured and scaled for use by the internal circuitry. This input is not used when the CAN interface is enabled.

Fuel Level And Fuel Leak

A current of less than 20 milliamperes is provided to the fuel level transducer. The developed voltage is measured and scaled for use by the internal circuitry. The internal fuel level transducer failure circuitry and the fuel leak detector also use this input. An open circuit across these terminals will indicate a failed fuel level transducer. A resistance of less than five ohms is used to indicate either a failed fuel level transducer or a fuel leak detector contact closure.

Sender Return Connection

It is important to connect the sender return terminal to battery minus at the engine chassis of the genset. The purpose of this connection is to isolate the analog senders voltage signals from the voltage drop that exists in the power leads between the DGC-1000 and the engine's battery. This voltage drop will adversely affect the accuracy of the readings from the analog senders. Because this input provides some resistive isolation with respect to battery minus within the DGC-1000, leaving it disconnected will cause considerable error in the readings from the analog senders and the battery voltage. The input should also not be jumpered back to battery minus at the DGC-1000 as this will defeat the purpose of having a separate connection

NOTE

The sender return terminal must be connected to battery minus back at the engine chassis to minimize the error in the analog sender and battery voltage readings.

Speed Signal Inputs

Generator Voltage

The voltage from the monitored generator is scaled and conditioned for use by the internal circuitry as a speed signal source circuitry. Differential amplifiers provide isolation for these inputs.

Magnetic Pickup

The voltage from the magnetic pickup is scaled and conditioned for use by the internal circuitry as a speed signal source. This input is not used when the CAN interface is enabled.

Voltage Inputs

Monitored generator voltages are sensed and scaled to levels suitable for use by the internal circuitry. Differential amplifiers provide isolation for these inputs. Internal circuitry selects line-to-line, line-to-neutral or single-phase values. Menu selections by the user determine these switch settings.

Current Inputs

Monitored generator currents are sensed and scaled to values suitable for use by the internal circuitry. Internal current transformers provide isolation. Two taps on the primary of these transformers accommodate either one or five ampere circuits.

Serial Communication/Ethernet Adaptor Port

This optically-isolated RS-232 port enables communication between the DGC-1000 and a PC running BESTCOMS software or a serial server connected to an Ethernet network.

Since the DGC-1000 does not communicate directly over Ethernet, an external device is required. One such device is the Vlinx Ethernet Serial Server, model ESP901 from B & B Electronics Manufacturing Company (www.bb-elec.com). This “serial server” has a 10/100 Mbps connection to an Ethernet LAN/WAN and a serial port to connect to the DGC-1000. Software included with the serial server is to be installed on the PC running BESTCOMS. The serial server manual assists the user in installing the software, configuring the server, and setting up a virtual communication port with the serial communication parameters necessary to communicate with BESTCOMS. Once installed and configured, the network is transparent to the DGC-1000 and BESTCOMS.

CAN Interface for ECU Communications

A controller area network (CAN) is a standard interface that allows communication between multiple controllers on a common network using the SAE J1939 message protocol or MTU MDEC communication protocol. Applications using an engine-driven generator set controlled by a DGC-1000, may also have an Engine Control Unit (ECU). The CAN interface allows the ECU and a DGC-1000 to communicate. The ECU will report operating information to the DGC-1000 via the interface. Operating parameters and diagnostic information, if supported, are decoded and displayed for monitoring.

The primary use of the CAN interface is to obtain engine operating parameters for monitoring speed, coolant temperature, oil pressure, coolant level and engine hours without the need for direct connection to individual senders. These parameters are transmitted via the CAN interface at preset intervals. See the column labeled Update Rate in Table 3-1 for transmission rates. This information can also be transmitted upon user request.

Table 3-1. Operating Parameters Obtained from CAN Interface Using J1939 Communication

Parameter	Metric Units	English Units	Update Rate	Decimal Place	SPN#
ECU Parameters Menu – Main Menu					
Throttle Position	%	%	50 ms	10th	91
Percent Load at Current RPM	%	%	50 ms	None	92
Actual Engine Percent Torque	%	%	Engine speed dependent	None	513
Engine Speed	rpm	rpm	Engine speed dependent	None	190
Injection Control Pressure	MPa	psi	500 ms	None	164
Injector Metering Rail Pressure	MPa	psi	500 ms	None	157
Total Engine Hours	hours	hours	Requested 1.5 s	100th	247
Trip Fuel	liters	gallons	Requested 1.5 s	None	182
Total Fuel Used	liters	gallons	Requested 1.5 s	None	250
Engine Coolant Temperature	°C	°F	1 s	None	110
Fuel Temperature	°C	°F	1 s	None	174
Engine Oil Temperature	°C	°F	1 s	10th	175
Engine Intercooler Temperature	°C	°F	1 s	None	52
Fuel Delivery Pressure	kPa	psi	500 ms	10th	94
Engine Oil Level	%	%	500 ms	10th	98
Engine Oil Pressure	kPa	psi	500 ms	10th	100
Coolant Pressure	kPa	psi	500 ms	10th	109
Coolant Level	%	%	500 ms	10th	111
Fuel Rate	liter/hr	gal/hr	100 ms	100th	183
Barometric Pressure	kPa	psi	1 s	10th	108
Ambient Air Temperature	°C	°F	1 s	10th	171
Air Inlet Temperature	°C	°F	1 s	None	172
Boost Pressure	kPa	psi	500 ms	None	102
Intake Manifold Temperature	kPa	psi	500 ms	None	105
Air Filter Differential Pressure	kPa	psi	500 ms	100th	107
Exhaust Gas Temperature	°C	°F	500 ms	10th	173
Electrical Potential Voltage	volts	volts	1 s	10th	168
Battery Potential Voltage Switched	volts	volts	1 s	10th	158
Oil Filter Differential Pressure	kPa	psi	1 s	10th	99
Fuel Filter Differential Pressure	kPa	psi	1 s	None	95
Crankcase Pressure	kPa	psi	500 ms	100th	101
Engine Configuration Submenu – Press Select to enter submenu and Previous to exit submenu					
Engine Speed at Idle Point 1	rpm	rpm	5 s	None	188
Percent Torque at Idle Point 1	%	%	5 s	None	539
Engine Speed at Point 2	rpm	rpm	5 s	None	528
Percent Torque at Point 2	%	%	5 s	None	540
Engine Speed at Point 3	rpm	rpm	5 s	None	529
Percent Torque at Point 3	%	%	5 s	None	541
Engine Speed at Point 4	rpm	rpm	5 s	None	530
Percent Torque at Point 4	%	%	5 s	None	542
Engine Speed at Point 5	rpm	rpm	5 s	None	531
Percent Torque at Point 5	%	%	5 s	None	543
Engine Speed at High Idle Point 6	rpm	rpm	5 s	None	532

Parameter	Metric Units	English Units	Update Rate	Decimal Place	SPN#
Gain (Kp) of Endspeed Governor	%/rpm	%/rpm	5 s	100th	545
Reference Engine Torque	N•m	lb/ft	5 s	None	544
Maximum Momentary Engine Override Speed Point 7	rpm	rpm	5 s	None	533
Maximum Momentary Engine Override Time Limit	s	s	5 s	10th	534
Requested Speed Control Range Lower Limit	rpm	rpm	5 s	None	535
Requested Speed Control Range Upper Limit	rpm	rpm	5 s	None	536
Requested Torque Control Range Lower Limit	%	%	5 s	None	538

Table 3-2 lists the operating parameters and annunciations obtained from the CAN interface using the MTU MDEC communication protocol.

Table 3-2. Operating Parameters Obtained from CAN Interface Using MTU MDEC Communication

Parameter	Metric Units	English Units	Update Rate	Decimal Place
Engine Coolant Temperature	°C	°F	100 ms when parameter changes, ≤20 s when not changing	None
Engine Oil Pressure	KPa	psi	100 ms when parameter changes, ≤20 s when not changing	10th
Engine Speed	rpm	rpm	100 ms when parameter changes, ≤20 s when not changing	None
Alarms, Pre-Alarms	N/A	N/A	As they occur	N/A

WARNING!

When the CAN interface is enabled, the unit will ignore the following sender inputs: oil pressure, coolant temperature and magnetic pickup.

The diagnostic function obtains the diagnostic condition of the transmitting electronic components. The DGC-1000 will receive an unsolicited message of the currently active diagnostic trouble codes (DTC). Previously active DTCs are available upon request. Active and previously active DTCs can be cleared on request. See Table 3-3 for details on diagnostic messaging.

Table 3-3. Diagnostic Information Transmitted Over CAN Interface

Parameter	Transmission Repetition Rate
Active Diagnostic Trouble Code	1 s
Lamp Status	1 s
Previously Active Diagnostic Trouble Code	On request
Request to Clear Previously Active DTCs	On request
Request to Clear Active DTCs	On request

DTCs are reported in coded diagnostic information which include the Suspect Parameter Number (SPN), Failure Mode Identifier (FMI) and Occurrence Count (OC). All parameters have an SPN and are used to display or identify the items for which diagnostics are being reported. The FMI defines the type of failure detected in the subsystem identified by an SPN. The problem may not be an electrical failure but may be a subsystem condition needing to be reported to a technician or operator. The OC contains the number of times a fault has gone from active to previously active.

Programmable Contact Sensing Inputs

If the DGC-1000 has the auxiliary input and output option, there are four programmable contact sensing inputs. Each input is designed to accept a normally open contact. The contact is connected between the input and battery minus. These inputs may be configured through the BESTCOMS PC program as an alarm, pre-alarm or neither. When the contact sensing input is closed, the front panel display shows the name of the closed input if it was programmed as alarm or pre-alarm. If neither is programmed, no indication is given on the front panel display. Programming the input as neither is useful when a call to a pager without an alarm or pre-alarm is necessary or to close additional contacts using the auxiliary outputs.

Each input also has a programmable name, which may be up to eight characters in length. The default names are AUX IN 1, AUX IN 2, AUX IN 3, and AUX IN 4.

MICROPROCESSOR

Software stored in the programmable flash memory controls how the DGC-1000 functions and makes all decisions based on programming and system inputs. Formulas that are used to determine the various calculated quantities and circuits related to microprocessor inputs are described in the follow paragraphs.

Formulas

For line-to-line (VL-L) voltage sensing:

$$V_{AB} = \sqrt{V_A{}^2 + V_A \times V_B + V_B{}^2}$$
$$V_{BC} = \sqrt{V_B{}^2 + V_B \times V_C + V_C{}^2}$$
$$V_{CA} = \sqrt{V_C{}^2 + V_C \times V_A + V_A{}^2}$$

For the four-wire delta case (with the mid-point between phases B and C connected to the voltage neutral terminal on the DGC-1000):

$$V_{AB} = \sqrt{V_A{}^2 + V_B{}^2}$$
$$V_{BC} = V_B + V_C$$
$$V_{CA} = \sqrt{V_C{}^2 + V_A{}^2}$$

For three-phase voltage sensing configurations:

kVA: $kVA_A = (V_{AB} \times I_A) \div (1000\ \sqrt{3})$
$kVA_B = (V_{BC} \times I_B) \div (1000\ \sqrt{3})$
$kVA_C = (V_{CA} \times I_C) \div (1000\ \sqrt{3})$
$kVA_{TOTAL} = KVA_A + KVA_B + KVA_C$

kW: $kW_A = kVA_A \times PF$
$kW_B = kVA_B \times PF$
$kW_C = kVA_C \times PF$
$kW_{TOTAL} = kVA_{TOTAL}\ PF$

PF (power factor) equals the cosine of the measured angle between voltage and current zero-crossings.

For single-phase (V_A to V_B) voltage sensing configurations:

kVA: Total kVA $= kVA_A + kVA_B$
$= (V_{AN} \times I_A \div 1000) + (V_{BN} \times I_B \div 1000)$

kW: Total kW $= kW_A + kW_B$
$= (kVA_A \times PF) + (kVA_B \times PF)$

Related Circuits

Zero Crossing Detection

The zero crossing of the A phase voltage or A to B line voltage and the B phase current is detected and used to calculate the phase angle between the current and voltage. This zero crossing is also used to measure the generator frequency.

Signal Switching

Solid state switches under microprocessor control, select the voltage or current sensing signal that is applied to the rms-to-dc converter. The resulting signal is sent to the twelve-bit analog-to-digital converter where it is digitized for use by the microprocessor.

RMS-to-DC Converter

Scaled and conditioned signals representing the voltage and current sensing inputs are used as the input to the rms to dc converter. This converter output is a dc level proportional to the rms value of the input.

Analog-to-Digital Converter

Signals from the rms to dc converter, coolant temperature sensing input, fuel level sensing input and the oil pressure sensing input are digitized by the twelve-bit, analog-to-digital converter. The digitized information is stored in random access memory (RAM). This information is used by the microprocessor for all metering and protection functions.

OUTPUTS

Each output relay is controlled by the microprocessor and the emergency stop contact input. All outputs are electrically isolated from each other and from the internal circuitry. Two outputs (start and fuel solenoid) are associated with engine cranking functions. The remaining four outputs (Figure 3-1) are associated with the following conditions: pre-start, supplying load, pre-alarm and alarm.

Emergency Stop Contact Input Interaction

When the emergency stop contact input is open, all output contacts open. When the emergency stop contact input is closed and a signal is given by the microprocessor, the output contacts close

Remote Display Panel

When the DGC-1000 is combined with the RDP-110, many of the alarm and pre-alarm conditions are indicated remotely. The following alarms are indicated by LED's and an audible alarm on the RDP-110: low coolant level, high coolant temperature, low oil pressure, overcrank, overspeed, emergency stop, fuel leak/fuel level sender failure and engine sender unit failure. The following pre-alarms are also displayed on the RDP-110: high coolant temperature, low coolant temperature, low oil pressure, low fuel level, battery overvoltage, weak battery and battery charger failure. In addition to these alarms and pre-alarms, the RDP-110 also indicates when the RUN/OFF/AUTO switch is not in auto and when the Emergency Power System (EPS) is supplying load.

Optional Auxiliary Outputs

If the DGC-1000 has the auxiliary input and output option, there are eight programmable output contacts. These outputs may be programmed through the BESTCOMS PC program to close when any of the selected inputs is active. Multiple outputs may be programmed to close when a single input is active. Also, multiple inputs may be programmed to close a single output.

TELEPHONE MODEMS

Two modems with dial-in, dial-out capability are available as optional equipment on the DGC-1000. The standard modem is rated from 0°C to 50°C (32°F to 122°F). The extended operating temperature range modem is rated from -40°C to 70°C (–40°F to 158°F). With the optional phone modem, the DGC-1000 can dial out to inform a pager that an alarm or pre-alarm condition has occurred. Up to four phone numbers can be dialed in sequence until an answer is received. The supplied modem is registered with the FCC under Part 68.

Type of Service

The DGC-1000 is designed to be used on standard device telephone lines and connects to the telephone line by means of a standard jack called the USOC RJ-11C. Connection to telephone company provided coin service (central office implemented systems) is prohibited. Connection to party lines service are subject to state tariffs.

Telephone Company Procedures

The goal of the telephone company is to provide you with the best service it can. In order to do this, it may occasionally be necessary for them to make changes in their equipment, operations or procedures. These changes might affect your service or the operation of your equipment, the telephone company will give you notice, in writing, to allow you to make any changes necessary to maintain uninterrupted service.

In certain circumstances, it may be necessary for the telephone company to request information from you concerning the equipment which you have connected to your telephone line. Upon request of the telephone company, provide the FCC registration number and the ringer equivalence number (REN); both items are listed on the label on the modem on the rear of the DGC-1000. The sum of all of the RENs on your telephone lines should be less than five in order to assure proper service from the telephone company. In some cases, a sum of five may not be usable on a given line.

If Problems Arise

If any of your telephone equipment is not operating properly, you should immediately remove it from your telephone line because it may cause harm to the telephone network. If the telephone company notes a problem, they may temporarily disconnect service. When practical, they will notify you in advance of this disconnection. If advance notice is not feasible, you will be notified as soon as possible. When you are notified, you will be given the opportunity to correct the problem and be informed of your right to file a complaint with the FCC. Contact your telephone company if you have any questions about your telephone line.

Cellular Communications

Data transfer over an analog cellular system may be optimized when the MNP10-EC (Microcom Network Protocol, Class 10, Enhanced Cellular) protocol is used. The modem connected to the PC must be capable of supporting this protocol. It is also necessary to invoke this protocol with the appropriate initialization string. This initialization string may be stored independently with each of the phone book entries. (Refer to the Section 6, *BESTCOMS Software*.) When MNP10-EC protocol is enabled on the landline modem, the DGC-1000 modem will automatically use MNP10-EC. This allows the user to enable and disable the MNP10-EC protocol by simply changing the initialization string. An example of a typical initialization strings is as follows:

AT &F\N5-SEC=1,18-K1M1L2

AT	Informs the modem that commands are being sent to it.
&F	Forces factory default settings.
\N5	Forces connection using MNP10-EC. (\N2 would allow the protocol to be negotiated as LAPM or MNP.)
-SEC=1,18	Enables MNP10-EC protocol, and sets the transmit level at –18dBm
-K1	Enables V.42 LAPM to MNP10 conversion.
M1	Enables speaker during dial-up. (M2 would leave speaker on all of the time, and M0 turns the speaker off.)
L2	Sets the speaker volume. (L0 is off, and L3 is the maximum value.)

The required initialization string will differ between different makes and models of modems. Please consult the modem's manual for the proper initialization strings.

MNP10-EC adjusts the communication parameters during cellular connection and transmission to provide quicker initial connection, to provide maximum throughput and to avoid disconnects. MNP10-EC recognizes typical signal impairments caused by the cellular environment and quickly recovers from the impairments. Typical impairments for which MNP10-EC compensates include frequent hand-offs, dropouts, call inference, fading and echo. Performance is significantly improved when the modems on each end of the connection support MNP10-EC.

SOFTWARE

Software embedded in the DGC-1000 controls all aspects of device functionality. This comprises power-up initialization, front panel set up and configuration, input contact status monitoring, protective function detection and annunciation, system parameter monitoring, output contact status control and RS-232 serial communications.

Power-Up Sequence

When battery power is first applied, the DGC-1000 initiates a power up sequence. The version of embedded software is displayed on the LCD and the memory is checked. Then all configuration data stored in non-volatile EEPROM is brought into main memory. Immediately after this, the LCD display begins in the Normal mode. When the Normal mode is displayed, all enabled functions are activated and input monitoring begins.

NOTE

When DGC-1000 operating power is restored following a loss of battery power, the DGC-1000 will resume operation in the mode that was active prior to the power loss. For example, if the DGC-1000 is operating in Auto mode when battery power is lost, the DGC-1000 will resume operation in Auto mode when battery power is restored.

The run-time counter, kilowatt-hour meter and maintenance timers are updated in volatile memory once per minute. Updated values are saved to nonvolatile memory when the Auto/Off/Run mode of operation is changed. Additionally, while the engine is running, the run time counter is saved every 15 minutes and the kilowatt-hour meter is saved every eight hours. If the battery power source fails during operation, these values are not updated and the changes made after the last save operation are irretrievably lost.

Watchdog Timer

The purpose of the watchdog timer is to re-initialize the microprocessor and restart the software execution process in the event that normal software execution is interrupted. During normal software execution, the watchdog timer is periodically reset to prevent it from expiring and initiating a software reset.

When the watchdog timer expires, the unit re-initializes itself as it normally does on power-up. If the user was logged into BESTCOMS when a watchdog timeout occurs, then BESTCOMS will lose communication with the DGC-1000. The user must close and reopen communications. If the watchdog times out five times between power cycles, then the unit will lock-up in a safe mode. The LCD of a locked up unit will read: "WATCHDOG FAILURE," "CYCLE POWER TO RESET." As long as the unit has not gone into the safe mode, BESTCOMS will notify the user of a watchdog timeout next time he or she logs onto the unit. After a watchdog timeout, the unit will return to the mode ("Run" but only if engine speed is still above crank disconnect speed; "Off" or "Auto") it was last in before the reset occurred, unless it has gone into the safe mode. The user must cycle the power to get out of safe mode. When in safe mode, the user cannot log on with BESTCOMS and the engine is shut off.

Cool Down Timer

In the Auto mode, this feature allows the engine to cool down by running unloaded for a programmed period of time. The cool down period of 0 to 60 minutes is programmed from the BESTCOMS software in one-minute increments. This cool down period will start when the load is removed or when the ATS contact opens. If load is removed from the generator prior to the ATS contact opening, the timer will start and continue to count while the ATS contact opens. At the time of the ATS contact opening, the remaining time of the cool down timer will be used and once the total remaining time is consumed, the engine will shutdown. A setting of 0 is used when no cool down period is desired.

Speed Source Failure

This function monitors the signal from the speed signal source selected from the BESTCOMS software. If only one source is selected and the signal from that source is lost, an alarm and a shutdown occurs and SPEED SIGNAL SOURCE FAILURE is displayed on the LCD. If both magnetic pickup and generator voltage are selected as speed signal sources and the magnetic pickup unit (MPU) fails, the DGC-1000 will switch to using generator voltage as the speed signal source and the LCD display will alternate between displaying the run time and MPU on the display. If the generator voltage signal also fails, an alarm and shutdown occurs. This function checks for the presence of a signal only; it is not a sender continuity check.

Cranking

The DGC-1000 is programmable for either cycle crank or continuous crank. If cycle cranking is chosen, the number of crank cycles allowed before the system shuts down can be selected. A crank cycle is defined as 5 to 15 seconds of crank followed by an equal number of seconds of rest, selectable in 1-second increments. The maximum number of cycles the DGC-1000 will allow is 7. If NFPA 100 Level 1 is chosen, the number of crank cycles is 5.

If a delay to crank feature has been selected, the DGC-1000 will close the pre-start contact upon receipt of a start command. The pre-start contact is programmable to either remain energized or to drop out after the delay has expired.

Figure 3-2 illustrates one normal and four abnormal engine starts (crank curves).

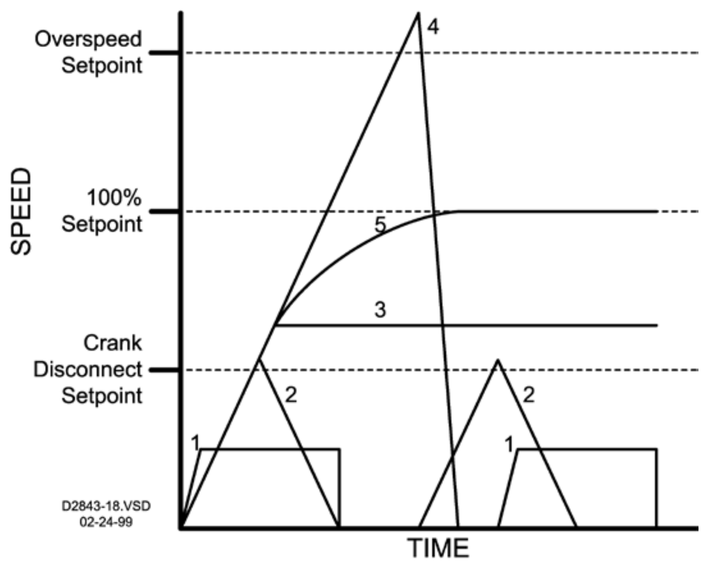

Figure 3-2. Normal and Abnormal Engine Crank Curves

Abnormal Start Curve One

This curve shows the typical cycle crank when a start signal is received. When the signal is received, the fuel solenoid and start contacts close and engine speed begins to increase. The fuel solenoid and start contacts remain closed until the crank cycle time is met. The start contact will open if the prime mover speed increases past the crank disconnect speed setting. The fuel solenoid contact remains closed above the crank disconnect speed. If the prime mover fails to start after the prescribed time, the rest timer is started and the starter solenoid and fuel solenoid contacts are opened. The crank cycle is repeated until the prime mover speed increases past the crank disconnect setpoint or the programmed number of crank cycles has been met and an overcrank condition occurs.

Abnormal Start Curve Two

This curve shows a failure to start condition. The prime mover reaches the crank disconnect setpoint but fails to start. If this condition occurs, the DGC-1000 has cranked the engine through one cycle of crank time and the engine is coasting down to a stop. After the rest period time has expired, the DGC-1000 will continue to cycle crank for the remainder of the crank cycles or the engine starts.

Abnormal Start Curve Three

This curve shows an engine start but the engine fails to reach rated speed. If this condition occurs, the start contact opens and the engine continues to run until it is turned off.

Abnormal Start Curve Four

This curve shows a typical overspeed occurrence. If this condition occurs, the engine, upon reaching the overspeed setpoint, will be shut down by the DGC-1000 opening the fuel solenoid contact and annunciate an alarm by closing the alarm contact.

Normal Start Curve Five

This curve shows a typical normal start and run condition. When this occurs, the start contact opens after the prime mover passes through the crank disconnect speed setpoint. The engine speed increases until the 100% setpoint is reached.

Alarms

Reset of all alarms can only be done locally by setting the Auto/Off/Run switch to the OFF position. All alarm conditions will light a red LED (labeled Alarm) along with displaying the condition on the LCD screen and sounding the optional audible alarm. All alarms have a common Form A contact. When an alarm condition occurs, the display indicates the cause of the alarm, the Form A Alarm contact closes and the fuel solenoid contact opens which shuts down the engine.

Overcrank Alarm

When the crank timer times out, cranking terminates. At that time, the common alarm contacts close and the LCD displays the message OVERCRANK and the current overcrank setting.

Overspeed Alarm

If the engine speed exceeds the overspeed value programmed by BESTCOMS and continues until the programmed delay time expires, an overspeed alarm occurs. At that time, the common alarm contact closes and the LCD displays the message OVERSPEED and the current overspeed setting.

High Coolant Temperature Alarm

If the engine coolant temperature exceeds the level programmed by the BESTCOMS software, an alarm occurs. At that time, the common alarm contact closes and the LCD displays the message, HIGH COOLANT TEMP and the current high coolant temperature setting.

Low Oil Pressure Alarm

If the oil pressure decreases below the low oil pressure alarm setting programmed by the BESTCOMS software, an alarm occurs. At that time, the common alarm contact closes and the LCD displays the message, LOW OIL PRESSURE and the current low oil pressure alarm setting.

Engine Sender Fault Alarm

If a failure of an engine sender (transducer) is enabled by the BESTCOMS software and a failure occurs, an alarm occurs. At that time, the common alarm contact closes and the LCD displays the message SENDER FAILURE and the failed sender. If a short circuit is detected across the fuel level transducer/fuel leak detector input, the message SENDER FAIL/FUEL LEAK is displayed.

Low Fuel Level Alarm

If the fuel level decreases below the low fuel level alarm setting programmed by the BESTCOMS software, an alarm occurs. At that time, the common alarm contact closes and the LCD displays the message, LOW FUEL LEVEL and the current low fuel level alarm setting.

Low Coolant Level Alarm

This alarm stops the engine when a loss of coolant is detected via the low coolant level contact input. At that time, the common alarm contact closes and the LCD displays the message LOW COOLANT LEVEL.

CAN Bus Alarm

A CAN Bus Failure annunciation may be enabled only when the CAN interface is enabled. The CAN interface is configurable from BESTCOM. When configured to pre-alarm, annunciation occurs when CAN communication is lost either by the unit becoming disconnected from the ECU or the ECU malfunctioning. If CAN communication is lost and the annunciation is configured as an alarm, then a normal alarm sequence will occur, including a CANBUS FAILURE ALARM message that appears on the display.

MTU MDEC ECU Alarms

A DGC-1000 connected to a genset equipped with an MTU MDEC engine controller is capable of annunciating a set of alarms unique to the MDEC ECU. Alarms issued by the MDEC ECU can be viewed on the MTU MDEC tab of the BESTCOMS Metering screen or through the front panel display. When an MDEC alarm is in effect, the front panel Alarm LED lights and the alarm message text is displayed on the front panel LCD. The first line displayed in an MDEC alarm message is MDEC ECU ALARM. The second line of an MDEC alarm message displays text specific to the alarm condition. If multiple alarms exist at the same time, then the first alarm encountered is the one displayed. The following paragraphs describe each of the eight MDEC alarm types. For more detailed information, refer to your MDEC ECU documentation.

HIGH CHARGE AIR TEMP. This alarm is annunciated when the MDEC ECU detects excessive turbocharger air temperature.

HIGH OIL TEMPERATURE. This alarm is annunciated when the MDEC ECU detects excessive engine oil temperature.

HIGH COOLANT TEMP. This alarm is annunciated when the MDEC ECU detects excessive engine coolant temperature. The trigger for this alarm is controlled by the ECU and operates independently of the DGC-1000 high coolant temperature alarm setting.

LO AFTERCLR COOL LVL. This alarm is annunciated when the MDEC ECU detects that the engine aftercooler coolant level is low.

LO FUEL DLV PRESSURE. This alarm is annunciated when the MDEC ECU detects low engine fuel pressure. The trigger for this alarm is controlled by the ECU and operates independently of the DGC-1000 low oil pressure alarm setting.

OVERSPEED. This alarm is annunciated when the MDEC ECU detects excessive engine speed (rpm).

COMBINED RED. This alarm is annunciated when the MDEC ECU issues a “red” shutdown (Level 2) message.

Pre-Alarms

A pre-alarm condition is annunciated by the DGC-1000 in the following ways:

- The front panel Alarm LED flashes on and off.
- The horn output cycles on and off. (The horn output can be enabled or disabled for pre-alarms in BESTCOMS.)
- A single set of Form A (SPST) output contacts closes.
- The front panel LCD displays the pre-alarms and associated values.

Low oil pressure, high coolant temperature, and battery voltage pre-alarms are shown on the main display of the front panel LCD. All other pre-alarms are individually displayed in sequence using the Alternate display mode. Values are flashed on and off to indicate their pre-alarm status. All pre-alarm parameters are displayed in this manner before non-pre-alarm parameters.

Pre-alarms are reset by correcting the cause of the pre-alarm. Audible pre-alarms are reset by pressing the Alarm Silence pushbutton on the front panel.

Magnetic Pickup (MPU) Failure Pre-Alarm

If the speed signal source is selected for MPU/GEN (Magnetic Pickup, Generator Frequency) via BESTCOMS, a pre-alarm will be annunciated when the MPU fails.

High Coolant Temperature Pre-Alarm

If engine coolant temperature increases above the high coolant temperature pre-alarm setpoint programmed by the BESTCOMS software for the programmed delay time, a pre-alarm occurs.

Low Coolant Temperature Pre-Alarm

If engine coolant temperature decreases below the low coolant temperature pre-alarm setpoint programmed by the BESTCOMS software for the programmed delay time, a pre-alarm occurs.

Weak Battery Voltage Pre-Alarm

If the battery voltage drops below the weak battery voltage value programmed by the BESTCOMS software for the programmed delay time during engine cranking, a pre-alarm occurs. The message, WEAK BATTERY is displayed in the alternate display mode and is reset by scrolling through the alternate display.

Low Battery Voltage Pre-Alarm

If the battery voltage decreases below the low battery voltage value programmed by the BESTCOMS software, a pre-alarm occurs.

Battery Overvoltage Pre-Alarm

If the battery voltage exceeds the battery over voltage level programmed by the BESTCOMS software, a pre-alarm occurs.

Low Fuel Level Pre-Alarm

If the fuel level decreases below the low fuel level pre-alarm value programmed by the BESTCOMS software, a pre-alarm occurs.

Engine Overload Pre-Alarm

If the engine load exceeds the engine overload level pre-alarm value programmed by the BESTCOMS software, a pre-alarm occurs.

Battery Charger Failure Pre-Alarm

If a battery charger failure is detected via the battery charger fail contact input, a pre-alarm occurs.

Maintenance Pre-Alarm

When the next scheduled maintenance timer reaches zero hours, a pre-alarm occurs. After the required maintenance is performed, the pre-alarm can be cleared either from BESTCOMS or the front panel. To clear the pre-alarm from the front panel, go to the alternate display mode and scroll to the screen that displays HRS TO NEXT SERVICE. Pressing the Select/Enter button while on this screen will clear the maintenance pre-alarm and reset the maintenance timer back to its programmed starting value.

Active DTC Pre-Alarm

When CAN Bus and DTC Support are both enabled, an "active DTC" pre-alarm may be enabled from BESTCOMS to announce the presence of a current condition that is causing a diagnostic trouble code to be sent to the DGC-1000 from the ECU.

CAN Bus Pre-Alarm

A CAN Bus Failure annunciation may be enabled only when the CAN interface is enabled. The CAN interface is configurable from BESTCOMS. When configure to alarm, annunciation occurs when CAN communication is lost either by the unit becoming disconnected from the ECU or the ECU malfunctioning. If CAN communication is lost and the annunciation is a pre-alarm, a screen will appear in the Alternate Display stating the pre-alarm and will be viewable only when the pre-alarm is in progress.

MTU MDEC ECU Pre-Alarms

A DGC-1000 connected to a genset equipped with an MTU MDEC engine controller is capable of annunciating a set of pre-alarms unique to the MDEC ECU. Pre-alarms issued by the MDEC ECU can be viewed on the MTU MDEC tab of the BESTCOMS Metering screen or through the alternate display mode of the front panel display. If more than one pre-alarm is present, the Raise and Lower pushbuttons can be used to scroll through the list. When an MDEC ECU pre-alarm is active, the front panel Alarm LED flashes on and off. The first line displayed in an MDEC pre-alarm message is MDEC ECU PREALARM. The second line of an MDEC pre-alarm message displays text specific to the pre-alarm condition. The following paragraphs describe each of the eight MDEC pre-alarm types. For more detailed information, refer to your MDEC ECU documentation.

HIGH ECU TEMPERATURE. This pre-alarm is annunciated when excessive temperature is detected within the ECU.

HIGH OIL TEMPERATURE. This pre-alarm is annunciated when the MDEC ECU detects excessive engine oil temperature.

HIGH INTERCOOLER TEMP. This pre-alarm is annunciated when the MDEC ECU detects excessive coolant temperature in the engine aftercooler.

HIGH CHARGE AIR TEMP. This pre-alarm is annunciated when the MDEC ECU detects excessive turbocharger air temperature.

HIGH COOLANT TEMP. This pre-alarm is annunciated when the MDEC ECU detects excessive engine coolant temperature. The trigger for this alarm is controlled by the ECU and operates independently of the DGC-1000 high coolant temperature pre-alarm setting.

SS OVERRIDE ON. This pre-alarm is annunciated when the MDEC ECU broadcasts an override pre-alarm.

HIGH FUEL RAIL PRESS. This pre-alarm is annunciated when the MDEC ECU detects excessive pressure in the engine's fuel rail.

LOW FUEL RAIL PRESS. This pre-alarm is annunciated when the MDEC ECU detects low pressure in the engine's fuel rail.

LOW COOLANT LEVEL. This pre-alarm is annunciated when the MDEC ECU detects low engine coolant level.

LOW CHARGE AIR PRESS. This pre-alarm is annunciated when the MDEC ECU detects low air pressure at the output of the engine turbocharger.

LOW FUEL DELIV PRESS. This pre-alarm is annunciated when the MDEC ECU detects low engine fuel pressure.

LOW OIL PRESSURE. This pre-alarm is annunciated when the MDEC ECU detects low engine oil pressure.

COMBINED YELLOW. This alarm is annunciated when the MDEC ECU issues a “yellow” warning (Level 1) message.

MTU MDEC ECU Fault Codes

A DGC-1000 connected to a genset equipped with an MTU MDEC engine controller tracks and displays the active fault codes issued by the MDEC ECU. Active MDEC ECU fault codes can be viewed on the MTU MDEC tab of the BESTCOMS Metering screen or through the alternate display mode of the front panel display. If any MDEC fault codes are active, an alternate mode display screen with the text MDEC ACTIVE FAULTS SEL/ENTER TO VIEW will appear as the last screen in the list of alternate mode screens. Pressing **Select/Enter** views the first fault. The **Raise/Scroll** and **Lower/Scroll** keys can be used to scroll through all active faults. When one has scrolled through all the faults in the list, a screen will appear with the text NO MORE FAULTS PREVIOUS TO EXIT. One can scroll through the faults list as many times as desired. Pressing **Previous** at any time returns to the alternate mode display screens. The menu mode is accessed by pressing **Display Toggle** at any time. If no fault codes are active, the MDEC ACTIVE FAULTS screen will not be displayed in the alternate mode screens.

A fault code is displayed with a first line of MDEC FAULT CODE: XXX, where XXX is the fault code number. The second line of a fault code message displays text describing the fault. MDEC ECU fault codes are listed below with the corresponding fault numbers. Fault numbers not listed display “NO TEXT AVAILABLE” as the descriptive text. For more detailed information, refer to your MDEC ECU documentation.

3, L1 T-FUEL
5, L1 T-CHRG AIR
9, L1 T-INTERCOOLER
15, L1 P-LUBE OIL
16, L2 P-LUBE OIL
19, L1 T-EXHAUST A
21, L1 T-EXHAUST B
23, L1 COOLANT LEVEL
24, L2 COOLANT LEVEL
30, ENGINE OVERSPEED
31, CHRGR1 OVERSPD 1
32, CHRGR1 OVERSPD 2
33, L1 P-FUELFLT DIF
44, L1 LEVEL INTRCLR
45, L2 LEVEL INTRCLR
51, L1 T-LUBE OIL
57, L1 P-COOLANT
58, L2 P-COOLANT
63, L1 P-CRANKCASE
65, L1 P-FUEL
67, L1 T-COOLANT
68, L2 T-COOLANT
69, L1 T-EXTERN 1
70, L2 T-EXTERN 1
71, L1 T-EXTERN 2
72, L2 T-EXTERN 2
73, L1 P-EXTERN 1
74, L2 P-EXTERN 1
75, L1 P-EXTERN 2
76, L2 P-EXTERN 2
77, LIN EXT CLNT LEV
78, LIN INTERCLR LEV
79, L BIN-EXTERN 3
80, L BIN-EXTERN 4
90, IDLE SPEED LOW
91, RUNUP SPEED LOW
92, START SPEED LOW
93, PREHT TMP. LIM 2
94, PREHT TMP. LIM 1
100, EDM NOT VALID
101, IDM NOT VALID
102, INVLD FUEL CNS 1
103, INVLD FUEL CNS 2
104, OP HRS1 INVALID
105, OP HRS2 INVALID
106, ERR REC1 INVALID
107, ERR REC2 INVALID
118, L1 SPPLY VOLT LO
119, L2 SPPLY VOLT LO
120, L1 SPPLY VOLT HI
121, L2 SPPLY VOLT HI
122, L1 T-ELECTRONIC
134, 15V POSECU DEFCT
136, 15V NEGECU DEFCT
137, L1 5V BUFFR TEST
138, SENSOR PWR DEFCT
139, L1 TE BUFFR TEST
140, TE BUF ECU DEFCT
142, BANK1ECU DEFECT
144, BANK2ECU DEFECT
145, 15V GOODECU DFCT
147, AD-TST1ECU DEFCT
149, AD-TST2ECU DEFCT
151, AD-TST3ECU DEFCT
170, MI MODULE FAIL
171, MI NOT ACTIVE
172, TBO EXPIRED
173, MODL WRITE LIMIT
180, CAN1 NODE LOST
181, CAN2 NODE LOST
183, CAN NO PU-DATA
184, CAN PUDATA EE-FL
185, CAN LESS MAILBXS
186, CAN1 BUS OFF
187, CAN1 ERROR PASSV
188, CAN2 BUS OFF
189, CAN2 ERROR PASSV
201, SD T-COOLANT
202, SD T-FUEL
203, SD T-CHARGE AIR
205, SD T-CLNT INTERC
208, SD P-CHARGE AIR
211, SD P-LUBE OIL
214, SD P-CRANKCASE
215, SD P-RAIL FUEL
216, SD T-LUBE OIL
220, SD COOLANT LEVEL
222, SD LVL LKG FUEL
223, SD LVL INTERCLR
230, SD CRANKSHFT SPD
231, SD CAMSHAFT SPD
245, SD POWER SUPPLY
246, SD T-ELECTRONIC

249, SD CAN STOP
250, SD CAN SPD DEMND
251, SD CAN UP/DOWN
252, SD CAN NOTCH POS
253, SD CAN OVERRIDE
254, SD CAN TST OVRSP
260, SD 15V POS SPPLY
261, SD 15V NEG SPPLY
262, SD 5V BUFFR TEST
263, SD TE BUFFR TEST
264, SD BANK 1 TEST
265, SD BANK 2 TEST
266, SD SPD DEMAND AN
267, SD SPDMTEST BNCH
269, SD LOAD PLS ANLG
271, SD T-EXTERN 1
272, SD T-EXTERN 2
273, SD P-EXTERN 1
274, SD P-EXTERN 2
275, MD EXT.CLNT LVL
276, MD INTERCLER LVL
277, MISDATA BIN-EXT3
278, MISDATA BIN-EXT4
279, SD CANRES TRIPFL
280, SD CAN ALRM RST
281, SD ADTEST1 SPPLY
282, SD ADTEST2 SPPLY
283, SD ADTEST3 SPPLY
284, SD CAN LAMP TEST

DISPLAY OPERATION

The DGC-1000 has three display modes: Normal, Alternate, and Menu. Pressing the **Display Toggle** pushbutton when in the Normal display mode allows the user to scroll through the Normal, Alternate, and menu display modes. DTC mode, when enabled, may be selected while in the Alternate mode. Figure 3-3 shows the top level of each display mode.

Normal Mode

This mode displays the engine and generator parameters as described by the labeling on the front panel. Pressing the **Phase Toggle** pushbutton when the engine is running scrolls through the voltage and current measurements that are available.

Alternate Display Mode

After pressing the **Display/Toggle** pushbutton to enter the alternate display mode, pressing the **Raise/Scroll** or **Lower/Scroll** pushbutton allows the user to scroll through the alternate display mode screens.

Quantities are displayed in the following order.

- Oil pressure
- Coolant temperature
- Fuel level
- Battery voltage
- Total kilowatt load
- Hours to next service
- Generator A-B voltage
- Generator B-C voltage (3-phase sensing)
- Generator C-A voltage (3-phase sensing)
- Generator A-N voltage (except 3-phase L-L sensing)
- Generator B-N voltage (except 3-phase L-L sensing)
- Generator C-N voltage (3-phase L-N sensing only)
- Generator phase A, B, and C currents
- Phase A kVA
- Phase B kVA
- Phase C kVA (3-phase sensing)
- Total kVA
- Generator phase A kilowatts
- Generator phase B kilowatts
- Generator phase C kilowatts (3-phase sensing)
- Generator total kilowatt-hours
- Generator power factor
- Generator frequency
- Total run hours
- Engine speed
- Unit identification number
- Coolant level (CAN interface enabled)
- Active DTC list (CAN interface and diagnostics enabled)
- Previous DTC list (CAN interface and diagnostics enabled)
- MDEC ECU pre-alarms
- MDEC ECU active faults

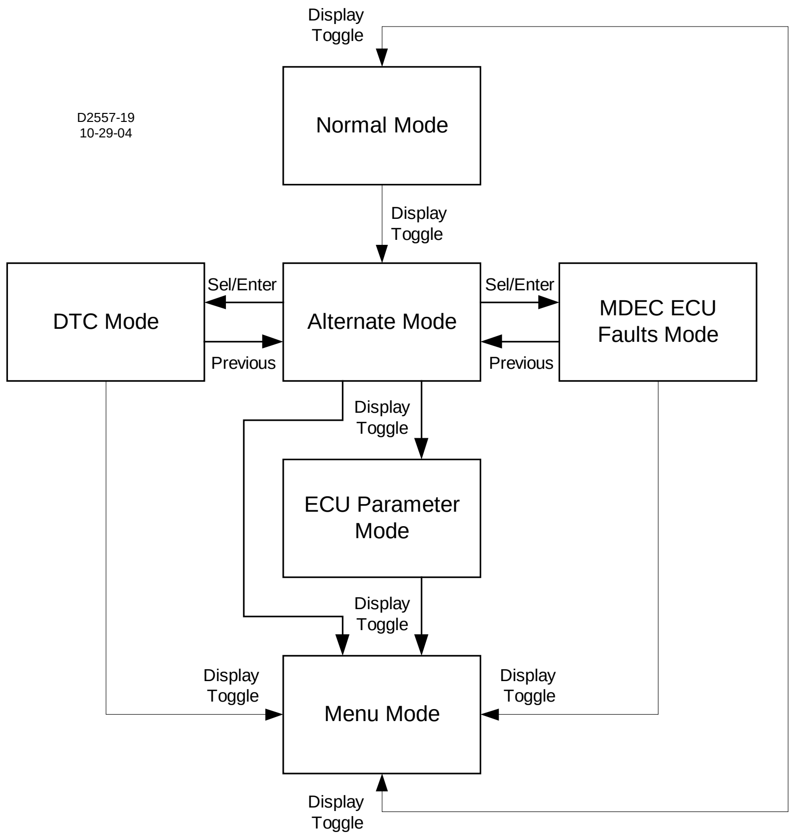

Figure 3-3. Top Level of Display Modes

Diagnostic Trouble Codes (DTC) Display Mode

Access to the Diagnostic Trouble Codes (DTCs) screens can be gained in the Alternate Display mode. The DTCs are the last two screens in the Alternate Display list. DTC screens are only available when the CAN interface and DTCs are enabled.

If there are no DTCs communicating with the unit, the **Select/Enter** button will have no affect, and "ACTIVE DTC LIST" and "NO DTC(S) TO VIEW" will be displayed. If there is at least one DTC communicating with the unit, the **Select/Enter** button will be an active input, and "ACTIVE DTC LIST" and "PRESS SELECT TO VIEW" will be displayed.

Pressing **Select/Enter** when “ACTIVE DTC LIST” and “PRESS SELECT TO VIEW” is displayed will put the DGC-1000 in DTC Mode. The next screen to appear will display the diagnostic lamp status information obtained from the ECU. One of five possible lamp status messages will be displayed. The list of possible messages in decreasing order of priority includes:

1. ENGINE STOP LAMP LIT
2. WARNING LAMP LIT
3. MALFUNCTION LAMP LIT
4. PROTECT LAMP LIT
5. NO LAMP IS LIT

Only one lamp status will be displayed from the front panel, the one with the highest priority that is currently true. The user may use BESTCOMS to view the status of all lamps. An example of the lamp status screen is shown below.

CURRENT LAMP STATUS
ENGINE STOP LAMP LIT

To be notified that a lamp status exists, the pre-alarm for Active DTCs must be enabled (from BESTCOMS). When one or more Active DTCs exists in the ECU, a lamp status should exist indicating the severity of the combined DTCs. After the pre-alarm is annunciated (through LED, Horn, and/or Dial-Out, the user will know to check the Lamp Status, Active DTCs in the system, and what relationship DTCs have with the parameters. (From the front panel, use the “ECU Parameters” menu to check the relationship. From BESTCOMS, hover the mouse over the DTC to see it’s related parameter).

To view the list of currently active DTCs, press **Raise/Scroll**. The next screen to appear will display the first DTC, the number of DTCs, the Suspect Parameter Number (SPN), the Failure Mode Indicator (FMI) and the Occurrence Count (OC).

NOTE: Always refer to the engine’s manual for the meaning of SPN and FMI combinations, *especially* for proprietary DTC descriptions.

In the DTC screen example of Figure 3-4, the first DTC of five is being displayed, the SPN is 111 (Coolant Level), the FMI is 1 (low voltage from the sender, thus we have Low Coolant Level), and the OC is 2 (the unit has had a low coolant level twice before). Refer to the engine manufacturer’s CAN Interface documentation for specific descriptions of codes.

The following list includes all the engine system monitoring parameters read from the ECU (if supported) in the order in which they appear when pressing **Raise/Scroll**, having started from the ECU Parameters menu.

- Throttle Position
- Percent Load at Current RPM
- Actual Engine Percent Torque
- Injection Control Pressure
- Injector Metering Rail Pressure
- Injector Metering Rail Pressure
- Engine Speed∗
- Total Engine Hours∗
- Trip Fuel
- Total Fuel Used
- Engine Coolant Temperature∗
- Fuel Temperature
- Engine Oil Temperature
- Engine Intercooler Temperature
- Fuel Delivery Pressure
- Engine Oil Level
- Engine Oil Pressure∗
- Coolant Pressure
- Coolant Level
- Fuel Rate
- Barometric Pressure
- Ambient Air Temperature
- Air Inlet Temperature
- Boost Pressure
- Intake Manifold Temperature
- Air Filter Differential Pressure
- Exhaust Gas Temperature
- Electrical Potential (Voltage)∗
- Battery Potential (Voltage), Switched
- Oil Filter Differential Pressure
- Fuel Filter Differential Pressure
- Crankcase Pressure
- Engine Configuration (Sub-Menu)

∗ These parameters may be monitored either directly by the DGC-1000 itself or by the DGC-1000 and the appropriate analog sender when the CAN bus/J1939 interface is disabled.

To start viewing the engine configuration parameters read from the ECU, press **Select/Enter** at the Engine Configuration sub-menu. The following list includes parameters in the order in which they appear when pressing **Raise/Scroll**:

- Engine Speed at Idle, Point 1
- Percent Torque at Idle, Point 1
- Engine Speed at Point 2
- Percent Torque at Point 2
- Engine Speed at Point 3
- Percent Torque at Point 3
- Engine Speed at Point 4
- Percent Torque at Point 4
- Engine Speed at Point 5
- Percent Torque at Point 5
- Engine Speed at High Idle, Point 6
- Gain (KP) of the Endspeed Governor
- Reference Engine Torque
- Maximum Momentary Engine Override Speed, Point 7
- Maximum Momentary Override Time Limit

- Requested Speed Control Range Lower Limit
- Requested Speed Control Range Upper Limit
- Requested Torque Control Range Lower Limit
- Requested Torque Control Range Upper Limit

Menu Mode

After pressing the **Display Toggle** pushbutton twice to begin the Menu display mode (first time selects the Alternate mode), pressing **Select/Enter** begins the next level of menus. Pressing the **Raise/Scroll** or **Lower/Scroll** pushbutton (Figure 3-5) allows the user to scroll through the menu display mode screens. Pressing the **Display Toggle** pushbutton returns the display to the Normal mode.

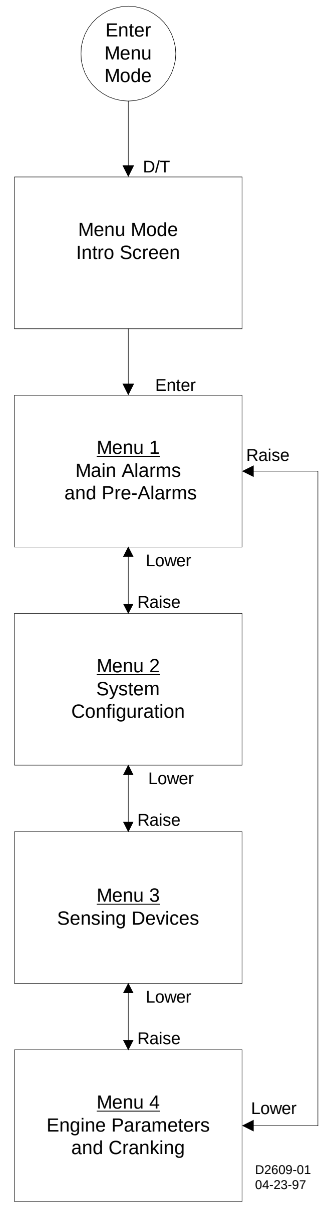

Figure 3-5. Menu Display Modes

__Menu 1__

Menu 1 is the alarm and pre-alarm menu. Pressing **Select/Enter** (Figure 3-6) from this menu begins the 1.x menu level. Pressing **Raise/Scroll** and **Lower/Scroll** from this menu scrolls through the 1.x menu level.

__Menu 1.1__

Menu 1.1 displays the overspeed alarm. Pressing **Select/Enter** begins the 1.1.1 level of menus and displays the function activation level. Pressing **Select/Enter** displays the setting. This is not adjustable from the front panel. Pressing **Previous** goes back to the 1.1.1 level.

Pressing **Raise/Scroll** or **Lower/Scroll** begins the 1.1.2 function activation delay level of menus. Pressing **Select/Enter** displays the activation delay time once the level has been exceeded. This is not adjustable from the front panel.

Pressing **Previous** twice goes back to the 1.1 level. Pressing **Raise/Scroll** goes to the 1.2 menu level. Pressing **Lower/Scroll** goes to the 1.13 menu level.

__Menu 1.2__

Menu 1.2 displays the high coolant temperature alarm. Pressing **Select/Enter** begins the 1.2.1 level of menus and displays the function activation level. Pressing **Select/Enter** displays the setting. This is not adjustable from the front panel.

Pressing **Previous** goes back to the 1.2.1 level. Pressing **Raise/Scroll** or **Lower/Scroll** begins the 1.2.2 function activation delay level of menus. Pressing **Select/Enter** displays the activation delay time once the engine crank disconnect speed is exceeded. This is not adjustable from the front panel.

Pressing **Previous** twice goes back to the 1.2 level. Pressing **Raise/Scroll** goes to the 1.3 menu level Pressing **Lower/Scroll** goes to the 1.1 menu level.

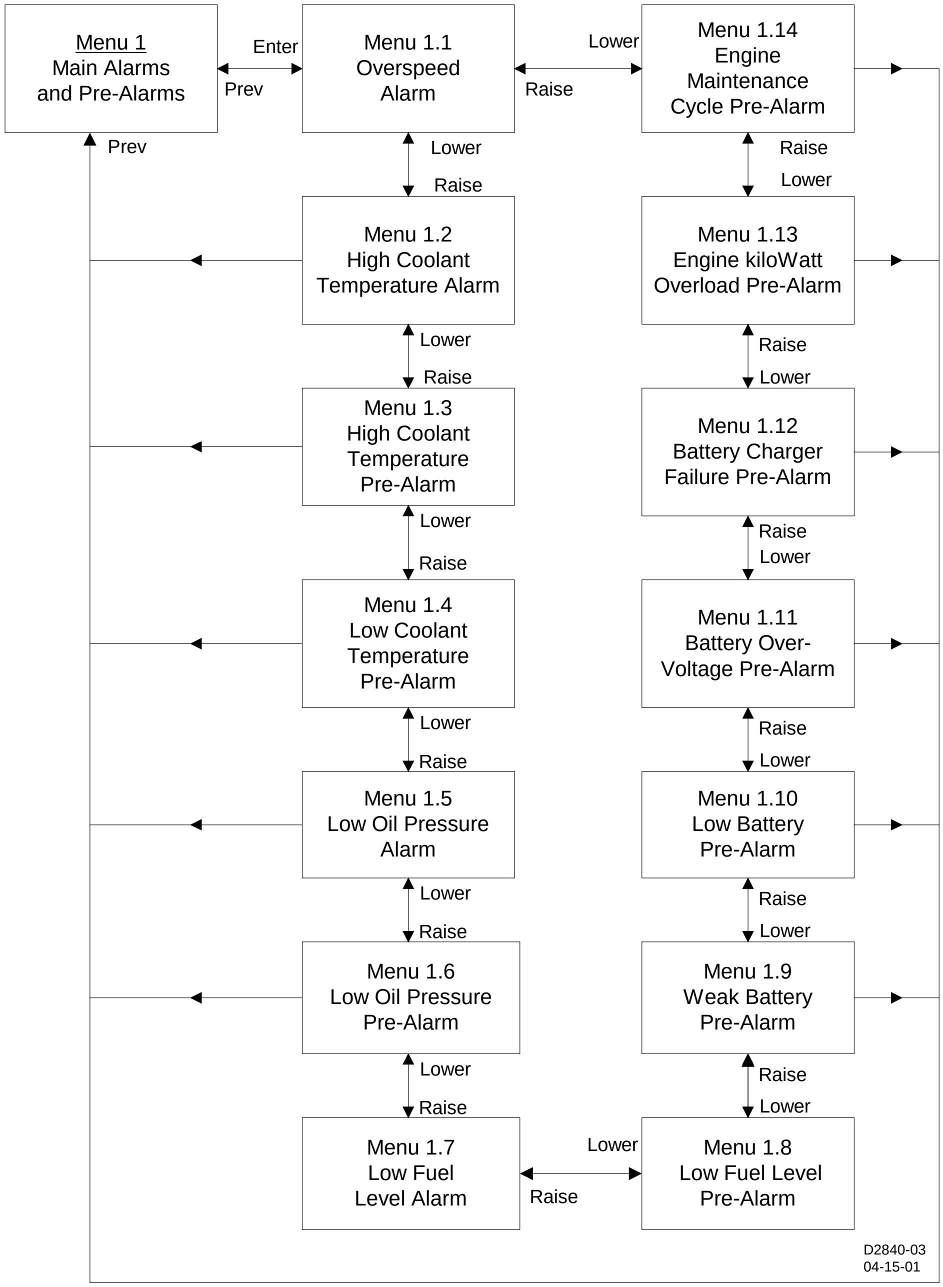

Figure 3-6. Menu 1

Menu 1.3

Menu 1.3 displays high coolant temperature pre-alarm. Pressing **Select/Enter** begins the 1.3.1 level of menus and displays the function activation level. Pressing **Select/Enter** displays the setting. This is not adjustable from the front panel.

Pressing **Previous** returns to the 1.3.1 level. Pressing **Raise/Scroll** or **Lower/Scroll** begins the 1.3.2 function activation delay level of menus. Pressing **Select/Enter** displays the activation delay time once the engine crank disconnect speed is exceeded. This is not front panel adjustable.

Pressing **Previous** twice goes back to the 1.3 level. Pressing **Raise/Scroll** goes to the 1.4 menu level Pressing **Lower/Scroll** goes to the 1.2 menu level.

Menu 1.4

Menu 1.4 displays low coolant temperature pre-alarm. Pressing **Select/Enter** begins the 1.4.1 level of menus and displays the function activation level. Pressing **Select/Enter** displays the setting. This is not adjustable from the front panel.

Pressing **Previous** goes back to the 1.4.1 level. Pressing **Raise/Scroll** or **Lower/Scroll** begins the 1.4.2 function activation delay level of menus. Pressing **Select/Enter** displays the activation delay time once the level has been exceeded. This is not adjustable from the front panel.

Pressing **Previous** twice goes back to the 1.4 level. Pressing **Raise/Scroll** goes to the 1.5 menu level Pressing **Lower/Scroll** goes to the 1.3 menu level.

Menu 1.5

Menu 1.5 displays low oil pressure alarm. Pressing **Select/Enter** begins the 1.5.1 level of menus and displays the function activation level. Pressing **Select/Enter** displays the setting. This is not adjustable from the front panel.

Pressing **Previous** goes back to the 1.5.1 level. Pressing **Raise/Scroll** or **Lower/Scroll** begins the 1.5.2 function activation delay level of menus. Pressing **Select/Enter** displays the activation delay time once the engine crank disconnect speed is exceeded. This is not adjustable from the front panel.

Pressing **Previous** twice goes back to the 1.5 level. Pressing **Raise/Scroll** goes to the 1.6 menu level Pressing **Lower/Scroll** goes to the 1.4 menu level.

Menu 1.6

Menu 1.6 displays low oil pressure pre-alarm. Pressing **Select/Enter** begins the 1.6.1 level of menus and displays the function activation level. Pressing **Select/Enter** displays the setting. This is not adjustable from the front panel.

Pressing **Previous** goes back to the 1.6.1 level. Pressing **Raise/Scroll** or **Lower/Scroll** begins the 1.6.2 function activation delay level of menus. Pressing **Select/Enter** displays the activation delay time once the engine crank disconnect speed is exceeded. This is not adjustable from the front panel.

Pressing **Previous** twice goes back to the 1.6 level. Pressing **Raise/Scroll** goes to the 1.7 menu level Pressing **Lower/Scroll** goes to the 1.5 menu level.

Menu 1.7

Menu 1.7 displays low fuel level alarm. Pressing **Select/Enter** begins the 1.7.1 level of menus and displays the function activation level. Pressing **Select/Enter** displays the setting. This is adjustable from the front panel.

Pressing **Previous** goes back to the 1.7.1 level. Pressing **Raise/Scroll** or **Lower/Scroll** begins the 1.7.2 function activation delay level of menus. Pressing **Select/Enter** displays the activation delay time once the level has been exceeded. After pressing **Raise/Scroll** or **Lower/Scroll**, the user will be instructed to enter the user key code. After entering the user key code followed by pressing **Select/Enter** twice, the setting will be adjustable with the **Raise/Scroll** and **Lower/Scroll** keys. After the desired setting has been selected, press **Select/Enter** to save the new settings.

Pressing **Previous** twice goes back to the 1.7 level. Pressing **Raise/Scroll** goes to the 1.8 menu level Pressing **Lower/Scroll** goes to the 1.6 menu level.

Menu 1.8

Menu 1.8 displays low fuel level pre-alarm. Pressing **Select/Enter** begins the 1.8.1 level of menus and displays the function activation level. Pressing **Select/Enter** displays the setting. This is adjustable from the front panel.

Pressing **Previous** goes back to the 1.8.1 level. Pressing **Raise/Scroll** or **Lower/Scroll** begins the 1.8.2 function activation delay level of menus. Pressing **Select/Enter** displays the activation delay time once the level has been exceeded. After pressing **Raise/Scroll** or **Lower/Scroll**, the user will be instructed to enter the user key code. After entering the user key code followed by pressing **Select/Enter** twice, the setting will be adjustable with the **Raise/Scroll** and **Lower/Scroll** keys. After the desired setting has been selected, press **Select/Enter** to save the new settings.

Pressing **Previous** twice goes back to the 1.8 level. Pressing **Raise/Scroll** goes to the 1.9 menu level Pressing **Lower/Scroll** goes to the 1.7 menu level.

Menu 1.9

Menu 1.9 displays weak battery pre-alarm. Pressing **Select/Enter** begins the 1.9.1 level of menus and displays the function activation level. Pressing **Select/Enter** displays the setting. This is not adjustable from the front panel.

Pressing **Previous** goes back to the 1.9.1 level. Pressing **Raise/Scroll** or **Lower/Scroll** begins the 1.9.2 function activation delay level of menus. Pressing **Select/Enter** displays the activation delay time once the level has been exceeded. This is not adjustable from the front panel.

Pressing **Previous** twice goes back to the 1.9 level. Pressing **Raise/Scroll** goes to the 1.10 menu level Pressing **Lower/Scroll** goes to the 1.8 menu level.

Menu 1.10

Menu 1.10 displays low battery pre-alarm. Pressing **Select/Enter** begins the 1.10.1 level of menus and displays the function activation level. Pressing **Select/Enter** displays the setting. This is not adjustable from the front panel.

Pressing **Previous** goes back to the 1.10.1 level. Pressing **Raise/Scroll** or **Lower/Scroll** begins the 1.10.2 function activation delay level of menus. Pressing **Select/Enter** displays the activation delay time once the level has been exceeded. This is not adjustable from the front panel.

Pressing **Previous** twice goes back to the 1.10 level. Pressing **Raise/Scroll** goes to the 1.11 menu level Pressing **Lower/Scroll** goes to the 1.9 menu level.

Menu 1.11

Menu 1.11 displays battery over voltage pre-alarm. Pressing **Select/Enter** begins the 1.11.1 level of menus and displays the function activation level. Pressing **Select/Enter** displays the setting. This is not adjustable from the front panel.

Pressing **Previous** goes back to the 1.11.1 level. Pressing **Raise/Scroll** or **Lower/Scroll** begins the 1.11.2 function activation delay level of menus. Pressing **Select/Enter** displays the activation delay time once the level has been exceeded. This is not adjustable from the front panel.

Pressing **Previous** twice goes back to the 1.11 level. Pressing **Raise/Scroll** goes to the 1.12 menu level Pressing **Lower/Scroll** goes to the 1.10 menu level.

Menu 1.12

Menu 1.12 displays battery charger failure pre-alarm. Pressing **Select/Enter** begins the 1.12.1 level of menus and displays the function activation level. Pressing **Select/Enter** displays the setting. This is not adjustable from the front panel.

Pressing **Previous** goes back to the 1.12.1 level. Pressing **Raise/Scroll** or **Lower/Scroll** begins the 1.12.2 function activation delay level of menus. Pressing **Select/Enter** displays the activation delay time once the level has been exceeded. This is not adjustable from the front panel.

Pressing **Previous** twice goes back to the 1.12 level. Pressing **Raise/Scroll** goes to the 1.13 menu level Pressing **Lower/Scroll** goes to the 1.11 menu level.

Menu 1.13

Menu 1.13 displays kilowatt overload pre-alarm. Pressing **Select/Enter** begins the 1.13.1 level of menus and displays the function activation level. Pressing **Select/Enter** displays the setting. This is not adjustable from the front panel.

Pressing **Previous** goes back to the 1.13.1 level. Pressing **Raise/Scroll** or **Lower/Scroll** begins the 1.13.2 function activation delay level of menus. Pressing **Select/Enter** displays the activation delay time once the level has been exceeded. This is not adjustable from the front panel.

Pressing **Previous** twice goes back to the 1.13 level. Pressing **Raise/Scroll** goes to the 1.14 menu level Pressing **Lower/Scroll** goes to the 1.12 menu level.

Menu 1.14

Menu 1.14 display engine maintenance pre-alarm. Pressing **Select/Enter** begins the 1.14.1 level of menus and displays the function activation level. Pressing **Select/Enter** displays the setting. This is not adjustable from the front panel.

Pressing **Previous** goes back to the 1.14.1 level. Pressing **Raise/Scroll** or **Lower/Scroll** begins the 1.14.2 function activation delay level of menus. Pressing **Select/Enter** displays the activation delay time once the level has been exceeded. This is not adjustable from the front panel.

Pressing **Previous** twice goes back to the 1.14 level. Pressing **Raise/Scroll** goes to the 1.1 menu level. Pressing **Lower/Scroll** goes to the 1.13 menu level.

Pressing **Previous** from any 1.x level menu goes to menu 1. Pressing **Raise/Scroll** goes to menu 2. Pressing **Lower/Scroll** goes to menu 3.

Menu 2

Menu 2 system configuration. Pressing **Select/Enter** from this menu (Figure 3-7) begins the 2.x level of menus. Pressing **Raise/Scroll** and **Lower/Scroll** from this menu scrolls through the 2.x levels of menus.

Menu 2.1

Menu 2.1 displays the generator voltage sensing connection. Pressing **Select/Enter** begins the 2.1.1 level and displays the sensing configuration. This is not adjustable from the front panel.

Pressing **Previous** goes back to the 2.1 level. Pressing **Raise/Scroll** goes to menu 2.2. Pressing **Lower/Scroll** goes to menu 2.5.

Menu 2.2

Menu 2.2 displays options. Pressing **Select/Enter** (Figure 3-8) begins the 2.2.1 level and displays the speed signal source selection. This is not adjustable from the front panel.

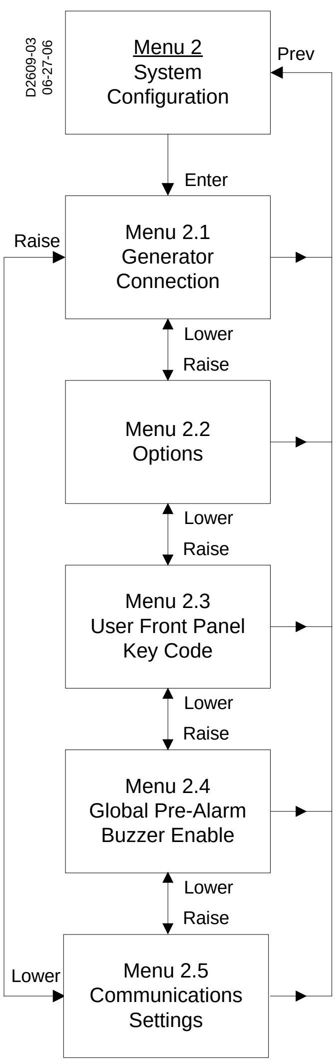

Figure 3-7. Menu 2

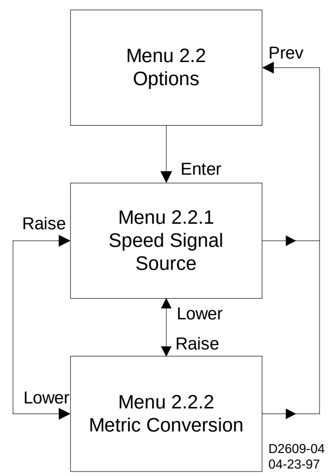

Figure 3-8. Menu 2.2

Pressing **Previous** goes back to the 2.2 level. Pressing **Raise/Scroll** or **Lower/Scroll** goes to menu 2.2.2 and displays metric conversion.

Pressing **Select/Enter** displays the status of this feature. To change to the metric display press **Raise/Scroll** and enter the user key code followed by the **Select/Enter** key. Press **Raise/Scroll** and then **Select/Enter**. The display will indicate that the new setting has been saved. Press previous twice to go to menu 2.2. Press **Raise/Scroll** to go to menu 2.3. Press **Lower/Scroll** to go to menu 2.1.

Menu 2.3

Menu 2.3 changes user key code. Press **Select/Enter** and then the user key code followed by **Select/Enter** twice. Press the key sequence for the new key code followed by **Select/Enter** twice. The user will be asked to re-enter the new key code. After entering the new key code followed by **Select/Enter** twice, the display will indicate the new code has been saved.

Pressing **Raise/Scroll** will go to menu 2.4. Pressing **Lower/Scroll** will go menu 2.2.

Menu 2.4

Menu 2.4 pre-alarm audible alarm enable. Pressing **Select/Enter** will display the status of the pre-alarm audible alarm. This feature is not adjustable from the front panel. Pressing **Previous** will go to menu 2.4.

Pressing **Raise/Scroll** will go to menu 2.5. Pressing **Lower/Scroll** will go to menu 2.3.

Pressing **Previous** from any 2.x menu will go to menu 2. Pressing **Raise/Scroll** goes to menu 3. Pressing **Lower/Scroll** goes to menu 1.

Menu 2.5

Menu 2.5 is the communications settings menu. Pressing **Select/Enter** begins the 2.5.x level of menus illustrated in Figure 3-9.

Menu 2.5.1

Menu 2.5.1 displays the Modbus address setting menu. Pressing **Select/Enter** displays the setting's value. This is not adjustable from the front panel. Pressing **Previous** goes to menu 2.5. Pressing **Raise/Scroll** goes to menu 2.5.2. Pressing **Lower/Scroll** goes to menu 2.5.4.

Menu 2.5.2

Menu 2.5.2 displays the serial port baud rate setting on the menu. Pressing **Select/Enter** displays the setting's value. This is not adjustable from the front panel. Pressing **Previous** goes to menu 2.5. Pressing **Raise/Scroll** goes to menu 2.5.3. Pressing **Lower/Scroll** goes to menu 2.5.1.

Menu 2.5.3

Menu 2.5.3 displays the serial port parity setting menu. Pressing **Select/Enter** displays the setting's value. This is not adjustable from the front panel. Pressing **Previous** goes to menu 2.5. Pressing **Raise/Scroll** goes to menu 2.5.4. Pressing **Lower/Scroll** goes to menu 2.5.2.

Menu 2.5.4

Menu 2.5.4 displays the J1939 address setting menu. Pressing **Select/Enter** displays the setting's value. This is not adjustable from the front panel. Pressing **Previous** goes to menu 2.5. Pressing **Raise/Scroll** goes to menu 2.5.1. Pressing **Lower/Scroll** goes to menu 2.5.3.

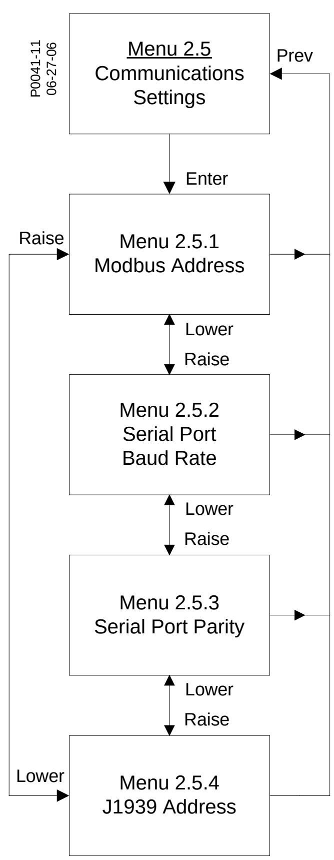

Figure 3-9. Menu 2.5

Menu 3

Menu 3 sensing devices. Pressing **Select/Enter** (Figure 3-10) begins the 3.1 level of menus.

Menu 3.1

Menu 3.1 transformer ratios menu. Menu 3.1.1 (Figure 3-11) displays generator potential transformer primary voltage rating. Pressing **Select/Enter** displays the value. This is not adjustable from the front panel. Pressing **Previous** twice goes to menu 3.1. Pressing **Raise/Scroll** goes to menu 3.1.2. Pressing **Lower/Scroll** goes to menu 3.1.5.

Menu 3.1.2

Menu 3.1.2 displays the generator potential transformer secondary voltage rating. Pressing **Select/Enter** displays the value. This is not adjustable from the front panel. Pressing **Previous** goes to menu 3.1. Pressing **Raise/Scroll** goes to menu 3.1.3. Pressing **Lower/Scroll** goes to menu 3.1.1.

Menu 3.1.3

Menu 3.1.3 displays the generator current transformer primary current rating. Pressing **Select/Enter** displays the value. This is not adjustable from the front panel. Pressing previous goes to menu 3.1. Pressing **Raise/Scroll** goes to menu 3.1.1. Pressing **Lower/Scroll** goes to menu 3.1.2.

Pressing **Raise/Scroll** from menu 3.1 goes to menu 3.2.

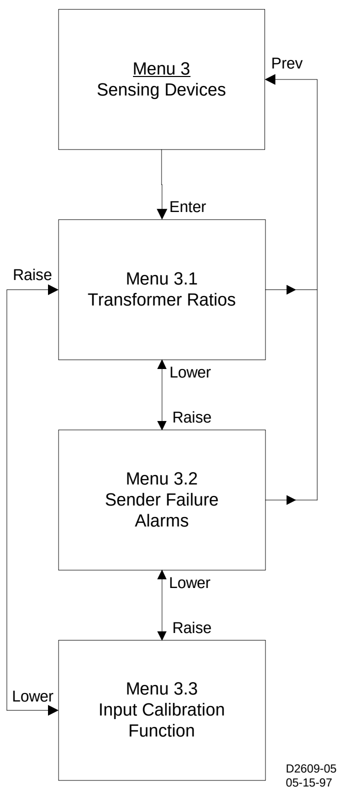

Figure 3-10. Menu 3

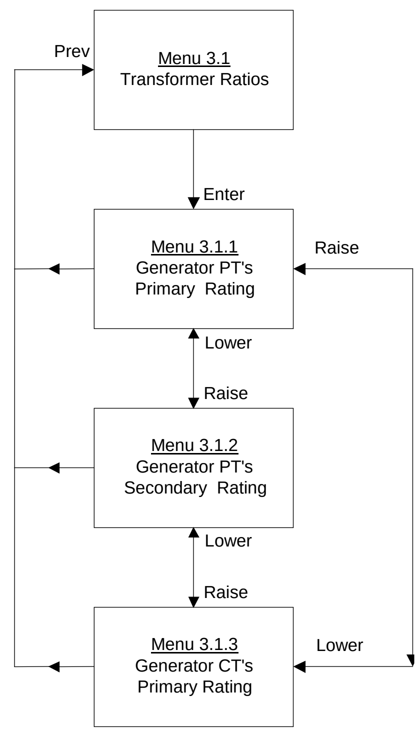

Figure 3-11. Menu 3.1

Menu 3.2

Menu 3.2 sender failure alarm menu. Pressing **Select/Enter** (Figure 3-12) begins menu 3.2.1

Menu 3.2.1

Menu 3.2.1 displays coolant temperature sensor failure alarm. Pressing **Select/Enter** displays the status of this alarm. This is not adjustable from the front panel. Pressing **Previous** goes to menu 3.2.1.

Pressing **Raise/Scroll** goes to menu 3.2.2. Pressing **Lower/Scroll** goes to menu 3.2.5.

Menu 3.2.2

Menu 3.2.2 displays oil pressure sensor failure alarm. Pressing **Select/Enter** displays the status of this alarm. This is not adjustable from the front panel. Pressing **Previous** goes to menu 3.2.2.

Pressing **Raise/Scroll** goes to menu 3.2.3. Pressing **Lower/Scroll** goes to menu 3.2.1.

Menu 3.2.3

Menu 3.2.3 displays speed signal failure alarm. Pressing **Select/Enter** displays the status of this alarm. This is not adjustable from the front panel. Pressing **Previous** goes to menu 3.2.3.

Pressing **Raise/Scroll** goes to menu 3.2.4. Pressing **Lower/Scroll** goes to menu 3.2.2.

Menu 3.2.4

Menu 3.2.4 displays voltage sensing failure alarm. Pressing **Select/Enter** displays the status of this alarm. This is not adjustable from the front panel. Pressing **Previous** goes to menu 3.2.4.

Pressing **Raise/Scroll** goes to menu 3.2.5. Pressing **Lower/Scroll** goes to menu 3.2.3.

Menu 3.2.5

Menu 3.2.5 displays sensor failure alarm time delay. Pressing **Select/Enter** displays the delay time. After pressing **Raise/Scroll** or **Lower/Scroll** the user will be instructed to enter the user key code. After entering the user key code followed by pressing **Select/Enter** twice, the setting will be adjustable with the **Raise/Scroll** and **Lower/Scroll** keys. After the desired setting has been selected, press **Select/Enter** to save the new setting. Pressing **Previous** goes to menu 3.2. Pressing **Raise/Scroll** goes to menu 3.2.1. Pressing **Lower/Scroll** goes to menu 3.2.4.

Pressing **Raise/Scroll** from menu 3.2 goes to menu 3.3. Pressing **Lower/Scroll** from menu 3.2 goes to menu 3.1.

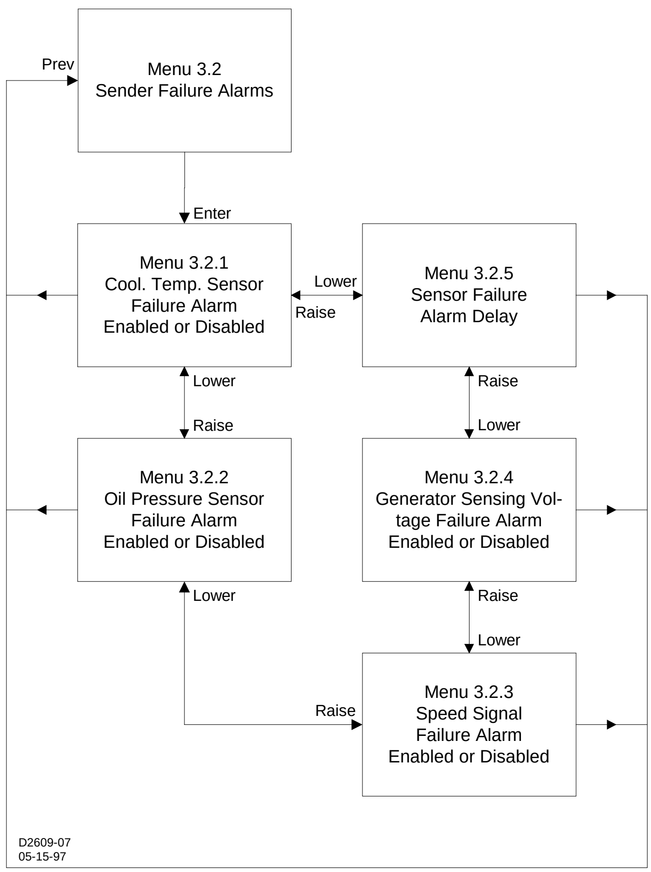

Figure 3-12. Menu 3.2

Menu 3.3

Menu 3.3 displays the input calibration function. This function is for Basler Electric Company use only. For more information contact Basler Electric Company.

Pressing **Previous** goes to menu 3. Pressing **Raise/Scroll** from menu 3 goes to menu 4. Pressing **Lower/Scroll** goes to menu 2.

Menu 4

Menu 4 (Figure 3-13) displays engine parameters and cranking. Pressing **Select/Enter** from menu 4 begins menu 4.1.

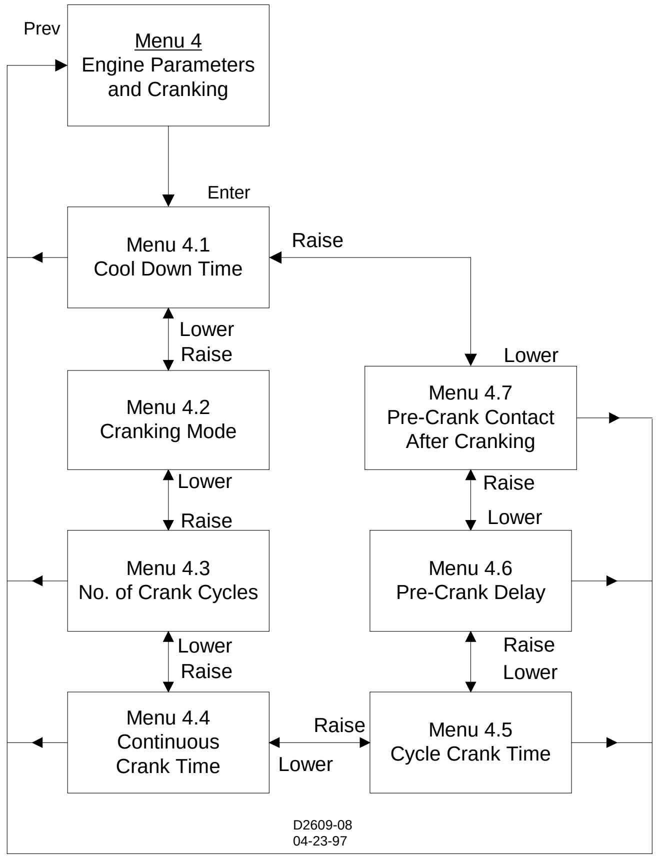

Figure 3-13. Menu 4

Menu 4.1

Menu 4.1 displays cool down time. After pressing **Raise/Scroll** or **Lower/Scroll**, the user will be instructed to enter the user key code. After entering the user key code followed by pressing **Select/Enter** twice, the setting will be adjustable with the **Raise/Scroll** and **Lower/Scroll** keys. After the desired setting has been selected, press **Select/Enter** to save the new setting. Pressing **Previous** goes to menu 4.1. Pressing **Raise/Scroll** goes to menu 4.2. Pressing **Lower/Scroll** goes to menu 4.7.

Menu 4.2

Menu 4.2 displays cranking mode. Pressing **Select/Enter** displays the cranking mode selected. This is not adjustable from the front panel. Pressing **Previous** goes to menu 4.2. Pressing **Raise/Scroll** goes to menu 4.3. Pressing **Lower/Scroll** goes to menu 4.1. *Menu 4.3.* Menu 4.3 displays the number of crank cycles. Pressing **Select/Enter** displays the number of crank cycles selected. This is not adjustable from the front panel. Pressing **Previous** goes to menu 4.3. Pressing **Raise/Scroll** goes to menu 4.4. Pressing **Lower/Scroll** goes to menu 4.2.

Menu 4.4

Menu 4.4 displays continuous crank time. Pressing **Select/Enter** displays the continuous crank time selected. This is not adjustable from the front panel. Pressing **Previous** goes to menu 4.4. Pressing **Raise/Scroll** goes to menu 4.5. Pressing **Lower/Scroll** goes to menu 4.3.

Menu 4.5

Menu 4.5 displays cycle crank time. Pressing **Select/Enter** displays the cycle crank time selected. This is not adjustable from the front panel. Pressing **Previous** goes to menu 4.5. Pressing **Raise/Scroll** goes to menu 4.6. Pressing **Lower/Scroll** goes to menu 4.4.

Menu 4.6

Menu 4.6 displays pre-crank delay time. After pressing **Raise/Scroll** or **Lower/Scroll**, the user will be instructed to enter the user key code. After entering the user key code followed by pressing **Select/Enter** twice, the setting will be adjustable with the **Raise/Scroll** and **Lower/Scroll** keys. After the desired setting has been selected press **Select/Enter** to save the new setting. Pressing **Previous** goes to menu 4.6. Pressing **Raise/Scroll** goes to menu 4.7. Pressing **Lower/Scroll** goes to menu 4.5.

Menu 4.7

Menu 4.7 displays the status of the Pre-crank contact after cranking. After pressing **Raise/Scroll** or **Lower/Scroll**, the user will be instructed to enter the user key code. After entering the user key code followed by pressing **Select/Enter** twice, the setting will be adjustable with the **Raise/Scroll** and **Lower/Scroll** keys. After the desired setting has been selected, press **Select/Enter** to save the new setting. Pressing **Previous** goes to menu 4.7. Pressing **Raise/Scroll** goes to menu 4.1. Pressing **Lower/Scroll** goes to menu 4.6.

Pressing **Previous** twice goes to the normal display mode.

Exiting Menu Mode

You may exit Menu mode (from any menu level) by pressing the **Display Toggle** pushbutton (see Figure 3-14). If the **Display Toggle** pushbutton is pressed before a parameter setpoint change has been saved, then the old setpoint value is preserved.

> **NOTE**
>
> Using DISPLAY TOGGLE to exit Menu mode will save the user's place within the menu system so that the next time Menu mode is entered, the display will return to the same screen.

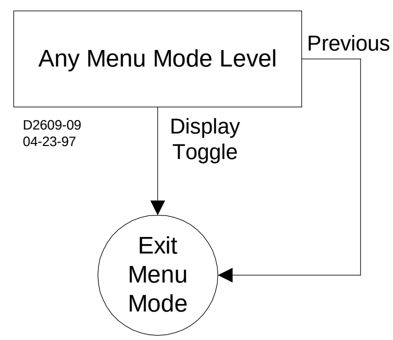

Figure 3-14. Exiting Menu Mode

As an alternative, pressing **Previous** allows the user to back out of the menu mode one level at a time so that the next time menu mode is entered, the display will start at the top of the menu structure.

Modifying Setpoints

To modify an existing setpoint, press the **Select/Enter** pushbutton (Figure 3-15). Press **Raise/Scroll** or **Lower/Scroll** buttons to raise or lower the current parameter setpoint. Press the **Select/Enter** pushbutton to save the modified setpoint value or press the **Previous** pushbutton to exit the parameter setting screen without changing the value.

Once in the menu mode, the first time an attempt is made to change a setting that is front panel adjustable, the user will be prompted to enter the key code. Upon successful entry of the key code, the user may modify any of the adjustable settings without re-entering the key code during the current menu mode session. The only exception to this is changing the key code itself. Changing the key code always requires entry of the existing key code. Also, whether the key code is actually changed or not, any further changes to other settings after that will require the key code to be entered once again. Leaving the Menu mode after an editing session automatically terminates the editing privilege.

Press the **Display Toggle** pushbutton to exit the menu mode.

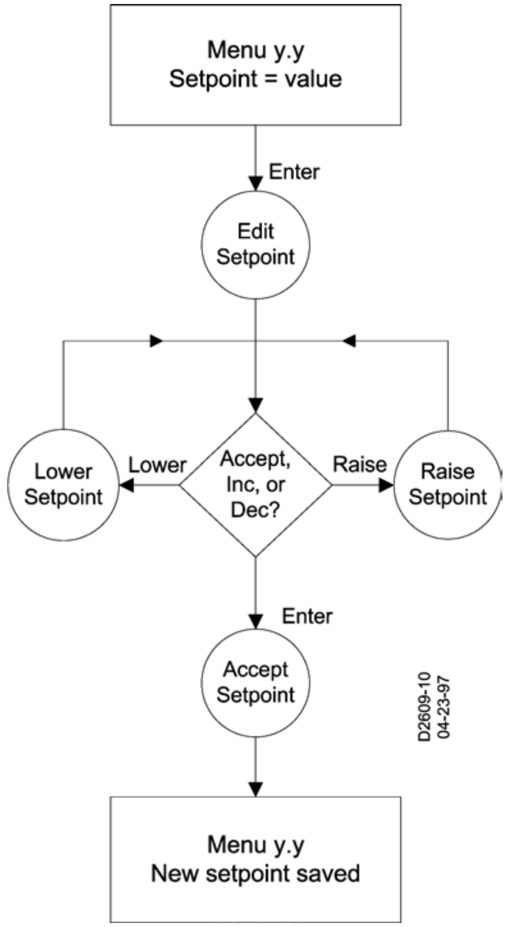

Figure 3-15. Modifying Setpoints

Key Code

The DGC-1000 is delivered with a key code consisting of the following pushbutton sequence.

1. Raise/Scroll
2. Lower/Scroll
3. Select/Enter
4. Previous
5. Display Toggle
6. Select/Enter
7. Select/Enter

The key code can be changed by accessing the CHANGE KEYCODE screen of Menu 2. Observe the following guidelines when changing the key code.

- Allowable key code pushbuttons are Raise/Scroll, Lower/Scroll, Select/Enter, Previous, Display Toggle, Phase Toggle, Alarm Silence, and Lamp Test.
- A key code entry must be followed by two presses of the Select/Enter pushbutton.
- A key code can consist of one to eight presses of the allowable key code pushbuttons.
- A key code cannot contain consecutive presses of the Previous pushbutton.

Front Panel Adjustable Parameters

Most settings are viewable at the front panel. The settings listed in Table 3-4 can be adjusted at the front panel.

Table 3-4. Front Panel Adjustable Settings

Parameter	Setting Range, Increment
Sensor Failure Alarm Time Delay	1 to 10 s, 1s
Metric Conversion	On or Off
Low Fuel Pre-Alarm Level	10 to 100%, 1%
Low Fuel Alarm Level	2 to 50%, 1%
Pre-Crank Contact After Cranking	Open or Closed
Cool-Down Time	0 to 60 m, 1 m
Pre-Crank Time Delay	0 to 30 s, 1 s

ENGINE CONTROL UNIT (ECU) SUPPORT

Enabling of ECU Support

To enable ECU support, select “Enable ECU Support” in the CANBus Interface area of the BESTCOMS System Settings screen. After re-sending the settings, the DGC-1000 will begin to ignore analog input for coolant temperature, oil pressure and engine speed, and it will no longer calculate engine run time. Once

NOTE
With Enable ECU Support selected, a non-programmable Coolant Level Sender Fail alarm can annunciate either when the engine is off or running. Coolant level is only metered and displayed when Enable ECU Support is selected in BESTCOMS.

the DGC-1000 establishes communications with an ECU, the engine run time, coolant level, coolant temperature, oil pressure and engine speed will be updated with the ECUs values.

ECU Limitations

For some ECUs, an external source cannot stop the engine without removing power from the ECU. Turning off power to the ECU is the only way to remove fuel from the engine, shutting it down. Different ECU manufacturers have their own rpm-setpoints for reapplying fuel to an engine. If the ECU is powered up and the engine is still spinning above 60 rpm, then the ECU will automatically turn the fuel on. Detroit Diesel J1939 ECUs, for example, have a setpoint of 60 rpm.

Not being able to stop the engine without removing ECU power causes two problems. The first problem is that the only way to stop the engine is to turn the ECU off and wait for the engine speed to fall below 60 rpm before powering the ECU back up. Otherwise, the engine will take off running. The second problem is that while the ECU is off, you can no longer meter and update coolant level, coolant temperature, oil pressure or engine speed values, effectively disabling features like low coolant temperature alarm/pre-alarm and crank control.

The DGC-1000 Solution

The DGC-1000 resolves ECU limitations by using timers. There are four user-programmable timers in ECU Timers under the Configure pull-down menu in BESTCOMS. In the ECU Related Time Values box you will see the following timers and their corresponding default values.

- *Pulse Cycle Time.* The time in minutes the unit waits before pulsing.
- *Response Timeout.* The time in seconds to attempt communications with the ECU when the DGC-1000 is in the Pulsing state or Connecting state.
- *Settling Time.* The time in tenths of seconds to gather data after connecting to the ECU during the Pulsing state. This allows all the metered values to be sent and ramp up to their steady-state values. Metered values are sent out by the ECU at different rates as designated by the J1939 protocol. ECU values initially sent are low and the ECU takes time to average out its own data values.
- *Engine Shut Down.* The time in seconds to stay disconnected from the ECU when going from Running to Shut-Down before starting the first pulse. This timer should allow enough time for the engine to slow down so that when the DGC-1000 pulses, the ECU will not start the engine.

Alarm and Pre-Alarm

If ECU communication is not established during the connecting state or is lost during the Pre-Start, Cranking, Resting, Running or Cooling states, then a non-programmable ECU Communications Fail alarm will be annunciated. If the last pulse was unsuccessful (ECU communications was not established) then the ECU Communications Fail pre-alarm will be annunciated. The pre-alarm is only checked after the Pulsing state and is annunciated only during the Ready state.

To clear Coolant Level Alarms when the ECU Power Support is needed, the user must first correct the condition causing the alarm and then pulse the ECU to update the data. The user may remotely pulse the ECU via BESTCOMS or locally pulse the ECU by pressing the keys in the ordered sequence **Auto** to **Off** on the front panel.

Fuel Solenoid Relay

For some ECUs, connecting to an external fuel solenoid may not be an option. In this case, the fuel solenoid relay has been designated to control ECU operating power. For example, Detroit Diesel's J1939 ECU applies fuel to the engine only after engine speed rises above 60 rpm. The following timers control the fuel solenoid relay when the unit is not running.

- Pulse Cycle Time - Fuel Solenoid is open.
- Response Timeout - Fuel Solenoid is closed.
- Settling Time - Fuel Solenoid is closed.
- Engine Shut Down - Fuel Solenoid is open.

In applications that do not require a separate pre-start contact function, the pre-start relay can also be used to control ECU operating power. Refer to the ECU Interface paragraphs in the BESTCOMS section for more information.

In an MTU MDEC ECU application, the ECU has a stop contact input to stop the engine. If this input is <u>not</u> connected to battery voltage, the engine will stop running. The fuel solenoid relay is wired such that when it is desired that the engine run, the stop input is connected to battery voltage. When it is desired that the engine stop, the fuel solenoid relay opens and removes battery voltage from the stop input.

> **NOTE**
>
> When ECU Support is enabled, during the Pre-Start and Resting states, the fuel solenoid is closed.

Eleven States of Operation

The DGC-1000 supports 11 operating states.

- Restart/Power-Up - The initial state.
- Ready - The DGC-1000 is in the Off or Auto-Off mode.
- Pulsing - <u>ECU Only</u> - pulses (momentarily powers up) the ECU for updated information.
- Connecting - <u>ECU Only</u> - The system configuration just changed to Run or Auto-Run.
- Pre-Start - Closes the pre-start relay or pauses the DGC-1000 while it is not safe to crank.
- Cranking - Cranks the engine until it is above the crank disconnect speed.
- Resting - Occurs between crank cycles and does not crank the engine.
- Running - The unit is no longer cranking and is now running.
- Cooling - Cool down running engine if a load was or is applied when going to Auto-Off mode.
- Shutting Down - <u>ECU Only</u> - Wait for engine to stop rotating before "pulsing."
- Alarm - Alarm was triggered. Wait for the alarm to clear.

Display Values (ECU Support Enabled)

The ECU is able to give the DGC-1000 in-depth information about the values it sends. This makes it possible for the DGC-1000 to display accurate information when metering these values from the ECU. After pulsing the unit, if the pulse was successful, the last values gathered when powering off the ECU are displayed until the next pulse. The following is a list of display values.

- Value-the actual value is displayed if the last pulse was successful or the engine is running.
- No Communications (abbreviated as NC)- displayed if the last pulse was unsuccessful.
- Not Applicable (abbreviated as NA)-The ECU does not monitor this data value.

- ECU Data Not Sent (abbreviated as NS)-data was not sent in the time designated by the protocol.
- Sender Failure (abbreviated as SF)-The ECU has determined a sender failure for that metered value.

Constantly Powered ECUs

The DGC-1000 supports ECUs that have the ability to cut-off fuel from the engine without powering the ECU off. The DGC-1000 requests engine run-time every minute to keep the ECU from going into a sleep-mode. After the Pulse Cycle Timer expires, the DGC-1000 checks to see if ECU communications exist. If so, then the DGC-1000 will not pulse the ECU. The same goes for Connecting, except that the DGC-1000 remembers if it skipped the Connecting state. If it did, then the DGC-1000 will also skip the Engine Shutting Down state when it turns off the engine.

For constantly powered ECUs, it is recommended that the Engine Shut Down Timer be set to its minimum value. This ensures that if the DGC-1000 temporarily loses power while running, the unit will go straight into the Run state and go to the Shutting Down state when the unit goes to Off. It is also recommended that the Response Timeout Timer be set to its minimum value in order to set the ECU Communications Fail pre-alarm as soon as possible.

The following screens will be displayed on the front panel if the last attempt to pulse the ECU for an information update was unsuccessful.

In the Normal display mode:

```
    "READY"
"NC  NC  24.0  NC"
```

In the Alternate and ECU Parameters display modes:

```
  "ENGINE SPEED"
"NO COMMUNICATIONS"
```

Normal Program Control

If an engine is not equipped with an ECU, then ECU support should be disabled for the DGC-1000 to use Analog sender data. An engine with ECU support disabled or ECU support enabled with a constant power supply and accessible fuel solenoid will follow the normal program control flowchart. See Figure 3-16.

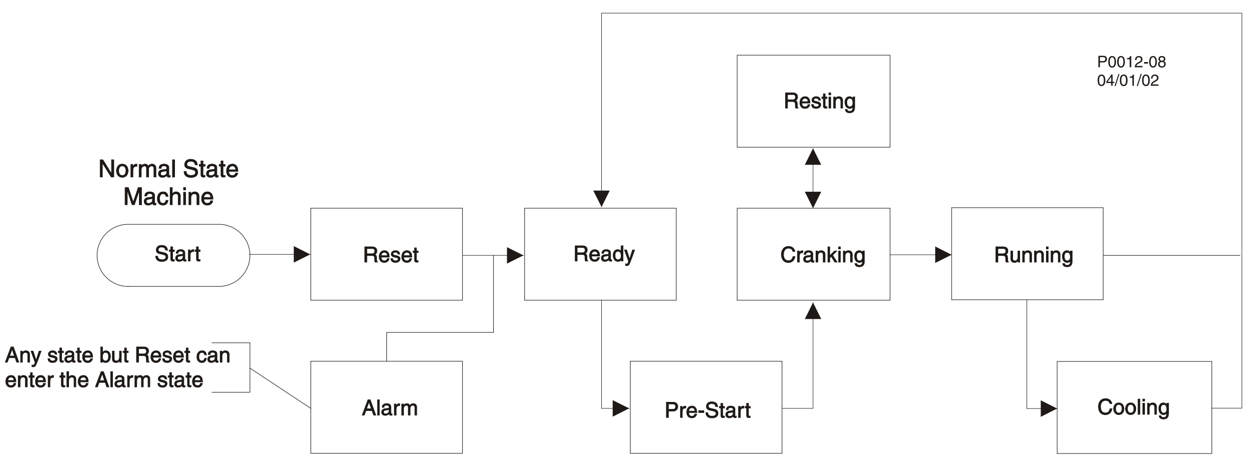

Figure 3-16. Normal Program Control Flowchart

ECU Power Support Program Control

If an engine has an ECU, then ECU Support should be enabled for the DGC-1000 to use sender data communicated over the CANBus protocol interface from the ECU. If the engine can only be shut down by powering off the ECU, then the genset will need ECU Power Support enabled. An engine with ECU Support enabled and a need for ECU Power Support through the fuel solenoid will follow the ECU Power Support diagram. See Figure 3-17.

> **NOTE**
>
> ECU Power Support is not a selectable option. The DGC-1000 will decide between using the fuel solenoid output relay or controlling the fuel to provide ECU Power Support. This smart technology is derived by doing the following:
>
> After the Pulse Cycle Timer expires, the DGC-1000 checks to see if ECU communications are present. If so, then the DGC-1000 will not pulse the ECU. The same goes for Connecting, except the DGC-1000 remembers if it skipped the Connecting state. If it did, then it will also skip the Engine Shutting Down state when the DGC-1000 turns off the engine.

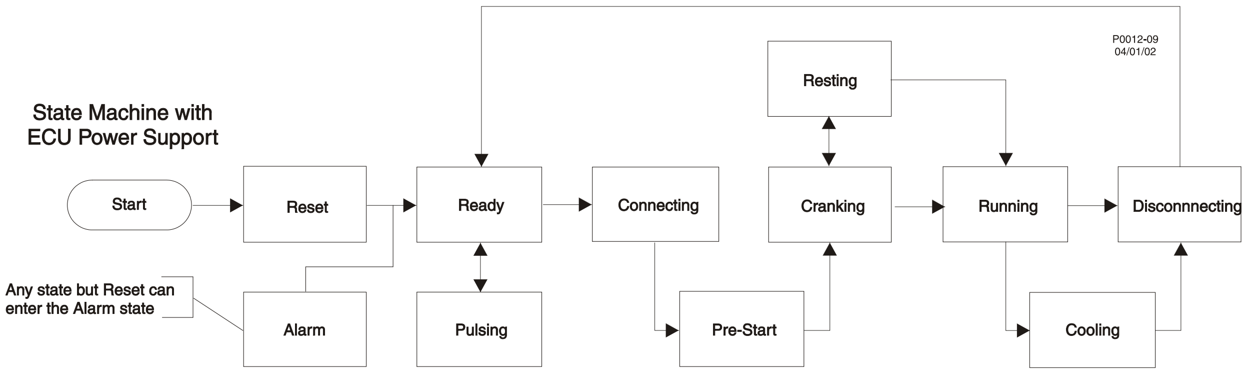

Figure 3-17. ECU Power Support Program Control

Output Relay Status

Tables 3-5 and 3-6 represent the output relay status for each of the 11 states that make up the State Transition Function. The fuel solenoid relay varies between these two types of matrixes and is bolded to emphasize this. The letter O represents an open relay state and the letter C represents a closed relay state.

Table 3-5. Normal Output Relay Matrix

	Current State										
Relay	**Reset**	**Ready**	**xxx**	**xxxx**	**Pre-Start**	**Crank**	**Rest**	**Run**	**Cool**	**xxx**	**Alarm**
Alarm	O	O			O	O	O	O	O		C
PreStart	O	O			C	C	C	∗	∗		O
Starter	O	O			O	C	O	O	O		O
Fuel	O	O			O	C	O	C	C		O

Table 3-6. Output Relay Matrix With ECU Support

	Current State										
Relay	**Reset**	**Ready**	**Pulse**	**Connect**	**Pre-Start**	**Crank**	**Rest**	**Run**	**Cool**	**Shut-down**	**Alarm**
Alarm	O	O	O	O	O	O	O	O	O	O	C
PreStart‡	O	O	O	O	C	C	C	∗	∗	O	O
Starter	O	O	O	O	O	C	O	O	O	O	O
Fuel	†	O	C	C	C	C	C	C	C	O	O

Notes for Tables 3-5 and 3-6:

∗ If the "Pre-Start Contact After Disconnect" is enabled from BESTCOMS, then the Pre-Start contact will always be closed during Running and Cooling. Otherwise, it will be open.

† If ECU Support is enabled and the previous SysConfig was Run or Auto-Run with the ATS closed, then close the fuel solenoid, otherwise leave it open.

‡ States shown for the PreStart relay correspond to normal prestart functionality—not to ECU Control functionality.

FIRMWARE UPGRADES

Future enhancements to DGC-1000 functionality may make a firmware upgrade desirable. Since DGC-1000 stores its firmware in flash memory, upgrading firmware with BESTCOMS is a straightforward procedure and requires no disassembly of hardware. Refer to Section 6, *BESTCOMS Software* for detailed instructions on upgrading DGC-1000 firmware.

WARNING!

The DGC-1000 should be removed from service for the purpose of upgrading firmware as it will not be able to control or monitor the genset once the firmware upgrade procedure has been started.

SECTION 4 • INSTALLATION

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SECTION 4 • INSTALLATION

INTRODUCTION

DGC-1000 Digital Genset Controllers are delivered in sturdy cartons to prevent shipping damage. Upon receipt of a unit, check the part number against the requisition and packing list for agreement. Inspect for damage, and if there is evidence of such, immediately file a claim with the carrier and notify the Basler Electric regional sales office, your sales representative, or a sales representative at Basler Electric, Highland Illinois.

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

HARDWARE

DGC-1000 controllers are packaged for mounting in any top-mount enclosure. The front panel is resistant to moisture, salt fog, humidity, dust, dirt, and chemical contaminants. It also inhibits insect and rodent entrance.

A DGC-1000 controller is secured to a panel by the four permanently-attached 10-32 by ⅝ inch (½ inch usable) studs and four nylon lined nuts (supplied). Hardware mounting torque is 30 in-lb (3.4 N•m).

MOUNTING

Case cutout dimensions are shown in Figure 4-1. Overall dimensions are shown in Figures 4-2.

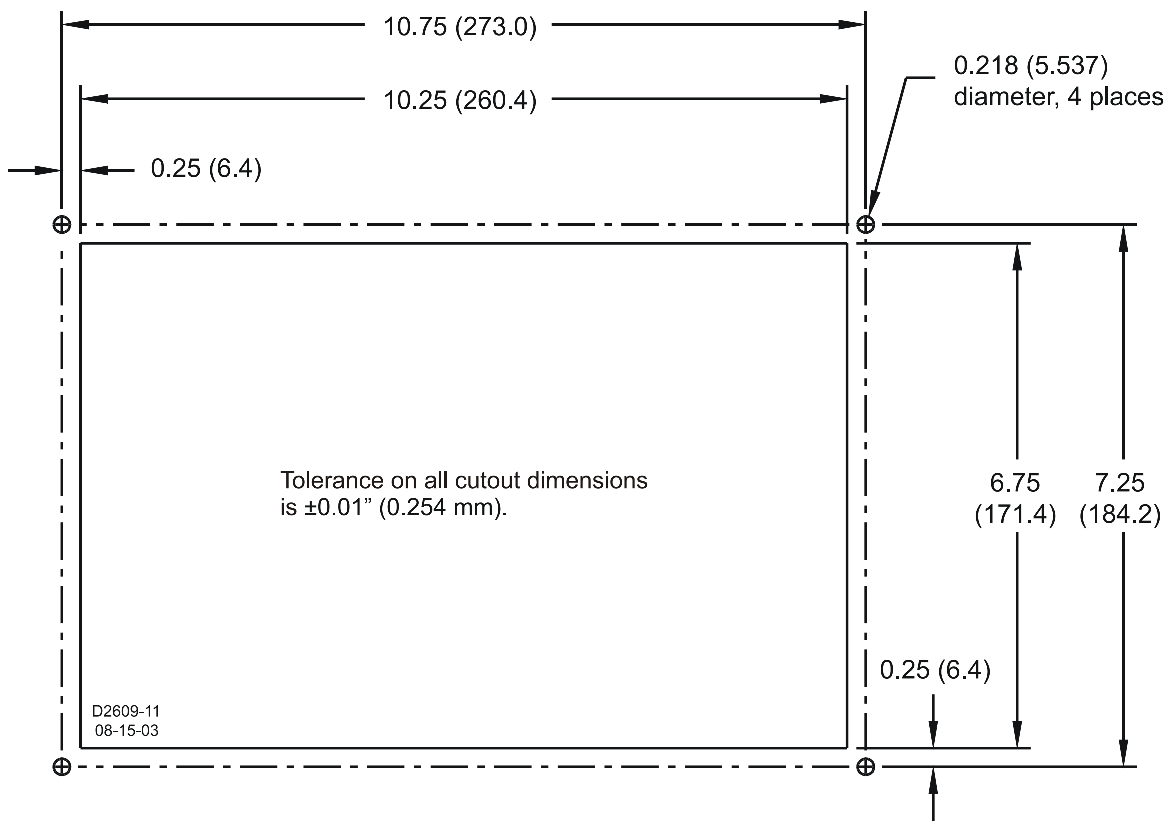

Figure 4-1. Cutout Dimensions in Inches (Millimeters)

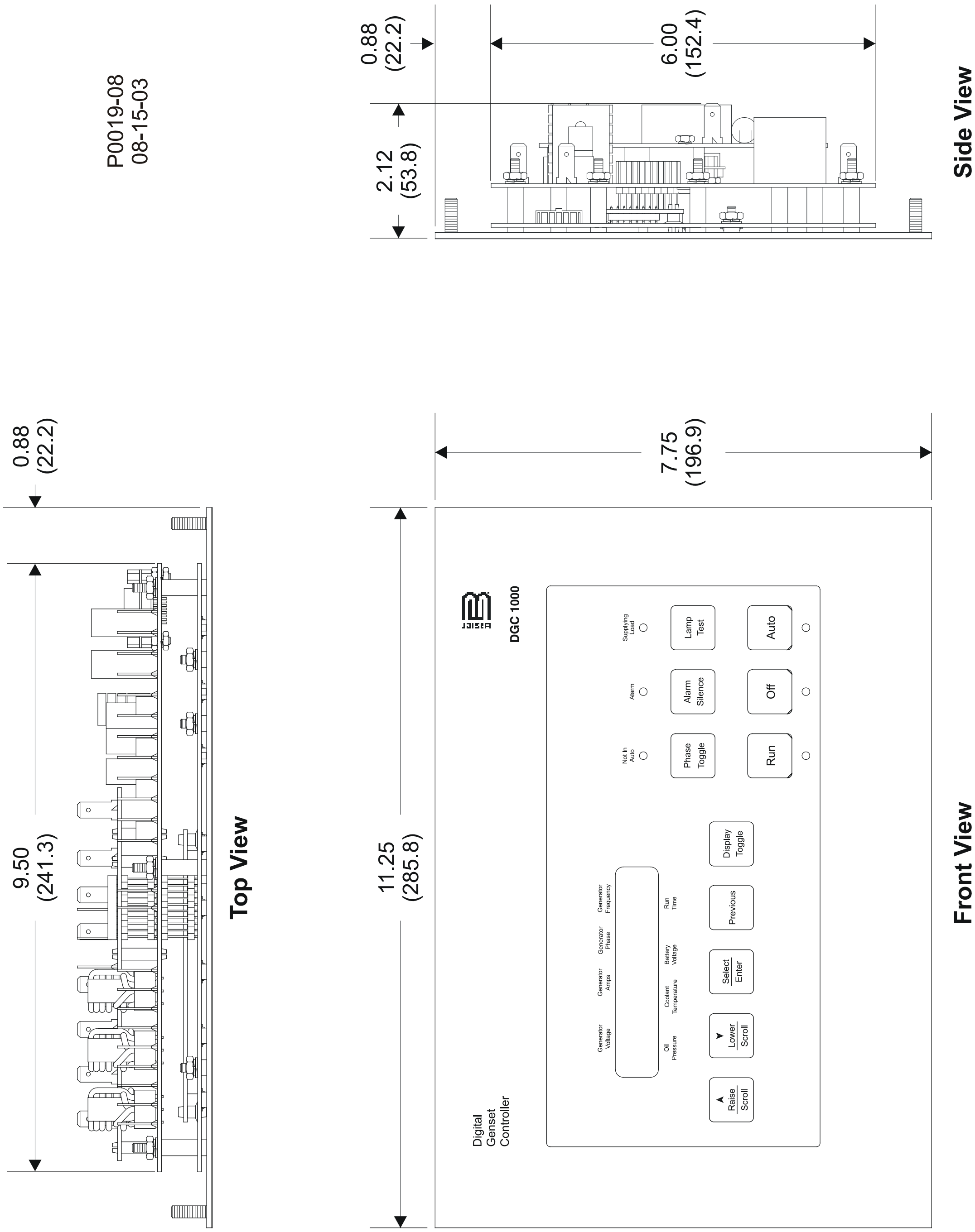

Figure 4-2. DGC-1000 Dimensions

DGC Isolator Kit

The optional DGC Isolator Kit provides an economical way to reduce the level of shock and vibration transmitted from a generator to the DGC-1000. The DGC Isolator Kit eliminates the need to mount an isolator box on top of the generator conduit box and simplifies wiring considerations. Isolator kits are available with either black- or gray-colored gaskets. Kit part number 9 3554 06 100 is supplied with a black gasket and kit part number 9 3554 06 101 is supplied with a gray gasket.

The DGC Isolator Kit provides vibration dampening at frequencies greater than 48 hertz. Above 90 hertz, vibration transmissibility is less than 10 percent of the input magnitude.

CONNECTIONS

NOTE

Ensure that the DGC-1000 control power wiring is correct. Reverse polarity will not damage the controller, but it will prevent the DGC-1000 from operating.

Be sure that the DGC-1000 is hard-wired to earth ground with no smaller than 12 AWG copper wire attached to the ground terminal on the rear panel of the controller.

Except as noted above, connections should be made with wire no smaller than 14 AWG.

Be sure to supply the controller with the correct level of operating power.

DGC-1000 Terminations

DGC-1000 terminals, excluding the serial communication port and CAN interface, consist of quarter-inch blade, quick-connect terminals. These terminals accept female, quarter-inch connectors. All DGC-1000 terminals are located on the rear panel of the controller. The connectors used on the DGC-1000 make it easy to remove the controller for out-of-circuit testing or maintenance.

DGC-1000 terminals are illustrated and described in Section 2, *Human-Machine Interface.*

Communication Port

The RS-232 port on the rear panel uses a DB9 female connector. Figure 4-3 illustrates the pin assignments of the communication port and Table 4-1 identifies the RS-232 connector pin functions. A standard communication cable terminated with a DB9 male connector is used for PC interface with the DGC-1000 as shown in Figure 4-4.

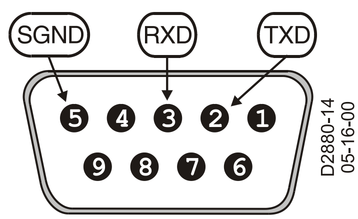

Figure 4-3. DGC-100 Communication Port Pin Assignments

Table 4-1. DGC-1000 Communication Port Pin Assignments

Pin	Function	Name	Direction
1	N/C	—	N/A
2	Transmit Data	TXD	From DGC-1000
3	Receive Data	RXD	To DGC-1000
4	N/C	—	N/A
5	Signal Ground	GND	N/A
6	N/C	—	N/A
7	N/C	—	N/A
8	N/C	—	N/A
9	N/C	—	N/A

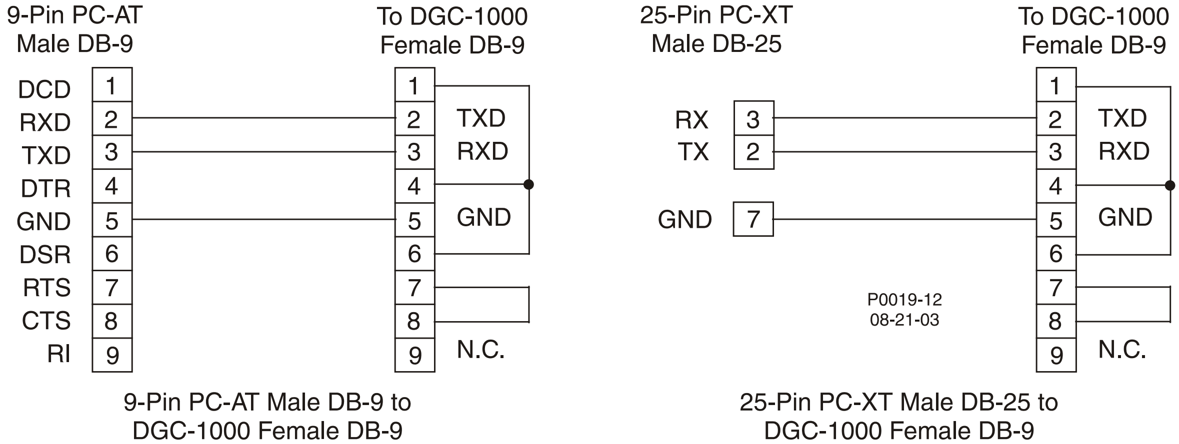

Figure 4-4. Personal Computer to DGC-1000 Connections

CAN Connections

The CAN connector mates with the cable assembly (Basler P/N 9358900002) provided with the DGC-1000. The cable assembly is illustrated in Figure 4-5 and the termination assignments are listed in Table 4-2.

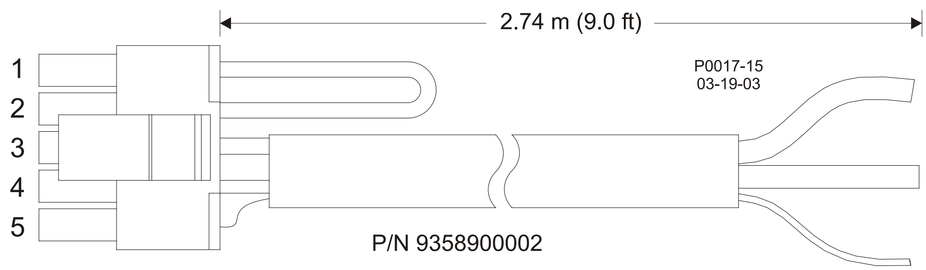

Figure 4-5. CAN Cable Assembly

Table 4-2. CAN Cable Assembly Termination Assignments

Termination	Function	User Termination
Pin 1	Termination Resistor	∗
Pin 2		
Pin 3	CAN High	Red Wire
Pin 4	CAN Low	Black Wire
Pin 5	Drain	Uninsulated Wire †

∗ If the DGC-1000 is not providing one end of the J1939 backbone, cut the jumper connected across pins 1 and 2 to disconnect the internal terminating resistor.

† The J1939 drain (shield) should be grounded at one point only. If grounded elsewhere, cut the drain connection to the DGC-1000.

Note: If the DGC-1000 is not part of the J1939 backbone, the stub connecting the DGC-1000 to the backbone should not exceed 914 millimeters (3 feet) in length.

DGC-1000 Connections for Typical Applications

Figures 4-6 through 4-9 illustrate typical applications using the DGC-1000. A typical DGC-1000 ladder diagram is shown in Figure 4-6. Figure 4-7 shows typical ac connections for a direct-connected, single-phase, three-wire sensing system. Figure 4-8 shows typical ac connections for a direct-connected, three-phase, line-to-line sensing system. Figure 4-9 shows typical ac connections for a direct-connected, three-phase, line-to-neutral sensing system.

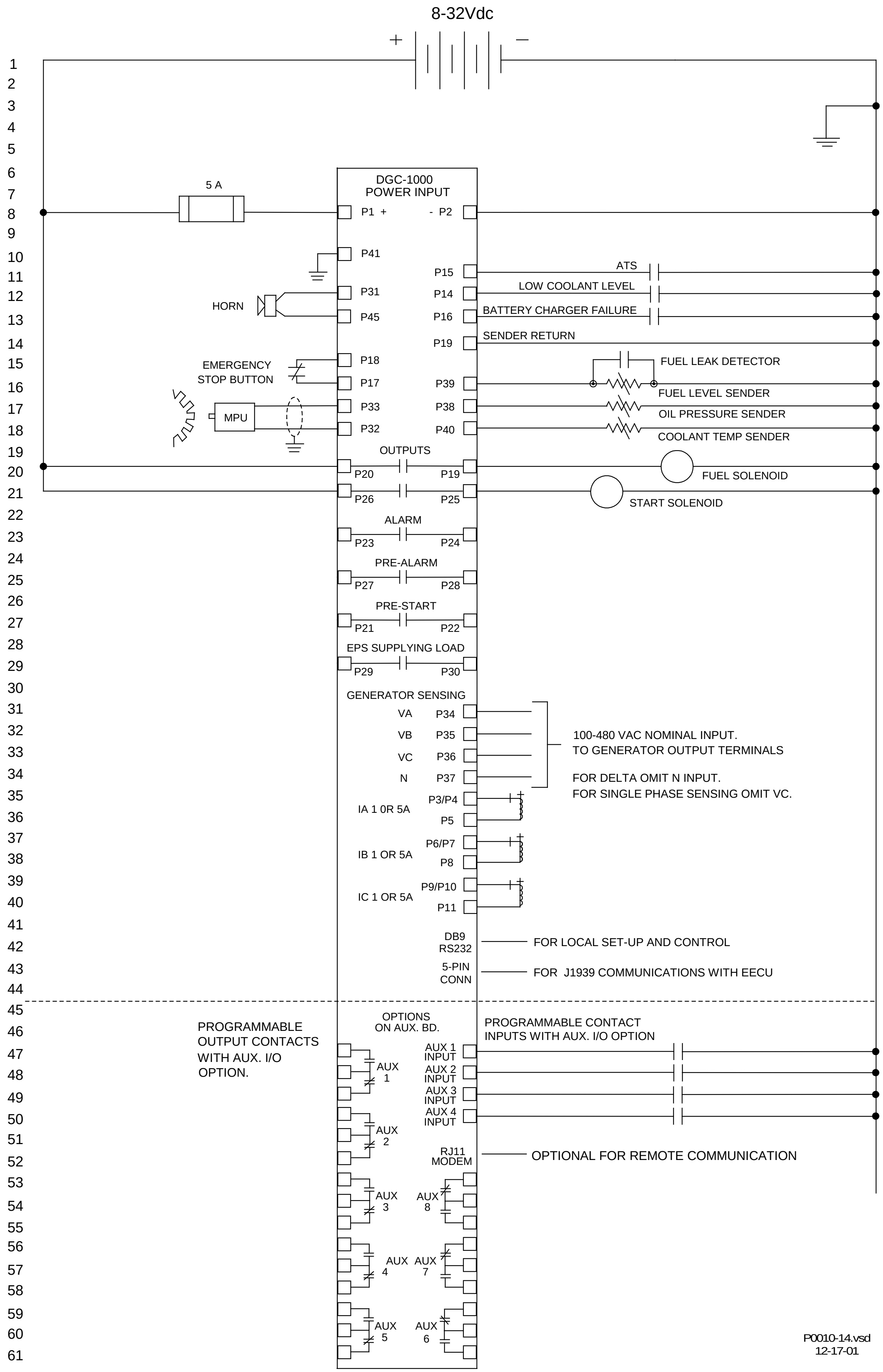

Figure 4-6. DGC-1000 System Ladder Diagram

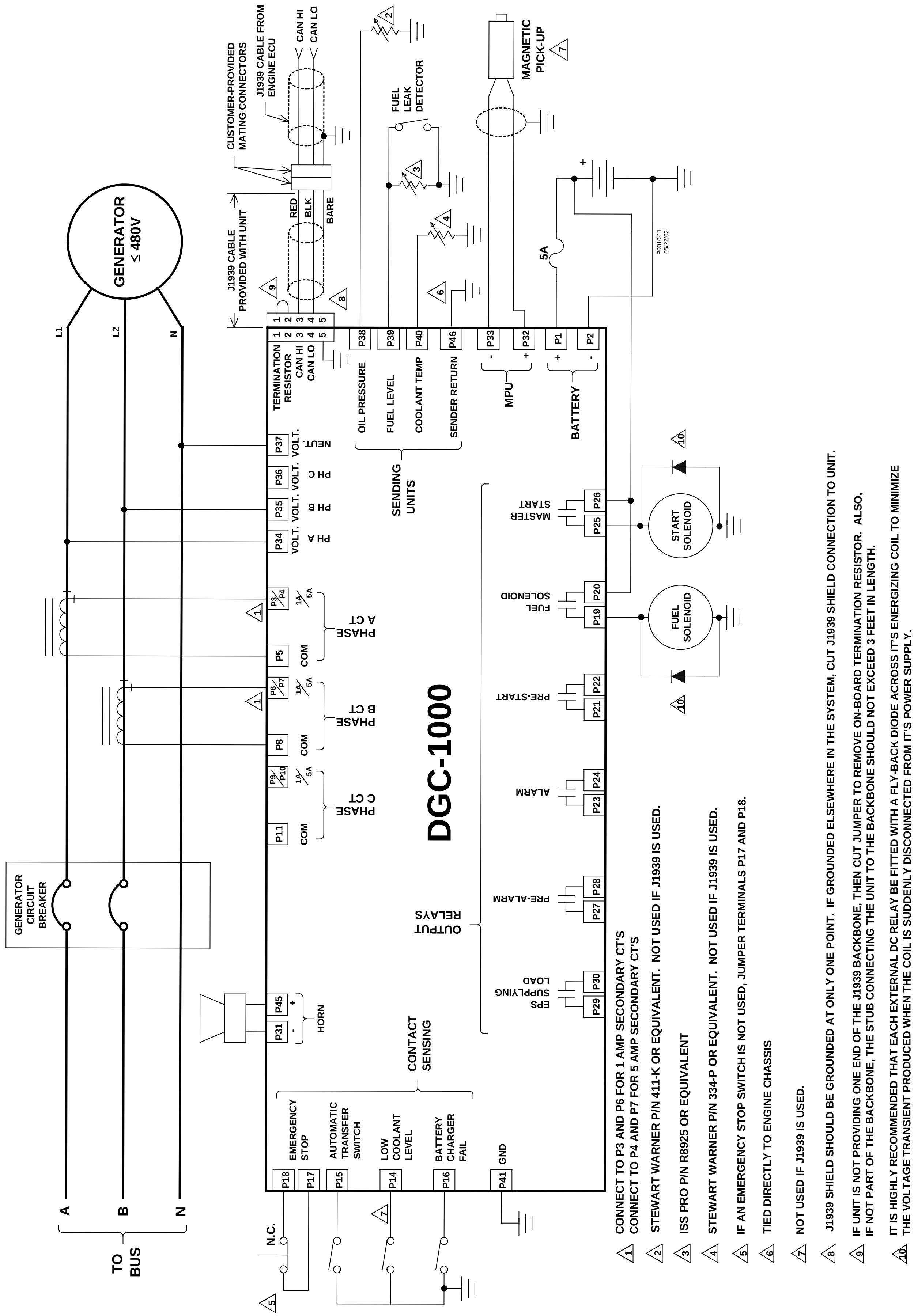

Figure 4-7. Direct-Connected, Single-Phase, Three-Wire Sensing

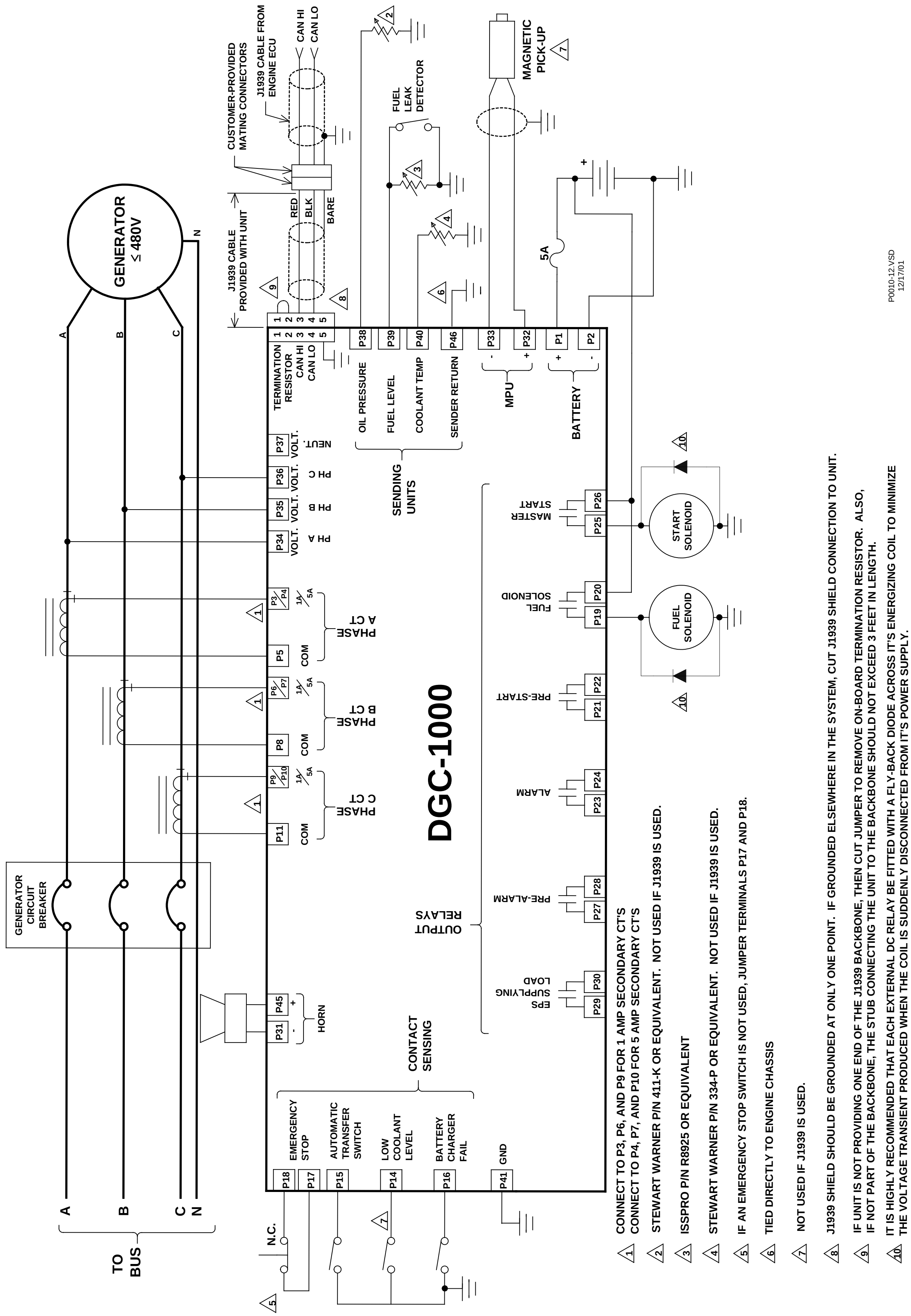

Figure 4-8. Direct-Connected, Three-Phase, Line-to-Line Sensing

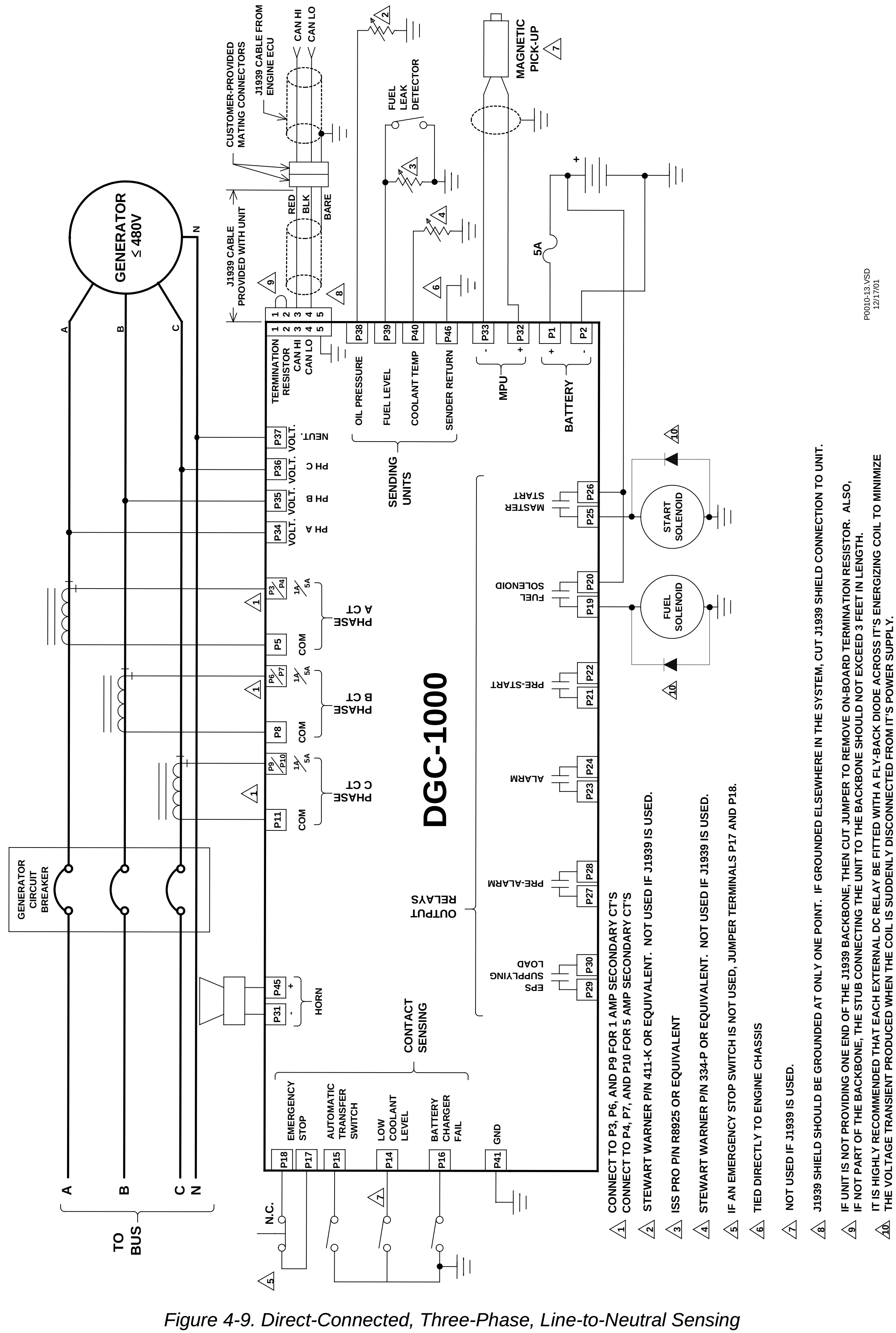

Figure 4-9. Direct-Connected, Three-Phase, Line-to-Neutral Sensing

Volvo Penta EDC III Applications

Volvo engines equipped with Volvo Penta EDC III controllers, like the TAD124xGE series, can receive engine control commands (such as start and stop) from the DGC-1000 through the SAE J1939 communication interface. To invoke this feature, the EDC must receive a J1939 message containing engine control information within one second of waking (exiting sleep mode). If the EDC III does not receive an engine control message within the prescribed time, it will enter the stand-alone mode and ignore any J1939 control messages. If this occurs, the EDC III must be forced back into sleep mode by pressing the auxiliary stop button on the engine or by momentarily disconnecting EDC power.

The interconnection diagrams of Figures 4-10, 4-11, and 4-12 illustrate the DGC-1000 and EDC connections that allow the DGC-1000 to awaken the EDC and start the engine, or simply acquire engine status information. Wakeup of the EDC is initiated by using the DGC-1000 fuel solenoid output contacts to apply battery power to the EDC. To stop the engine, the DGC-1000 issues a sleep command through the J1939 interface to the EDC and opens the fuel solenoid output contacts. This causes the EDC to stop the engine and enter the sleep mode.

In order for the DGC-1000 to communicate with the EDC, two DGC-1000 settings must be changed from their default values.

- The J1939 address of the DGC-1000 must be set at 17.
- The engine start/stop configuration setting must be set for “Volvo Penta EDC III”.

In order for the Volvo engine to operate at rated rpm, verify the following DGC-1000 settings.

- Speed Select setting should be set at “Primary”.
- Accelerator Position setting should be set at 50%.

The above settings are configured on the BESTCOMS System Settings screen. Section 6, *BESTCOMS Software* has information about adjusting DGC-1000 settings through BESTCOMS.

MTU MDEC ECU Applications

MTU MDEC ECUs, supplied on some Detroit Diesel engines, can receive engine control commands from the DGC-1000 and transmit engine operating status information to the DGC-1000 through the SAE J1939 communication interface.

In order for the DGC-1000 to communicate with the MDEC ECU, ECU support must be enabled on the BESTCOMS System Settings screen and “MTU MDEC” must be selected as the engine configuration. The appropriate ECU module type, speed demand source, and engine rpm must also be selected.

The MTU MDEC ECU must be configured properly in order for CAN communication to function correctly. The parameters listed in Table 4-3 must be configured in the ECU with the MDEC service tool. Contact Detroit Diesel if ECU reconfiguration is required and your facility is not equipped to perform this task.

Table 4-3. MTU MDEC ECU Configuration Parameters

MDEC Parameter Number	Parameter Name	Description and Value
200	CAN Interface Config Param	Set to 898 – Indicates one CAN bus with PIMS
201.01	CAN Monitor Nodes 1–16	Binary value indicating which communication devices are on the CAN network. If a binary representation of this parameter’s value does not have the bit set corresponding to a value of 00100000, take the value in this register, add 32 to it, and rewrite it to the register to set the bit. This informs the MTU MDEC ECU that a third part controller resides on the CAN bus.
156.19	CAN Speed Demand Switch Active	Set to 1 – This is necessary only if it is desired to set the engine speed demand source and speed demand from the DGC-1000. This capability may be blocked by setting the parameter to 0.

The interconnection diagrams of Figure 4-13, 4-14, and 4-15 illustrate DGC-1000 and MDEC ECU connections for three types of generator sensing configurations.

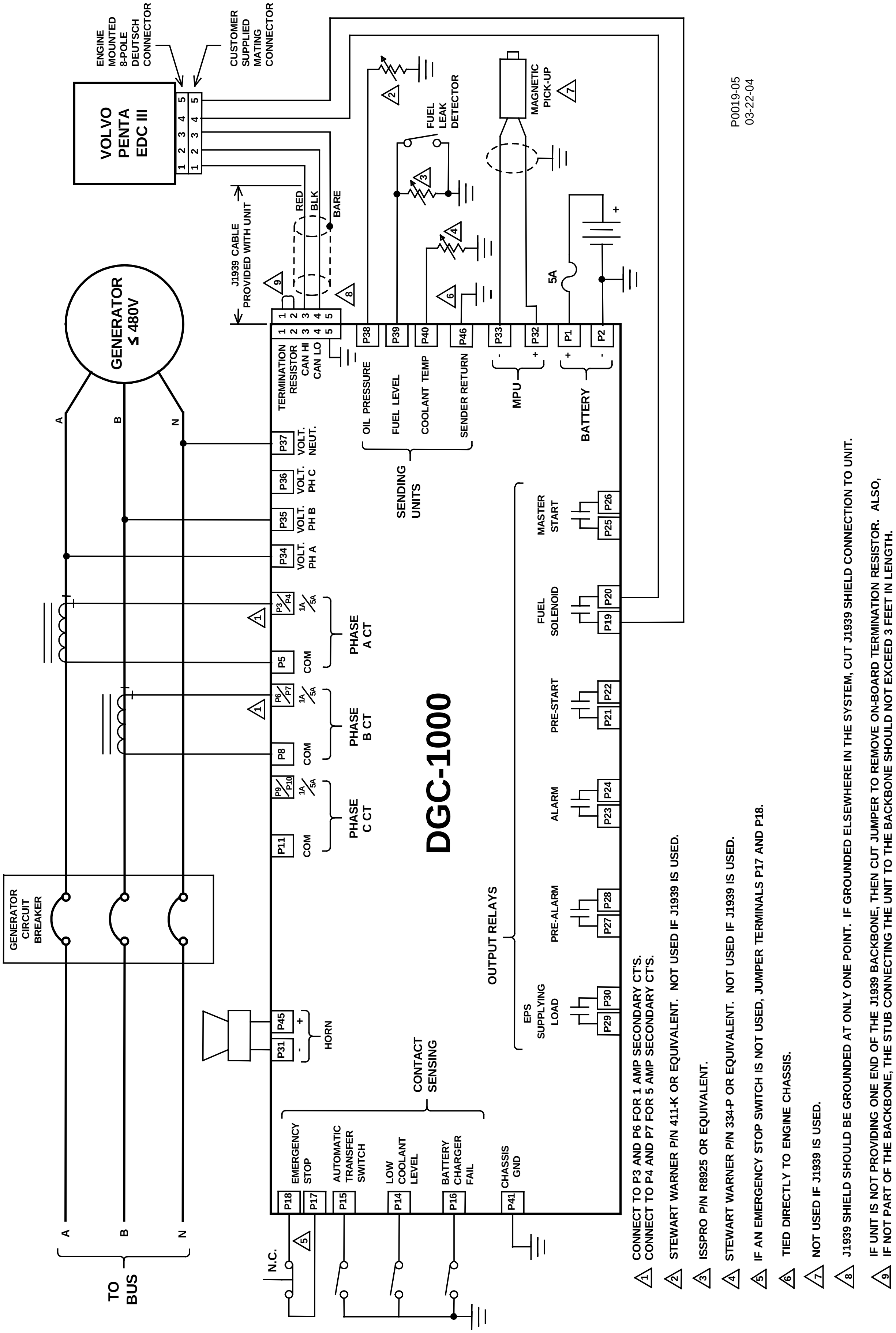

Figure 4-10. Direct-Connected, Single-Phase, Three-Wire Sensing, Volvo Penta EDC III

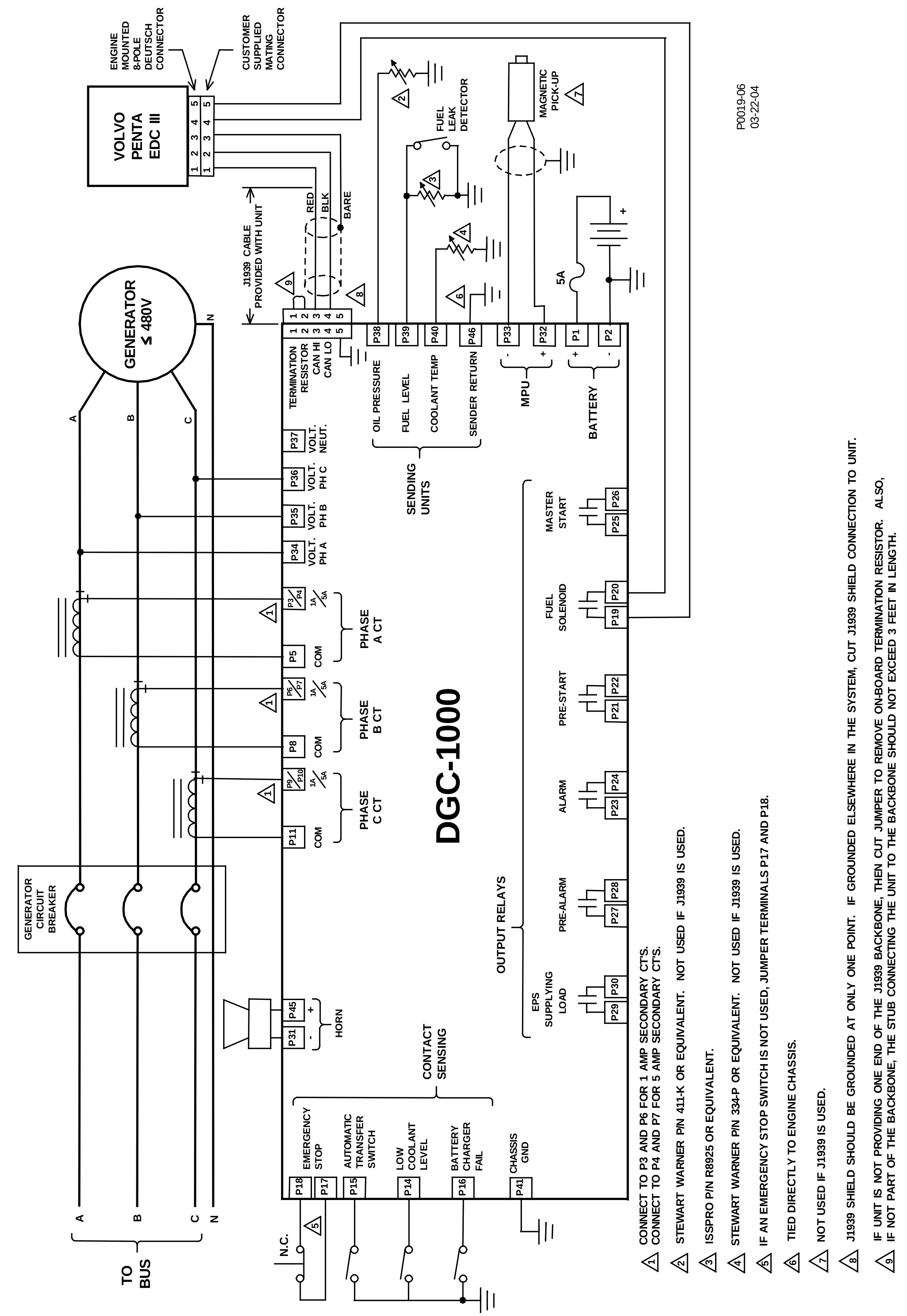

Figure 4-11. Direct-Connected, Three-Phase, Line-to-Line Sensing, Volvo Penta EDC III

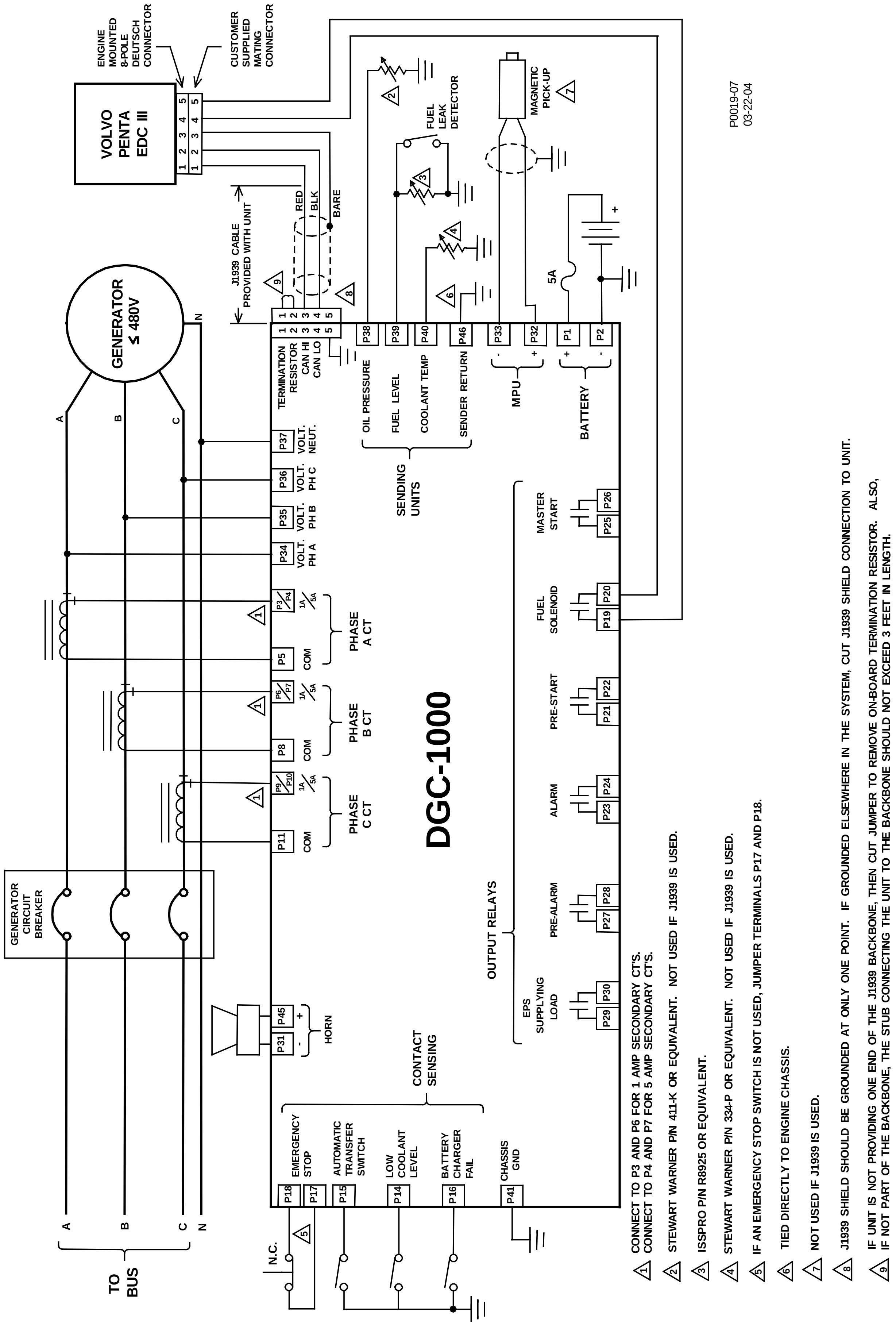

Figure 4-12. Direct-Connected, Three-Phase, Line-to-Neutral Sensing, Volvo Penta EDC III

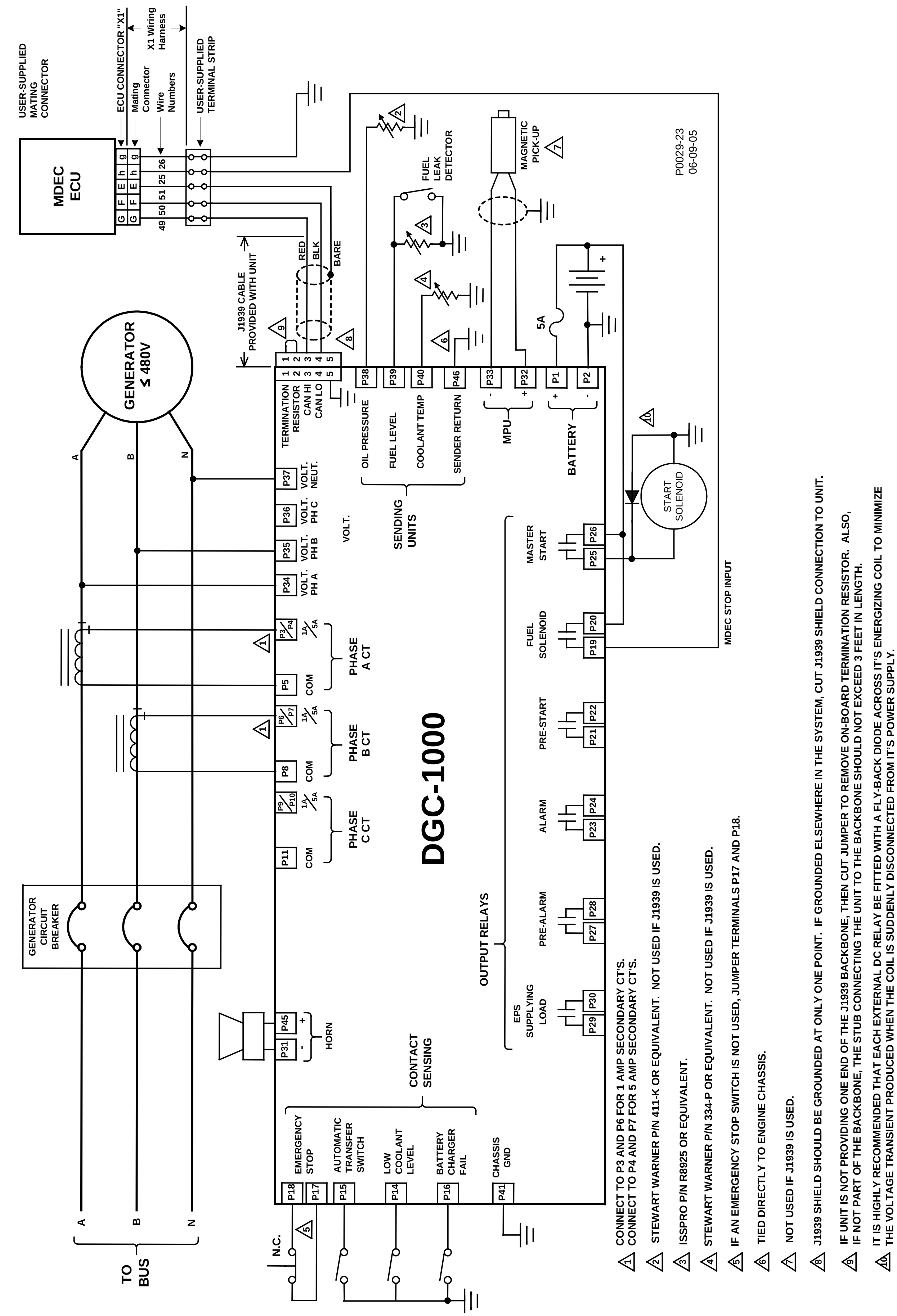

Figure 4-13. Direct-Connected, Single-Phase, Three-Wire Sensing, MTU MDEC ECU

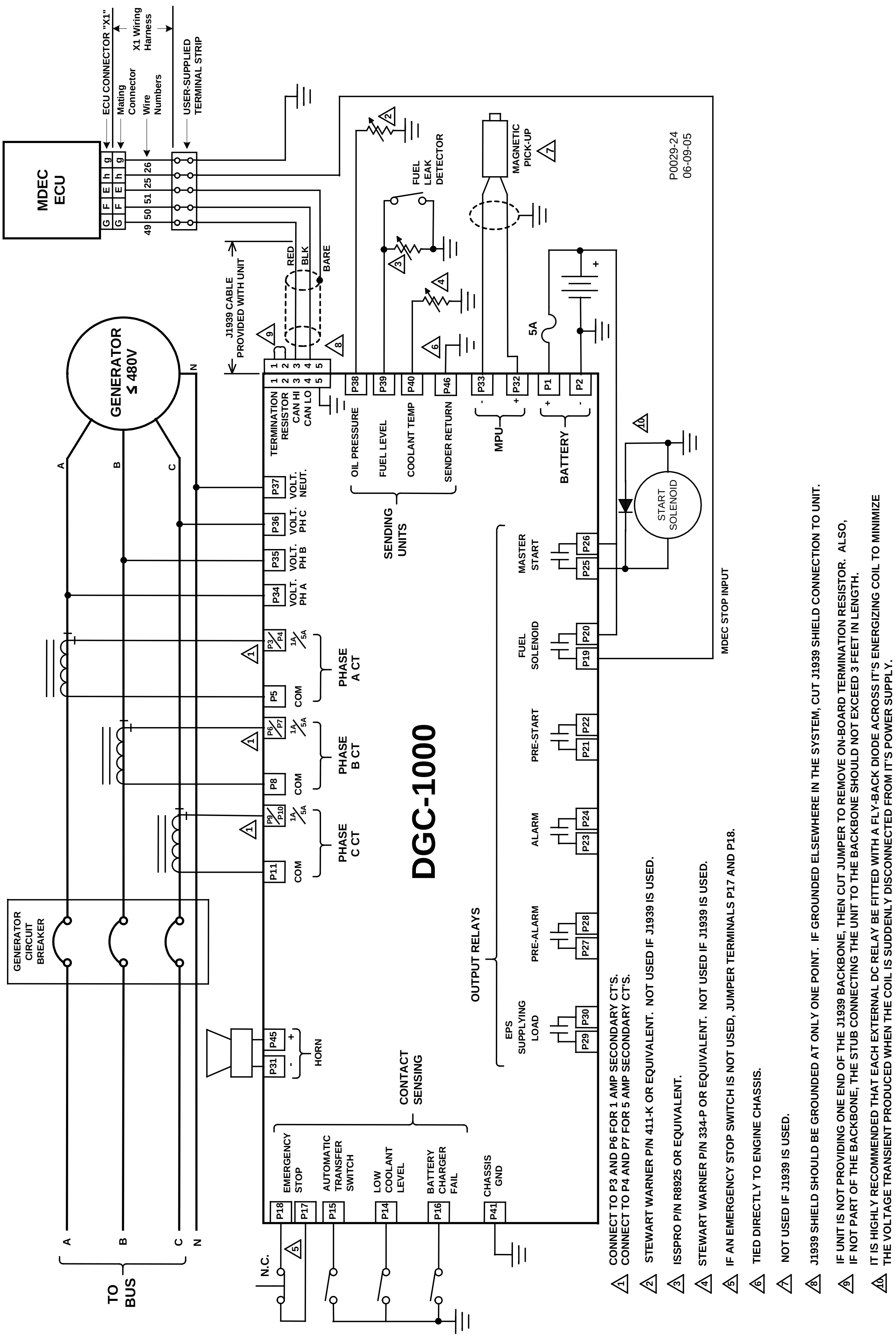

Figure 4-14. Direct-Connected, Three-Phase, Line-to-Line Sensing, MTU MDEC ECU

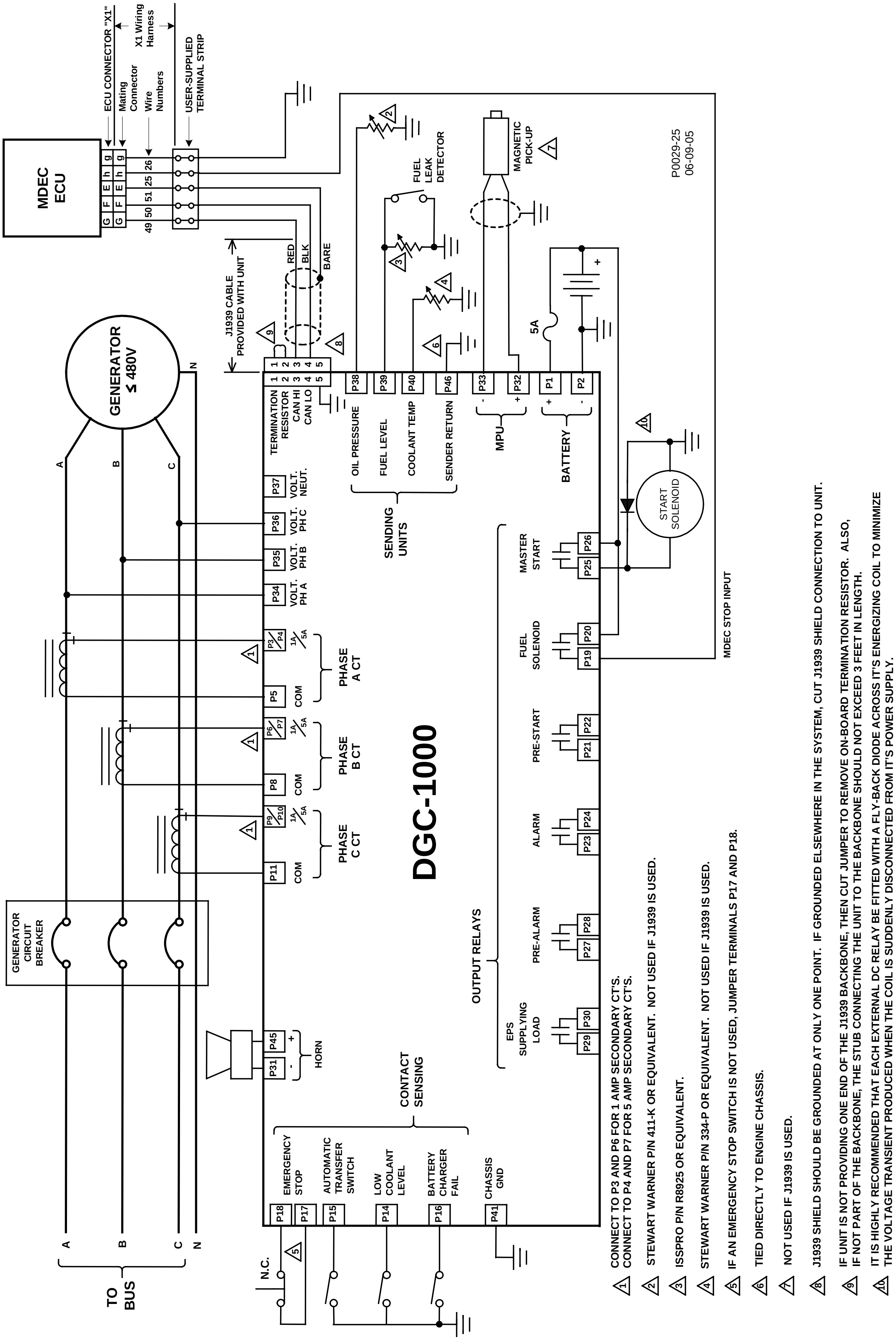

Figure 4-15. Direct-Connected, Three-Phase, Line-to-Neutral Sensing, MTU MDEC ECU

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SECTION 5 • TESTING

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SECTION 5 • TESTING

INTRODUCTION

The procedures of this section test DGC-1000 operation using the preset, factory-default settings.

EQUIPMENT REQUIRED

- Power supply, 12 or 24 Vdc
- Fuse, 2 A
- Voltage source, 60 Hz, 0 to 120 Vac
- Current source, 60 Hz, 0 to 5 Aac
- Signal generator, sine-wave, 0 to 5 kHz, 0 to 5V
- Digital voltmeter, 4½ digits (Fluke 8050A or equivalent)
- Continuity tester
- SPST switch (4)
- Variable resistor, 250 ohms (2)
- Variable resistor, 2,500 ohms

INITIAL TEST PROCEDURE

Unless otherwise specified, the test procedures in this manual use the default parameter settings provided in Table 5-1.

Table 5-1. Default Parameter Settings

Parameter	Setting
Comm Baud Rate	9600 baud
Remote Delay Time	1 millisecond/10
Comm Parity	None
Device Address	125
Settings Source	User
Generator Connection	3-ph L-N
NFPA Level	0
ECU Support	Disabled
Engine Configuration	Standard J1939
Unit System	English
Battery Volts	24 volts
Generator Frequency	60 Hz
Rated Engine RPM	1800 rpm
Number Flywheel Teeth	126
Genset kW Rating	300 kilowatt
No Load Cool Down Time	0 minutes
Generator PT Primary Voltage	480 Vac
Generator PT Secondary Voltage	480 Vac
Generator CT Primary Current	500 Aac
Low Fuel Alarm Enable	ON
Low Fuel Alarm Threshold	2% full tank
Low Fuel Pre-alarm Enable	OFF
Low Fuel Pre-alarm Threshold	25% full tank

Parameter	Setting
Low Coolant Temperature Pre-alarm Enable	OFF
Low Coolant Temperature Pre-alarm Threshold	50 degrees F
Battery Overvoltage Pre-alarm Enable	OFF
Battery Overvoltage Pre-alarm Threshold	30.0 Vdc
Maintenance Interval Pre-alarm Enable	OFF
Maintenance Interval Pre-alarm Threshold	500 hours
Engine kW Overload Pre-alarm Enable	OFF
Engine kW Overload Pre-alarm Threshold	105 % of rated
High Coolant Temperature Pre-alarm Enable	ON
High Coolant Temperature Pre-alarm Threshold	250 degrees F
Low Oil Pressure Pre-alarm Enable	ON
Low Oil Pressure Pre-alarm Threshold	25 psi
Low Battery Voltage Pre-alarm Enable	OFF
Low Battery Voltage Pre-alarm Threshold	20.0 Vdc
Low Battery Voltage Pre-alarm Activation Time Delay	10 seconds
Weak Battery Pre-alarm Enable	OFF
Weak Battery Pre-alarm Threshold	15.0 Vdc
Weak Battery Pre-alarm Activation Time Delay	2 seconds
High Coolant Temperature Alarm Enable	ON
High Coolant Temperature Alarm Threshold	275 degrees F
High Coolant Temperature Alarm Arming Delay After Crank Disconnect	60 seconds
Low Oil Pressure Alarm Enable	ON
Low Oil Pressure Alarm Threshold	15 psi
Low Oil Pressure Alarm Arming Delay After Crank Disconnect	10 seconds
Overspeed Alarm Enable	ON
Overspeed Alarm Threshold	110% of rated
Overspeed Alarm Activation Time Delay	50 millisecond
Coolant Temperature Sender Failure Alarm Enable	OFF
Oil Pressure Sender Failure Alarm Enable	OFF
Speed Failure Alarm Enable	OFF
Loss of Generator Voltage Alarm Enable	OFF
Pre-alarm Buzzer Enable	ON
Battery Charger Failure Pre-alarm Enable	OFF
Global Sender Failure Alarm Time Delay	10 seconds
Coolant Temp. Sender Failure Alarm Activation Time Delay	5 minutes
Cranking Style	Cycle
Number of Crank Cycles	2
Cycle Crank Time	5 seconds
Continuous Crank Time	10 seconds
Crank Disconnect Limit	30 % of rated
Pre-Crank Delay	0 seconds
Pre-crank Contact After Crank Disconnect	Open
Generator Speed Mode	MPU/GEN
Generator Rotation	A-B-C

Step 1. Connect the DGC-1000 test setup as shown in Figure 5-1.

Step 2. Apply operating voltage to battery voltage terminals.

Result: The LCD displays DGC 1000 and the software version for approximately one second before switching to the normal display mode and at the same time, the Alarm sounds. The audible alarm will sound continuously when Not In Auto or in Alarm. The audible alarm may be silenced by pressing the Alarm Silence switch on the front panel.

Step 3 Press the Off switch to place the DGC-1000 in the OFF position.

Step 4. Verify that LEDs Not In Auto and Off are ON, the Alarm LED is flashing, and the LCD backlight is ON with system parameters displayed.

Step 5. Press the Lamp Test switch and verify that all six LEDs are ON (Not In Auto, Alarm, and Off are red; Supplying Load, Run, and Auto are green). All LCD pixels should be visible.

Step 6. Verify Run, Off, and Auto switches, along with their respective LEDs, toggle as each switch is operated. Not In Auto LED should be OFF when Auto is selected.

Step 7. Verify that switches Raise/Scroll, Lower/Scroll, Select/Enter, Previous, and Display/Toggle are functional by scrolling through the unit menus.

METERING TEST PROCEDURES

Metering Battery And Generator Voltages

NOTE

Displayed voltage is equal to the generator potential transformer primary voltage setting times the applied voltage divided by the generator potential transformer secondary voltage setting.

Step 1. Verify that the battery input (terminals P1 and P2) voltage is 24.0 Vdc.

Step 2. Verify that the DGC-1000 displayed value is 24.0 ±0.5 Vdc.

Step 3. Apply 120.0 Vac, 60.0 hertz to phase A (line-to-neutral) generator voltage input (terminals P34 and P37).

Step 4. Verify that the DGC-1000 generator frequency displayed value is 60.0 ±0.2 hertz.

Step 5. Verify that the DGC-1000 phase A to neutral voltage displayed value is 120.0 ±2.0 Vac.

Step 6. Remove the voltage.

Step 7. Apply 120.0 Vac, 60.0 hertz to phases A and B generator voltage input (terminals P34 and P35).

Step 8. Verify that the DGC-1000 generator A to B voltage displayed value is 120.0 ±2.0 Vac.

Step 9. Remove the voltage.

Step 10. Apply 120.0 Vac, 60.0 hertz (line-to-neutral) to phase B generator voltage input (terminals P35 and P37).

Step 11. Verify that the DGC-1000 line-to-neutral voltage displayed value is 120.0 ±2.0 Vac.

Step 12. Remove the voltage.

Step 13. Apply 120.0 Vac, 60.0 hertz to phases B and C generator voltage input (terminals P35 and P36).

Step 14. Verify that the DGC-1000 generator B to C voltage displayed value is 120.0 ±2.0 Vac.

Step 15. Remove the voltage.

Step 16. Apply 120.0 Vac, 60.0 hertz (line-to-neutral) to phase C generator voltage input (terminals P36 and P37).

Step 17. Verify that the DGC-1000 line-to-neutral voltage displayed value is 120.0 ±2.0 Vac.

Step 18. Remove the voltage.

Step 19. Apply 120.0 Vac, 60.0 hertz to phases C and A generator voltage input (terminals P36 and P34).

Step 20. Verify that the DGC-1000 generator C to A voltage displayed value is 120.0 ±2.0 Vac.

Step 21. Remove the voltage.

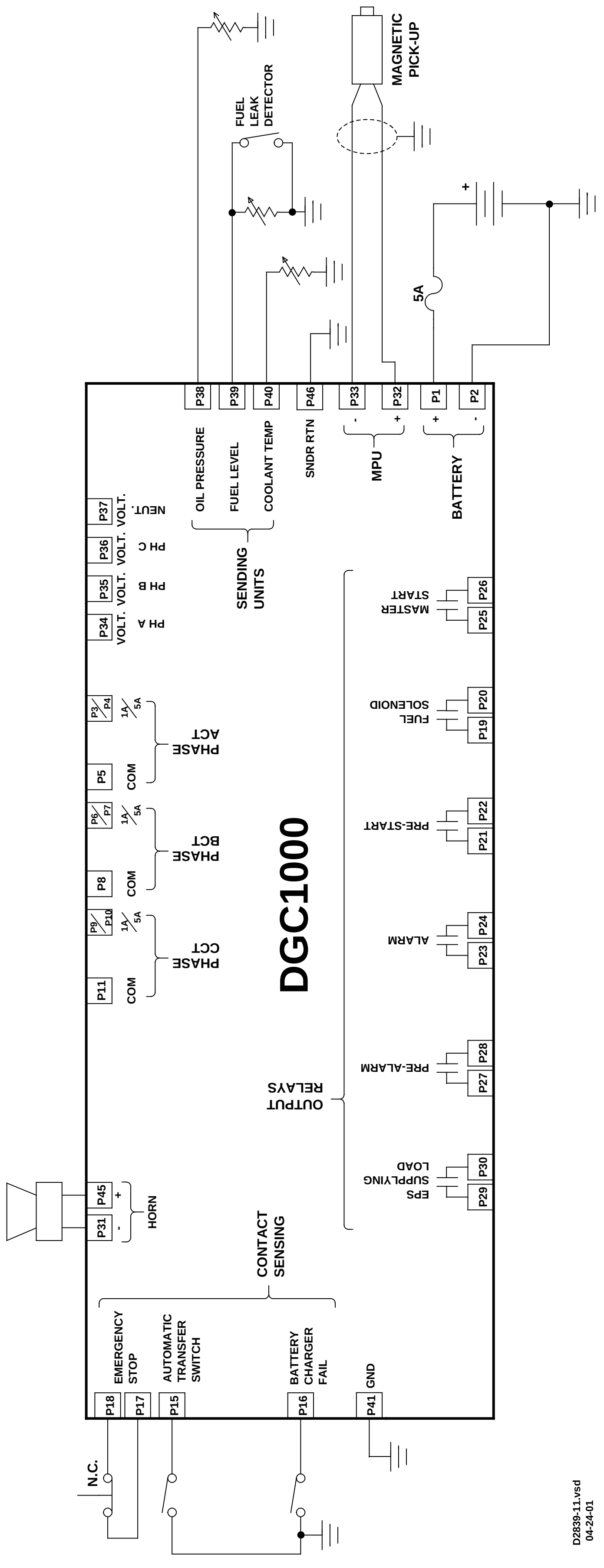

Figure 5-1. Test Set Diagram

Metering Generator Current

> **NOTE**
>
> Displayed current is equal to the generator current transformer primary current setting times the applied current divided by one or five (the nominal current value).

Step 1. Apply 1.000 Aac to the DGC-1000 generator five ampere phase A CT input (terminals P4 and P5).

Step 2. Verify that the DGC-1000 phase A current displayed value is 100.0 ±2.0 amperes.

Step 3. Remove the current.

Step 4. Apply 1.000 Aac to the DGC-1000 generator five ampere phase B CT input (terminals P7 and P8).

Step 5. Verify that the DGC-1000 phase B current displayed value is 100.0 ±2.0 amperes.

Step 6. Remove the current.

Step 7. Apply 1.000 Aac to the DGC-1000 generator five ampere phase C CT input (terminals P10 and P11).

Step 8. Verify that the DGC-1000 phase C current displayed value is 100.0 ±2.0 amperes.

Step 9. Remove the current.

Oil Pressure

Step 1. Apply 60 ohms across the Oil Pressure transducer input (terminals P38 and P2).

Step 2. Verify that the DGC-1000 displayed value is 80 ±2.0 psi.

Coolant Temperature

Step 1. Apply 100 ohms across the Coolant Temperature transducer input (terminals P40 and P2).

Step 2. Verify that the DGC-1000 displayed value is 205 ±4.0°F.

Percent Fuel Level

Step 1. Apply 137 ohms across the Fuel Level transducer input (terminals P39 and P2).

Step 2. Verify that the DGC-1000 displayed value is 50 ±2.0%.

Engine Speed (RPM)

> **NOTE**
>
> RPM as derived from the MPU is equal to [MPU output frequency (hertz) times 60] divided by the number of flywheel teeth.
>
> RPM as derived from the generator is equal to [generator output voltage frequency] divided by the rated generator frequency (hertz) times the rated rpm.

Step 1. Apply a 5 Vac, 3,780 hertz sine wave to the DGC-1000 magnetic pickup unit inputs (terminals P32 and P33).

Step 2. Verify that the DGC-1000 displayed value is 1,800 ±36 rpm.

Step 3. Remove the voltage.

Generator Power Factor

> **NOTE**
>
> The DGC-1000 uses phase A voltage and phase B current for Power Factor calculations. Therefore, if this test is performed with the current lagging the voltage by 120 degrees, the displayed Power Factor will be approximately 1.00.

Step 1. Apply 120 Vac to phase A to neutral generator voltage inputs (terminals P34 and P37).

Step 2. Apply 1.0 Aac to phase B current transformer inputs (terminals P7 and P8) in phase with the phase A to neutral voltage.

Step 3. Verify that the DGC-1000 displayed value is -0.50 ±0.02.

Step 4. Remove voltage and current.

Generator kW And kVA

> **NOTE**
>
> The displayed kW is equal to the kVA times the power factor.

Step 1. Apply in parallel 120 Vac to phase A to neutral (terminals P34 and P37), phase B to neutral (terminals P35 and P37), and phase C to neutral (terminals P36 and P37).

Step 2. Apply in series and in phase with the voltage 1 Aac to Phase A current transformer input (terminals P3 and P5), Phase B current transformer input (terminals P6 and P8), and Phase C current transformer input (terminals P9 and P11).

Step 3. Verify that the DGC-1000 displayed value for individual phase kW is –30 ±2 kW.

Step 4. Verify that the DGC-1000 displayed value for total kW is –90 ±2 kW.

Step 5. Verify that the DGC-1000 displayed value for individual phase kVA is 60 ±2 kVA.

Step 6. Verify that the DGC-1000 displayed value for total kVA is within 180 ±5 kVA.

Step 7. Remove voltage and current.

CRANKING TEST PROCEDURES

Crank Cycle

> **NOTE**
>
> The DGC will go into cvercrank if the Off switch is not pressed before two crank cycles expire. Pressing Off will reset this condition if it occurs.

Step 1. Verify that all output contacts are open.

Step 2. Press the Run switch on the front panel.

Step 3. Verify that the DGC-1000 displays CRANKING STATUS.

Step 4. Verify that only the Master Start, Auxiliary Start, Fuel Solenoid and Pre-Start output contacts are closed during CRANKING CYCLE.

Step 5. Verify that only the Pre-Start contact remains closed during RESTING.

Step 6. Press the Off switch on the front panel.

Step 7. Press the Auto switch on the front panel.

Step 8. Apply a contact closure across the Automatic Transfer Switch input (terminals P15 and P2).

Step 9. Verify that the DGC-1000 displays CRANKING STATUS.

Step 10. Verify that only the Master Start, Auxiliary Start, Fuel Solenoid and Pre-Start output contacts are closed during CRANKING CYCLE.

Step 11. Verify that only the Pre-Start contact remains closed during RESTING.

Step 12. Press the Off switch on the front panel.

Step 13. Open the contact across the Automatic Transfer Switch inputs.

Running

Step 1. Press the Run switch on the front panel.

Step 2. Within 5 seconds of beginning cranking, apply in parallel 120 Vac to phase A to neutral (terminals P34 and P37), phase B to neutral (terminals P35 and P37) and phase C to neutral (terminals P36 and P37).

Step 3. Verify that only the fuel solenoid output contact is closed.

Step 4. Verify that the DGC-1000 normal mode display now meters the active generator values listed on the front panel instead of displaying READY.

Step 5. Press the Off switch on the front panel.

Step 6. Remove the voltage.

Step 7. Press the Auto switch on the front panel.

Step 8. Apply a contact closure across the Automatic Transfer Switch input (terminals P15 and P2).

Step 9. Within 5 seconds of beginning cranking, apply in parallel 120 Vac to phase A to neutral (terminals P34 and P37), phase B to neutral (terminals P35 and P37), and phase C to neutral (terminals P36 and P37).

Step 10. Verify that only the Fuel Solenoid output contact is closed.

Step 11. Verify that the DGC-1000 normal mode display now meters the active generator values listed on the front panel instead of displaying READY.

Step 12. Press the Off switch on the front panel.

Step 13. Remove the voltage.

Step 14. Open the contact across the Automatic Transfer Switch inputs.

PROTECTIVE FUNCTION TEST PROCEDURES

Overcrank

Step 1. Press the Run switch on the front panel.

Step 2. Verify that after two crank cycles the DGC-1000 display indicates GEN OVER-CRANK ALARM and that only the Alarm output contacts are closed.

Step 3. Press the Off switch on the front panel and verify that the DGC-1000 resets to the Ready mode and that all output contacts open.

Overspeed

Step 1. Apply in parallel 120 Vac to phase A to neutral (terminals P34 and P37), phase B to neutral (terminals P35 and P37), and phase C to neutral (terminals P36 and P37).

Step 2. Apply a 5 Vac, 4,000 hertz sine wave to the DGC-1000 MPU inputs (terminals P32 and P33).

Step 3. Press the Run switch on the front panel.

Step 4. Slowly increase the frequency to the DGC-1000 MPU input until an overspeed shutdown occurs.

Step 5. Verify shutdown occurs within 4,158 ±83 hertz (1,980 ±38 rpm).

Step 6. Verify that the DGC-1000 display indicates GEN OVERSPEED ALARM and that only the Alarm output contacts are closed.

Step 7. Remove the voltages.

Step 8. Press the Off switch on the front panel and verify that the DGC-1000 resets to the Ready mode and that all output contacts open.

Low Oil Pressure

Step 1. Apply in parallel 120 Vac to phase A to neutral (terminals P34 and P37), phase B to neutral (terminals P35 and P37), and phase C to neutral (terminals P36 and P37).

Step 2. Press the Run switch on the front panel.

Step 3. Wait ten seconds after crank disconnect. Increase the resistance across the Oil Pressure sender input (terminals P38 and P2) until a Pre-alarm occurs. Note that an alarm or pre-alarm will occur only if the sender input detects resistance in the range of 5 to 280 ohms. An open or shorted sender will not result in an alarm or pre-alarm.

Step 4. Verify that the DGC-1000 display value is 25 ±2 PSI when Pre-alarm occurs.

Step 5. Verify that the DGC-1000 displays an alternately flashing dark field in the oil pressure location and that the Pre-alarm output contact has closed.

Step 6. While monitoring displayed oil pressure, further increase the resistance across the Oil Pressure sender input until a low oil pressure shutdown occurs. Note that an alarm or pre-alarm will occur only if the sender input detects resistance in the range of 5 to 280 ohms. An open or shorted sender will not result in an alarm or pre-alarm.

NOTE

Oil pressure below 15 psi is displayed as 0.

Step 7. Verify that the DGC-1000 displayed value is within 0 to 17 psi when shutdown occurs.

Step 8. Verify that the DGC-1000 display indicates LOW OIL PRESSURE ALARM and that only the Alarm output contacts are closed.

Step 9. Remove the voltage and return the resistance to 60 ohms.

Step 10. Press the Off switch on the front panel and verify that the DGC-1000 resets to the Ready mode and that all output contacts open.

High Coolant Temperature

Step 1. Apply in parallel 120 Vac to phase A to neutral (terminals P34 and P37), phase B to neutral (terminals P35 and P37), and phase C to neutral (terminals P36 and P37).

Step 2. Press the Run switch on the front panel.

Step 3. Wait 60 seconds after crank disconnect. Decrease the resistance across the Coolant Temperature sender input (terminals P40 and P2) until a Pre-alarm occurs. Note that an alarm or pre-alarm will occur only if the sender input detects resistance in the range of 5 to 3,100 ohms. An open or shorted sender will not result in an alarm or pre-alarm.

Step 4. Verify that the DGC-1000 display value is 250 ±5 degrees when Pre-alarm occurs.

Step 5. Verify that the DGC-1000 displays an alternately flashing dark field in the coolant temperature location and that the Pre-alarm output contact has closed.

Step 6. While monitoring displayed coolant temperature, further decrease the resistance across the Coolant Temperature sender input until an over temperature shutdown occurs.

Step 7. Verify that the DGC-1000 displayed value is 275 ±6 degrees when shutdown occurs.

Step 8. Verify that the DGC-1000 indicates OVER TEMP ALARM and that only the Alarm and Pre-alarm output contacts are closed.

Step 9. Remove the voltage and return the resistance to 100 ohms.

Step 10. Press the Off switch on the front panel and verify that the DGC-1000 resets to the Ready mode and that all output contacts open.

Emergency Stop

Step 1. Apply in parallel 120 Vac to phase A to neutral (terminals P34 and P37), phase B to neutral (terminals P35 and P37), and phase C to neutral (terminals P36 and P37).

Step 2. Press the Run switch on the front panel.

Step 3. Open the contact across the Emergency Stop inputs (terminals P17 and P18).

Step 4. Verify that the DGC-1000 indicates EMERGENCY SHUTDOWN SWITCH PRESSED and that all output contacts are open.

Step 5. Reapply the contact closure across the Emergency Stop inputs.

Step 6. Press the Off switch on the front panel and verify that the DGC-1000 resets to the Ready mode and that all output contacts open.

Step 7. Remove the voltage.

Low Coolant Level

Step 1. Apply in parallel 120 Vac to phase A to neutral (terminals P34 and P37), phase B to neutral (terminals P35 and P37), and phase C to neutral (terminals P36 and P37).

Step 2. Press the Run switch on the front panel.

Step 3. Close the Low Coolant Level contact.

Step 4. Verify that the DGC-1000 indicates LOW COOLANT LEVEL and that the Alarm contact is closed.

Step 5. Open the Low Coolant Level contact.

Step 6. Press the Off switch on the front panel and verify that the DGC-1000 resets to the Ready mode and that all output contacts open.

Step 7. Remove the voltage.

Low Fuel Level

Step 1. Apply 30 ohms across the Fuel Level transducer input (terminals P39 and P2).

Step 2. Press the Display/toggle pushbutton to enter the alternate display mode and press the Raise/Scroll pushbutton to access the Fuel Level quantity screen.

Verify that the DGC-1000 displayed value is 100%.

Step 3. Increase the resistance until the LOW FUEL alarm occurs. Note that an alarm or pre-alarm will occur only if the sender input detects resistance in the range of 5 to 280 ohms. An open or shorted sender will not result in an alarm or pre-alarm.

Verify that only the alarm contact closes.

Step 4. Slowly decrease the resistance until the DGC-1000 resets to the Ready mode.

Verify that all output contacts are open and the resistance is 236 ±5 ohms.

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SECTION 6 • BESTCOMS™ SOFTWARE

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SECTION 6 • BESTCOMS™ SOFTWARE

INTRODUCTION

BESTCOMS-DGC-100 software provides a user-friendly communication link between the DGC-1000 and the user. All DGC-1000 settings can be changed through BESTCOMS and all DGC-1000 settings can be saved in a computer file for use later to configure other controllers with the same settings.

CAUTION

This product contains one or more *nonvolatile memory* devices. Nonvolatile memory is used to store information (such as settings) that needs to be preserved when the product is power-cycled or otherwise restarted. Established nonvolatile memory technologies have a physical limit on the number of times they can be erased and written. In this product, the limit is 10,000 erase/write cycles. During product application, consideration should be given to communications, logic, and other factors that may cause frequent/repeated writes of settings or other information that is retained by the product. Applications that result in such frequent/repeated writes may reduce the useable product life and result in loss of information and/or product inoperability.

INSTALLATION

BESTCOMS-DGC-1000 software operates with IBM-compatible personal computers (PCs) using Microsoft® Windows® 95, 98, Me, 2000, XP, and NT®. The minimum recommended operating requirements are listed below.

- IBM-compatible PC, 486DX2 or faster and a minimum of 4 MB of RAM
- CD-ROM drive
- An available serial port

Installing BESTCOMS-DGC-1000

1. Insert the BESTCOMS CD-ROM into the PC CD-ROM drive.
2. When the DGC-1000 Setup and Documentation CD menu appears, click the Install button for the BESTCOMS application. The setup utility automatically installs BESTCOMS-DGC-1000 on your PC.

Connecting the DGC-1000 and PC

Connect a communication cable between the rear RS-232 connector of the DGC-1000 and the appropriate communication port of the PC. Refer to Figure 2-2 for the location of the DGC-1000 RS-232 connector and Figure 4-4 for the required connections between the DGC-1000 and a PC.

STARTING BESTCOMS

BESTCOMS is started by clicking the Windows® Start button, pointing to Programs, the Basler Electric folder, and then clicking the BESTCOMS-DGC-1000 icon. At startup, a screen with the program title and version number (Figure 6-1) is displayed briefly. After this dialog is displayed, the Sensing Transformers screen (Figure 6-2) is displayed.

Figure 6-1. BESTCOMS Title and Version

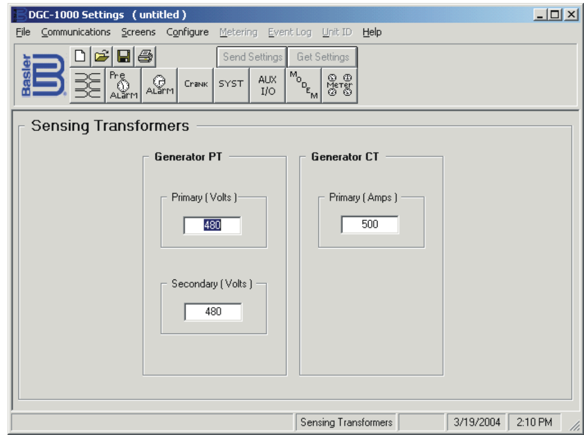

Figure 6-2. Sensing Transformers Screen

ESTABLISHING COMMUNICATION

Communication between BESTCOMS and the DGC-1000 must be established before reading or changing settings. BESTCOMS screen settings are updated only after communication is opened or the communication settings have been changed.

DGC-1000 communication with BESTCOMS can be established through the RS-232 serial interface or optional modem.

Initiating RS-232 Communication

Open the DGC-1000 RS-232 port by clicking **Communications** on the menu bar, clicking **Open**, and then **RS232 Connection**. When RS232 Connection is selected, the Comm Port screen of Figure 6-3 appears. Select the appropriate communication port for you PC and click the **Initialize** button. (Information about altering the baud rate, parity setting, and unit identification is provided in *Changing the Communication Parameters*. Information about using the RS-232 phone book (Phone Book 2) is provided in *RS-232 Phone Book*.) When the Password screen of Figure 6-4 appears, enter the appropriate password and click **OK**. The DGC-1000 is delivered with the following default passwords.

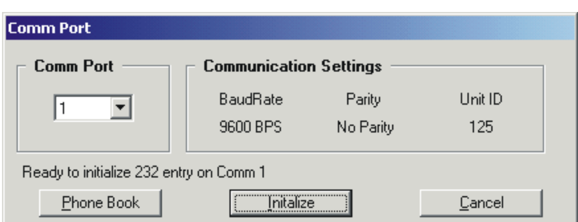

Figure 6-3. RS-232 Comm Port Screen

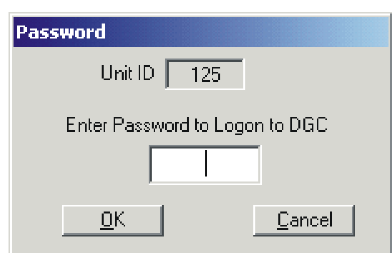

Figure 6-4. Password Screen

DGC. This limited access password allows all DGC-1000 settings to be read, but prevents any settings changes.

DGC1000. This full access password allows all DGC-1000 settings to be read and changed.

OEMLVL. This special access password allows all DGC-1000 settings to be read and changed. It also allows the DGC-1000 embedded firmware to be upgraded.

Passwords are case sensitive; all default passwords use upper-case letters. More information about passwords is provided in the *Password Protection* sub-section.

The unit ID number displayed in the Password screen indicates the identification number of the DGC-1000. Information about changing the unit ID for polled communication is provided in Changing the Communication Parameters.

When the appropriate password is entered in the Password screen and OK is clicked, communication with the DGC-1000 is established.

RS-232 Phone Book

The RS-232 phone book (Phone Book 2, Figure 6-5) is accessed by clicking the **Phone Book** button on the RS-232 Comm Port screen (accessed by clicking **Communications** on the menu bar, then **Open**, RS232 Connection). This screen allows phone book entries to be selected, added, edited, and deleted.

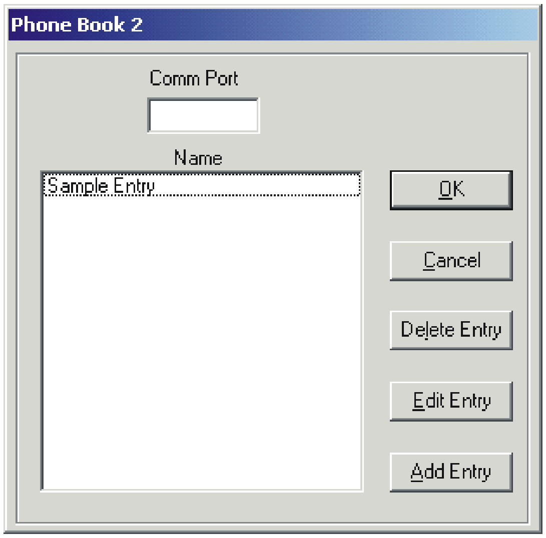

Figure 6-5. RS-232 Phone Book (Phone Book 2)

Selecting an Entry. A phone book entry is selected from the list of entries in the Name window of the phone book screen. When an entry in the list is highlighted, the entry's communication port number is indicated in the Comm Port field. Clicking **OK** selects the entry and returns to the Comm Port screen. The communication port number will be displayed in the Comm Port field of the Comm Port screen.

Adding an Entry. A phone book entry is added to the list of entries in the Name window of the phone book screen by clicking **Add Entry**. When the Add Entry button is clicked, an Add New Entry screen appears. This screen has a field for assigning a descriptive name to the entry and a Comm Port field for assigning a communication port number to the entry. Clicking the **OK** button saves the entry and returns to the Phone Book 2 screen.

Editing an Entry. A phone book entry is edited by selecting the desired entry in the Name window and clicking the **Edit Entry** button. When the Edit Entry button is clicked, an Edit Entry screen appears and allows the entry name and port number to be changed as desired. Clicking the **OK** button saves the entry and returns to the Phone Book 2 screen.

Deleting an Entry. A phone book entry is deleted by selecting the desired entry in the Name window and clicking the **Delete Entry** button.

Initiating Modem Communication

Establish a modem connection by clicking **Communications** on the menu bar, clicking **Open**, and then **Modem Connection**. When Modem Connection is selected, the Comm Port screen of Figure 6-6 appears. Select the appropriate communication port and click the **Initialize** button. (Information about altering the baud rate, parity setting, and unit identification is provided in *Changing the Communication Parameters*.) If the selected communication port is available, the Phone Book screen of Figure 6-7 will appear when the **Initialize** button is clicked. Select the desired entry from the list in the Name window and click the **Dial Number** button to connect with the phone book entry. Creating, editing, and accessing phone book entries is discussed in the following paragraphs.

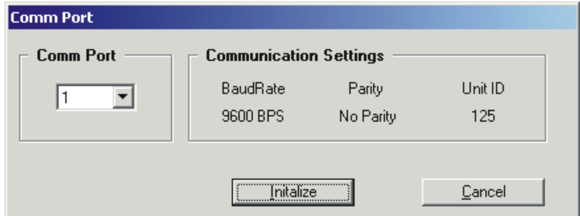

Figure 6-6. Modem Comm Port Screen

Modem Phone Book

The modem phone book (Figure 6-7) is accessed by clicking the **Initialize** button of the Comm Port screen after selecting a modem connection (see previous paragraph). This screen allows phone book entries to be selected, added, edited, and deleted much like the RS-232 phone book. Modem phone book features that differ from the RS-232 phone book are described in the following paragraphs.

Phone Number Field. The phone number field is displayed on the Add New Entry screen, Edit Entry screen, and Phone Book screen. This field displays the telephone number associated with the selected phone book entry and is used by the modem when dialing out.

Modem Initialization String. This field is displayed on the Add New Entry screen, Edit Entry screen, and Phone Book screen. The default string, AT&F, resets the modem to its default, factory profile. Consult your modem documentation for the appropriate AT command.

Dial Number Button. Clicking this button initiates communication by causing the modem to dial the selected phone book entry.

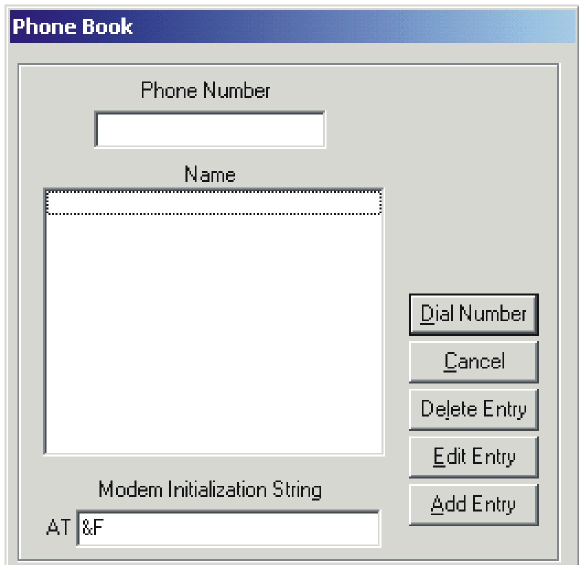

Figure 6-7. Modem Phone Book

Unit ID

Clicking **Unit ID** on the menu bar and then clicking **Select Another Unit ID** displays the Select Another Unit dialog box. The ID number of another DGC-1000 on the same network can be entered in the Unit ID field. Clicking the **Save** button causes BESTCOMS to disconnect from the current DGC-1000 and log onto the DGC-1000 identified by the number in the Unit ID field. Because this feature allows selection of a new unit ID without breaking communication, it is useful for applications where a modem is used to remotely connect to a network of units.

CHANGING SETTINGS

DGC-1000 settings are arranged into seven groups.

- Sensing Transformers
- Pre-Alarms
- Alarms
- Crank
- System
- Auxiliary I/O
- Modem

Each setting group has a corresponding button (shown in Figure 6-8) that can be selected to access that group of settings. The seven setting groups can also be accessed by clicking **Screens** on the menu bar and then selecting the desired setting group from the list. Once a setting group is accessed, the individual settings of the group can be viewed and changed.

A setting is changed by clicking within the setting field and typing the new setting. If the new setting is outside the prescribed setting range, a dialog box showing the acceptable range appears when another setting field is accessed or when attempting to send the new setting to the DGC-1000. The following paragraphs describe how settings are sent to the DGC-1000.

SENDING AND RECEIVING SETTINGS

When communication is enabled, DGC-1000 settings can be sent and received through BESTCOMS.

Sending Settings

Setting changes are sent to the DGC-1000 by clicking the **Send Settings** button. This causes all BESTCOMS settings to become the DGC-1000 settings. Settings can also be sent to the DGC-1000 by clicking **Communications** on the menu bar and clicking **Send to DGC**.

Receiving Settings

DGC-1000 settings are retrieved by clicking the **Get Settings** button. This causes the current settings of the DGC-1000 to be loaded into BESTCOMS. Settings can also be received from the DGC-1000 by clicking **Communications** on the menu bar and clicking **Get from DGC**. Settings are also automatically retrieved when logging onto the DGC-1000.

SETTING DEFINITIONS

Each of the seven setting groups has a corresponding BESTCOMS screen. The settings of each screen are categorized by one or more tabs. In the following paragraphs, settings are arranged and defined according to the organization of the BESTCOMS screens and tabs.

Sensing Transformers

The button displaying a transformer icon is clicked to access the Sensing Transformers screen. The Sensing Transformers screen can also be accessed by clicking **Screens** on the menu bar and clicking **Sensing Transformers**. Sensing Transformer settings are shown in Figure 6-8 and described in the following paragraphs.

Generator PT – Primary (Volts). This setting selects the rating of the primary side of the transformer used to sense generator voltage. The primary voltage setting is adjustable from 1 to 15,000 Vac.

Generator PT – Secondary (Volts). This setting selects the rating of the secondary side of the transformer used to sense generator voltage. The secondary voltage setting is adjustable from 1 to 480 Vac.

Generator CT – Primary (Amps). This setting selects the rating of the primary side of the transformer used to sense generator current. The primary current setting is adjustable from 1 to 5,000 Aac.

Pre-Alarms

Click the **Pre Alarm** button to access the Pre-Alarm Settings screen or click **Screens** on the menu bar and click **Pre-Alarm Settings**. The Pre-Alarms screen consists of five tabs.

- Low Fuel-Low Cool-Batt. OverVolt.
- Maint. Interv.-Eng. kW Overload-Hi Cool
- Low Oil-Low Batt. Volt-Weak Batt Volt
- Audible – Battery Charger – Fuel Level Sender
- CAN Bus – Diagnostic Trouble Codes.

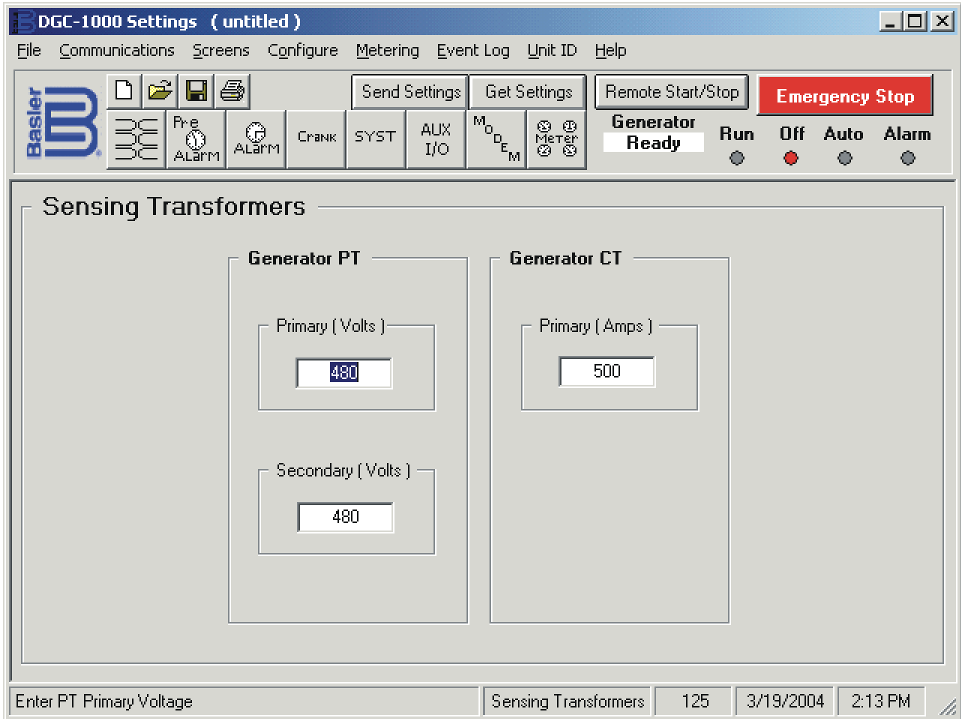

Figure 6-8. Sensing Transformers Screen

Low Fuel-Low Cool-Batt. OverVolt Tab

The Low Fuel-Low Cool-Batt. OverVolt tab settings are shown in Figure 6-9 and described in the following paragraphs.

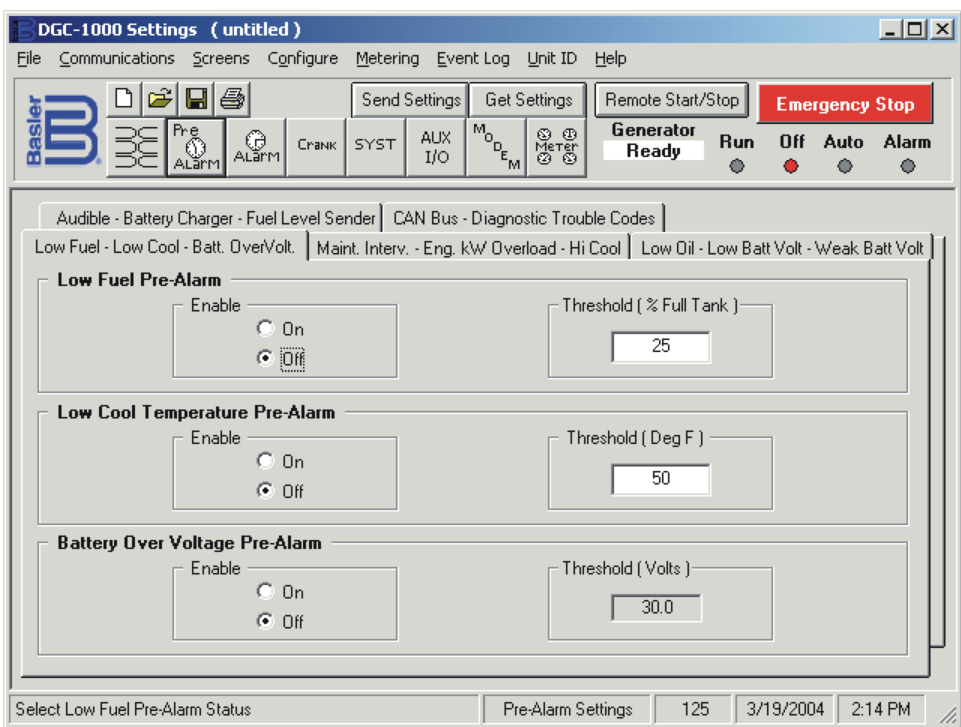

Figure 6-9. Pre-Alarms Screen, Low Fuel-Low Cool-Batt. OverVolt. Tab

Low Fuel Pre-Alarm – Enable. This setting enables and disables annunciation of a low fuel pre-alarm.

Low Fuel Pre-Alarm – Threshold (% Full Tank). This setting selects the fuel level that will trigger a low fuel pre-alarm. A threshold setting of 10 to 100 percent may be entered.

Low Cool Temperature Pre-Alarm – Enable. This setting enables and disables annunciation of a low coolant temperature pre-alarm.

Low Cool Temperature Pre-Alarm – Threshold (Deg). This setting selects the coolant temperature that will trigger a low coolant temperature pre-alarm. A threshold setting of 50 to 100 degrees Fahrenheit or 10 to 38 degrees Celsius may be entered. The unit of measure (Fahrenheit or Celsius) is determined by the Unit System setting of the System screen.

Battery Over Voltage Pre-Alarm – Enable. This setting enables and disables annunciation of a battery overvoltage pre-alarm.

Battery Over Voltage Pre-Alarm – Threshold (Volts). This read-only setting displays the voltage level that will trigger a battery overvoltage pre-alarm. The threshold is fixed at 15 Vdc for systems operating at 12 Vdc and 30 Vdc for systems operating at 24 Vdc.

Maint. Interv. – Eng. kW Overload – Hi Cool Tab

The Maint. Interv. – Eng. kW Overload – Hi Cool Tab settings are shown in Figure 6-10 and described in the following paragraphs.

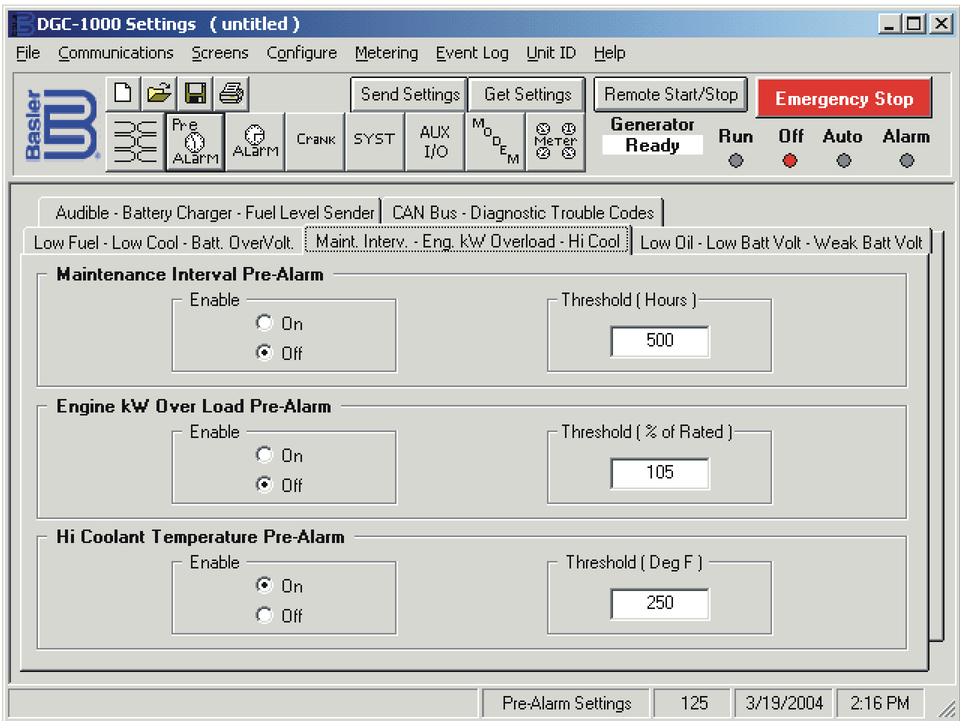

Figure 6-10. Pre-Alarms Screen, Maint. Interv.-Eng. kW Overload-Hi Cool Tab

Maintenance Interval Pre-Alarm – Enable. This setting enables and disables annunciation of a maintenance interval pre-alarm.

Maintenance Interval Pre-Alarm – Threshold (Hours). This setting selects the length of the maintenance interval. An interval of 0 to 5,000 hours may be selected. When a new threshold setting is entered, the Maintenance Interval Timer Reset checkbox of the System Settings screen is selected to apply the new value.

Engine kW Over Load Pre-Alarm – Enable. This setting enables and disables annunciation of an engine kW overload pre-alarm.

Engine kW Over Load Pre-Alarm – Threshold (% of Rated). This setting, expressed as a percentage of the engine rating, selects the generator power level that will trigger an engine kW overload pre-alarm. A threshold setting of 95 to 140 percent may be entered.

Hi Coolant Temperature Pre-Alarm – Enable. This setting enables and disables annunciation of a high coolant temperature pre-alarm. A 60 second activation delay prevents a high coolant temperature pre-alarm from occurring at engine startup.

Hi Coolant Temperature Pre-Alarm – Threshold (Deg). This setting selects the coolant temperature that will trigger a high coolant temperature pre-alarm. A threshold setting of 100 to 280 degrees Fahrenheit or

38 to 138 degrees Celsius may be entered. The unit of measure (Fahrenheit or Celsius) is determined by the Unit System setting of the System screen.

Low Oil-Low Batt Volt-Weak Batt Volt Tab

The Low Oil-Low Batt Volt-Weak Batt Volt Tab settings are shown in Figure 6-11 and described in the following paragraphs.

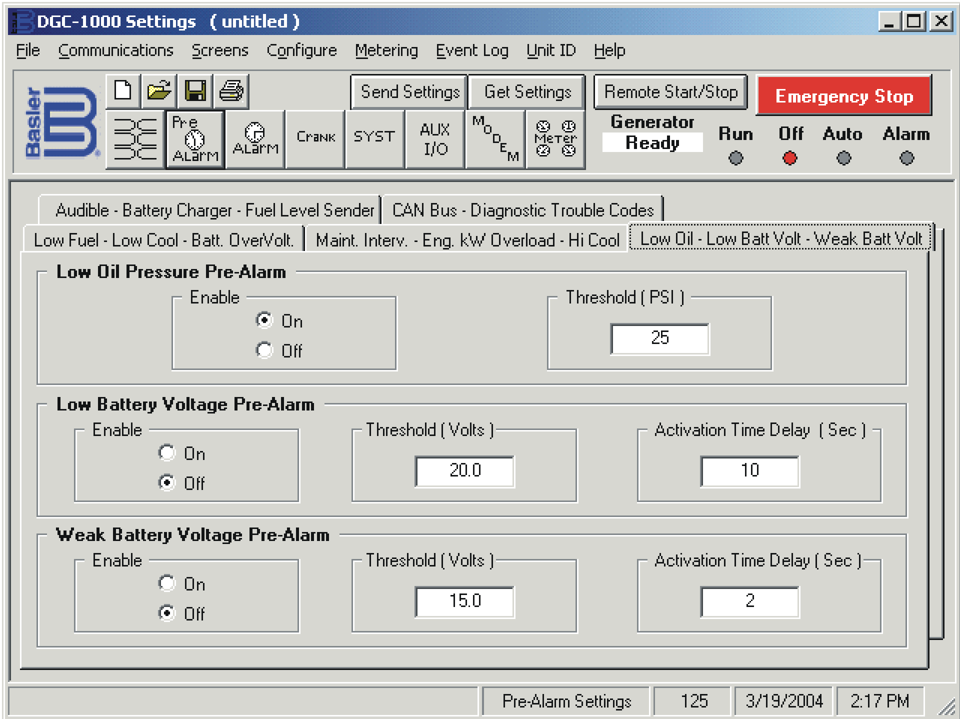

Figure 6-11. Pre-Alarms Screen, Low Oil-Low Batt Volt-Weak Batt Volt Tab

Low Oil Pressure Pre-Alarm – Enable. This setting enables and disables annunciation of a low oil pressure pre-alarm. A 10 second activation time delay prevents low oil pressure annunciation during engine startup.

Low Oil Pressure Pre-Alarm – Threshold. This setting selects the oil pressure level that will trigger a low oil pressure pre-alarm. A threshold setting of 3 to 150 psi or 20 to 1035 kPa may be entered. The unit of measure (psi or kPa) is determined by the Unit System setting of the System screen. A 10 second activation time delay prevents low oil pressure annunciation during engine startup.

Low Battery Voltage Pre-Alarm – Enable. This setting enables and disables annunciation of a low battery voltage pre-alarm.

Low Battery Voltage Pre-Alarm – Threshold (Volts). This setting selects the voltage level that will trigger a low battery voltage pre-alarm. The threshold is adjustable from 6 to 12 Vdc for 12 Vdc systems and 12 to 24 Vdc for 24 Vdc systems.

Low Battery Voltage Activation Time Delay (Sec). This setting selects the time delay from when low battery voltage is detected until a pre-alarm is annunciated. A time delay of 1 to 10 seconds may be entered.

Weak Battery Voltage Pre-Alarm – Enable. This setting enables and disables annunciation of a weak battery voltage pre-alarm.

Weak Battery Voltage Pre-Alarm – Threshold (Volts). This setting selects the voltage level that will trigger a weak battery voltage pre-alarm. The threshold is adjustable from 4 to 8 Vdc for 12 Vdc systems and 8 to 16 Vdc for 24 Vdc systems.

Weak Battery Voltage Pre-Alarm – Activation Time Delay (Sec). This setting selects the time delay from when weak battery voltage is detected until a pre-alarm is annunciated. A time delay of 1 to 10 seconds may be entered.

Audible-Battery Charger-Fuel Level Sender Tab

The Audible-Battery Charger-Fuel Level Sender Tab settings are shown in Figure 6-12 and described in the following paragraphs.

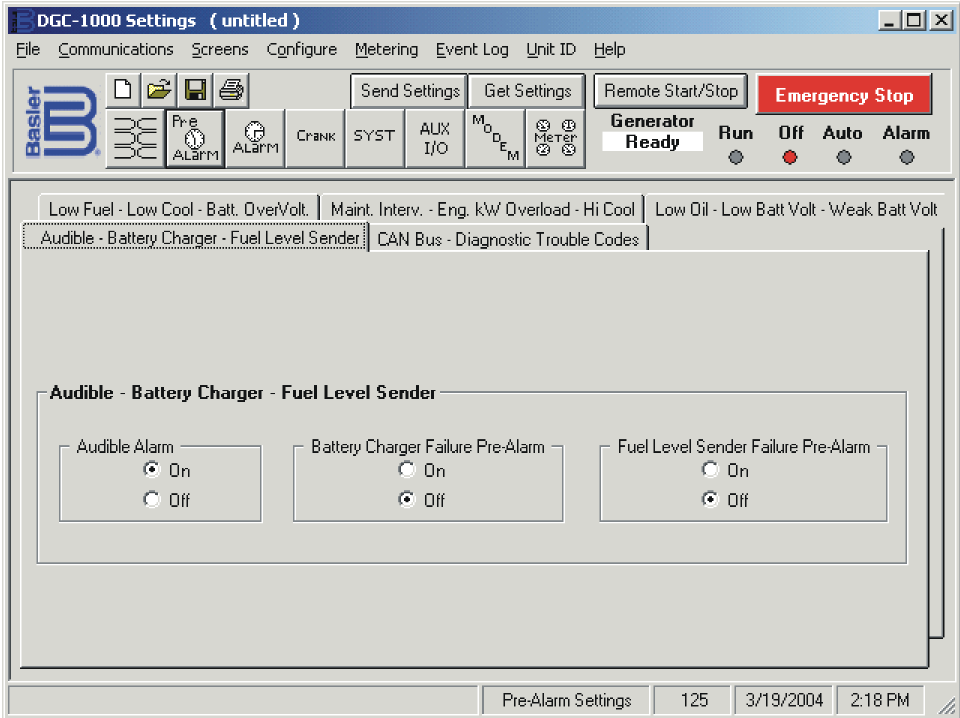

Figure 6-12. Pre-Alarms Screen, Audible-Battery Charger-Fuel Level Sender Tab

Audible Alarm. This setting enables and disables the DGC-1000 horn output.

Battery Charger Failure Pre-Alarm. This setting enables and disables annunciation of a battery charger failure pre-alarm.

Fuel Level Sender Failure Pre-Alarm. This setting enables and disables annunciation of a fuel level sender failure pre-alarm.

CAN Bus – Diagnostic Trouble Codes Tab

The CAN Bus – Diagnostic Trouble Codes Tab settings are shown in Figure 6-13 and described in the following paragraphs.

Loss of ECU Communication – Pre Alarm Selection. This setting enables and disables annunciation of a loss of ECU communication pre-alarm. This pre-alarm can occur only when the DGC-1000 is in Off mode and pulsing the ECU has failed to establish communication with the ECU. For details about ECU support, refer to Section 3, *Functional Description*.

Diagnostic Trouble Code Pre-Alarm – Enable. This setting enables and disables annunciation of diagnostic trouble codes (DTC) pre-alarms as they are received from the ECU.

Alarms

Click the **Alarm** button to access the Alarms screen or click **Screens** on the menu bar and click **Alarm Settings**. The Alarms screen consists of two tabs: Hi Cool-Low Fuel-Low Oil and Overspeed-Sender Fail.

Hi Cool-Low Fuel-Low Oil Tab

The Hi Cool-Low Fuel-Low Oil Tab settings are shown in Figure 6-14 and described in the following paragraphs.

Hi Cool Temperature Alarm – Alarm Enable. This setting enables and disables annunciation of a high coolant temperature alarm and engine shutdown. A 60 second activation delay prevents a Hi Coolant Temperature Alarm from occurring at engine startup.

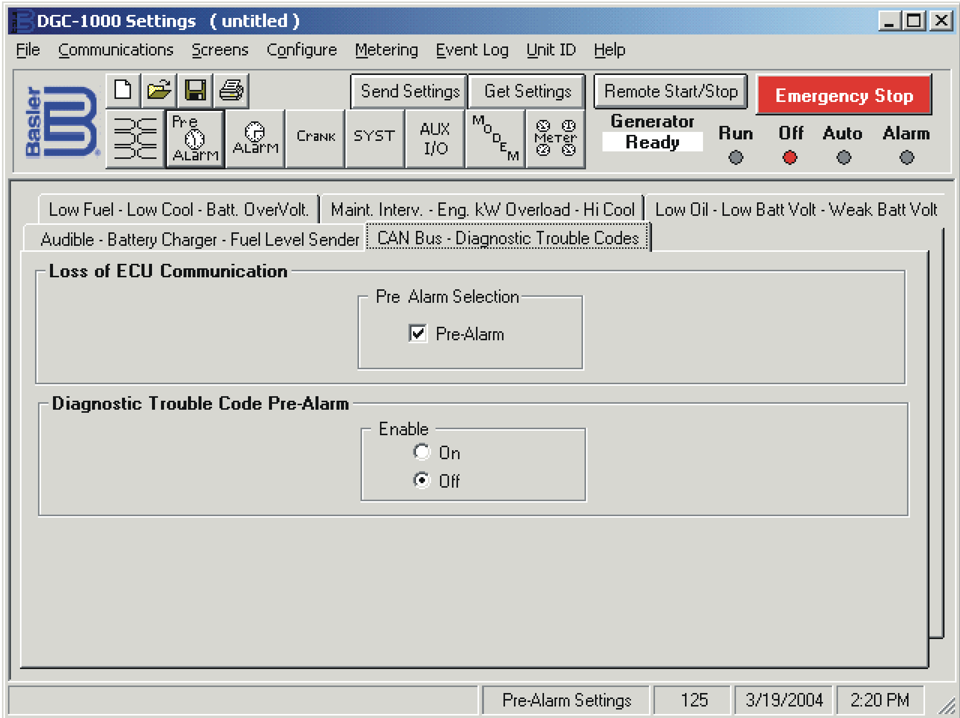

Figure 6-13. Pre-Alarms Screen, CAN Bus-Diagnostic Trouble Codes Tab

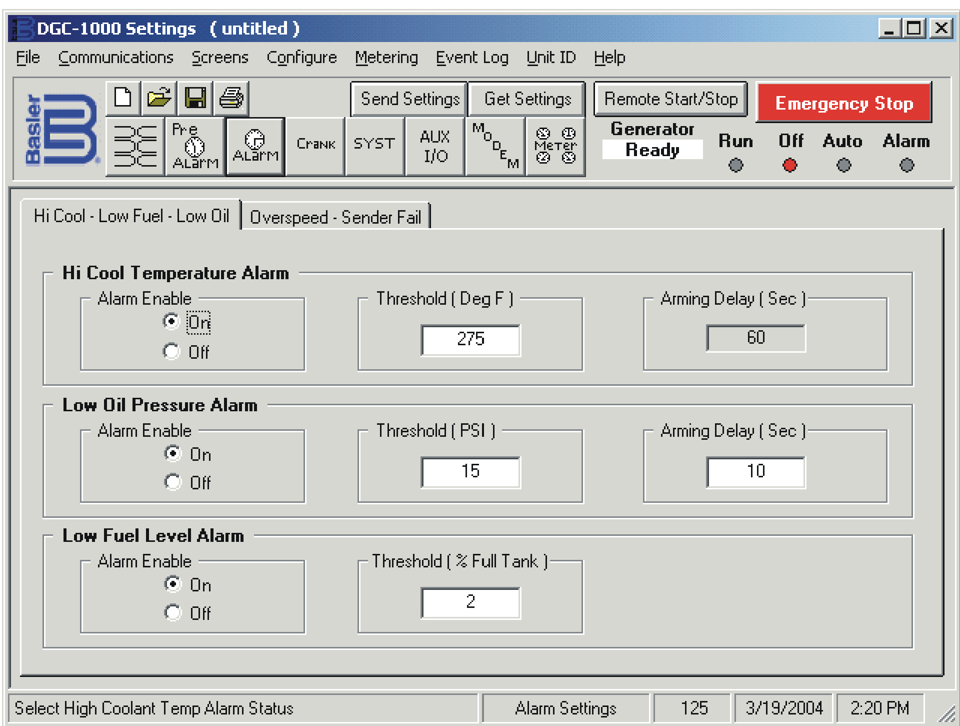

Figure 6-14. Alarms Screen, Hi Cool-Low Fuel-Low Oil Tab

Hi Cool Temperature Alarm – Threshold (Deg). This setting selects the coolant temperature that will trigger a high coolant temperature alarm. A threshold setting of 100 to 280 degrees Fahrenheit or 38 to 138 degrees Celsius may be entered. The unit of measure (Fahrenheit or Celsius) is determined by the Unit System setting of the System screen. A 60 second activation delay prevents a Hi Coolant Temperature Alarm from occurring at engine startup.

Hi Cool Temperature Alarm – Arming Delay (Sec). This read-only setting displays the time delay between when high coolant temperature is detected and an alarm is annunciated and the engine is shut down. The arming delay is fixed at 60 seconds.

Low Oil Pressure Alarm – Alarm Enable. This setting enables and disables annunciation of a low oil pressure alarm and engine shutdown. A 10 second activation time delay prevents low oil pressure annunciation during engine startup.

Low Oil Pressure Alarm – Threshold. This setting selects the oil pressure level that will trigger a low oil pressure alarm and engine shutdown. A threshold of 3 to 150 psi or 20 to 1035 kPa may be entered. The unit of measure (psi or kPa) is determined by the Unit System setting of the System screen. A 10 second activation time delay prevents low oil pressure annunciation during engine startup.

Low Oil Pressure Alarm – Arming Delay (Sec). This setting selects the time delay between when low oil pressure is detected and an alarm is annunciated and the engine is shut down. A time delay of 5 to 15 seconds may be entered. A 10 second activation time delay prevents low oil pressure annunciation during engine startup.

Low Fuel Level Alarm – Alarm Enable. This setting enables and disables alarm annunciation and engine shutdown for a low fuel level.

Low Fuel Level Alarm – Threshold (% Full Tank). This setting selects the fuel level that will trigger a low fuel level alarm. A threshold of 0 to 100 percent may be entered.

__Overspeed-Sender Fail Tab__

The Overspeed-Sender Fail Tab settings are shown in Figure 6-15 and described in the following paragraphs.

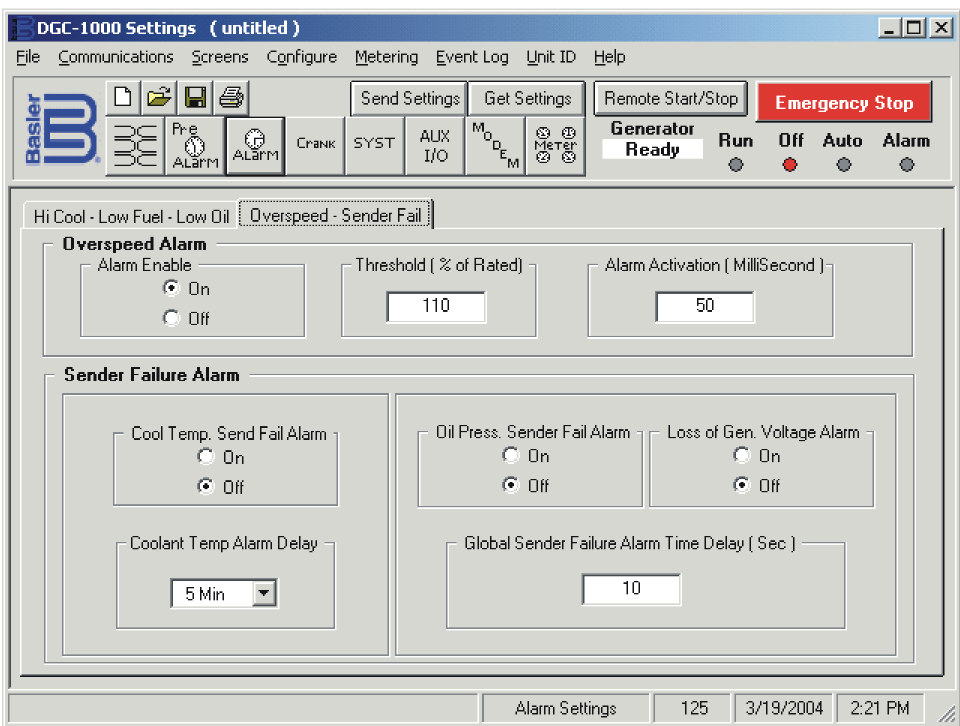

Figure 6-15. Alarms Screen, Overspeed-Sender Fail Tab

Overspeed Alarm – Alarm Enable. This setting enables and disables alarm annunciation and engine shutdown for an overspeed condition.

Overspeed Threshold (% of Rated). This setting selects the percentage of overspeed that triggers an overspeed alarm and engine shutdown. The threshold is adjustable from 105 to 140 percent of nominal speed.

Overspeed Alarm – Alarm Activation (MilliSecond). This setting adjusts the time delay from when an overspeed alarm condition is detected until it is annunciated and the engine is shut down. A time delay of 0 to 500 milliseconds may be entered.

Sender Failure Alarm – Cool Temp. Send Fail Alarm. This setting enables and disables alarm annunciation and engine shutdown for a coolant temperature sender failure.

Sender Failure Alarm – Coolant Temp Alarm Delay. This setting adjusts the time delay from when a coolant temperature sender failure is detected until it is annunciated and the engine is shut down. A time delay of 5, 10, 15, 20, 25, or 30 minutes may be selected.

Sender Failure Alarm – Oil Press. Sender Fail Alarm. This setting enables and disables alarm annunciation and engine shutdown for an oil pressure sender failure. An oil pressure sender failure alarm is annunciated and engine shutdown is initiated when the Global Sender Failure Alarm Time Delay setting expires.

Sender Failure Alarm – Loss of Gen. Voltage Alarm. This setting enables and disables alarm annunciation and engine shutdown for a loss of generator voltage. A loss of generator voltage alarm is annunciated when the generator voltage decreases below 1.5 Vac and the Global Sender Failure Alarm Time Delay expires. This setting does not disable a Sender Failure alarm for the speed signal source when generator frequency is selected as the speed signal source.

Sender Failure Alarm – Global Sender Failure Alarm Time Delay (Sec). This setting selects the time delay between when an oil pressure sender failure, loss of generator voltage failure, or MPU sender failure is detected and alarm annunciation and engine shutdown.

Engine Cranking

Click the **Crank** button to access the Engine Cranking screen or click **Screens** on the menu bar and click **Crank Settings**. Engine cranking settings are shown in Figure 6-16 and are described in the following paragraphs.

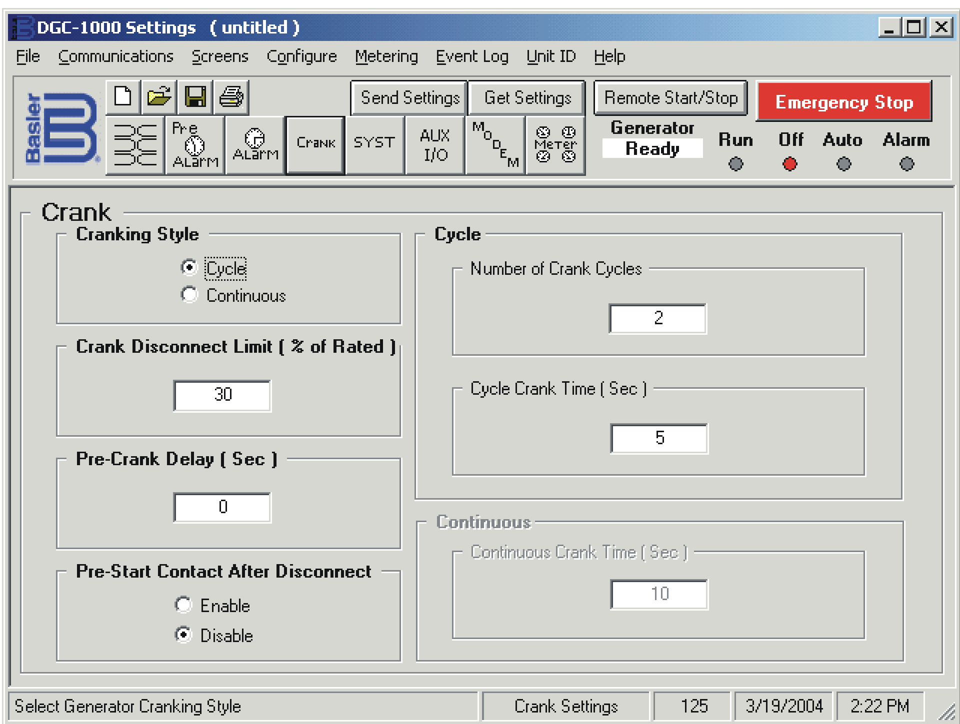

Figure 6-16. Engine Cranking Screen

Cranking Style. This setting selects the engine cranking method as continuous or cycle.

Crank Disconnect Limit (% of Rated). This setting selects the percentage of rated engine speed at which cranking is terminated. A disconnect limit of 10 to 100 percent may be entered.

Crank Disconnect Limit (% of Rated). This setting selects the percentage of rated engine speed at which cranking is terminated. A disconnect limit of 10 to 100 percent may be entered.

Pre-Crank Delay (Sec). This setting adjusts the time delay between initiating engine starting and beginning engine cranking. A delay of 0 to 30 seconds may be entered.

Pre-Start Contact After Disconnect. This setting selects whether or not the pre-start contact remains closed after disconnect occurs.

Cycle – Number of Crank Cycles. This setting, available only if cycle cranking is selected, selects the number of engine cranking attempts before an overcrank condition occurs and cranking is terminated. The crank cycles setting range is 1 to 7.

Cycle – Cycle Crank Time (Sec). This setting, available only if cycle cranking is selected, controls the duration of each cranking cycle. Each cranking period is separated by a resting period of equal length. A crank time of 5 to 15 seconds may be entered.

Continuous – Continuous Crank Time (Sec). This setting, available only if continuous cranking is selected, sets the duration of a single engine cranking attempt before an overcrank condition occurs. A continuous crank time of 1 to 60 seconds may be entered.

System

Click the **SYST** button to access the System Settings screen or click **Screens** on the menu bar and click **System Settings**. System settings are shown in Figure 6-17 and are described in the following paragraphs.

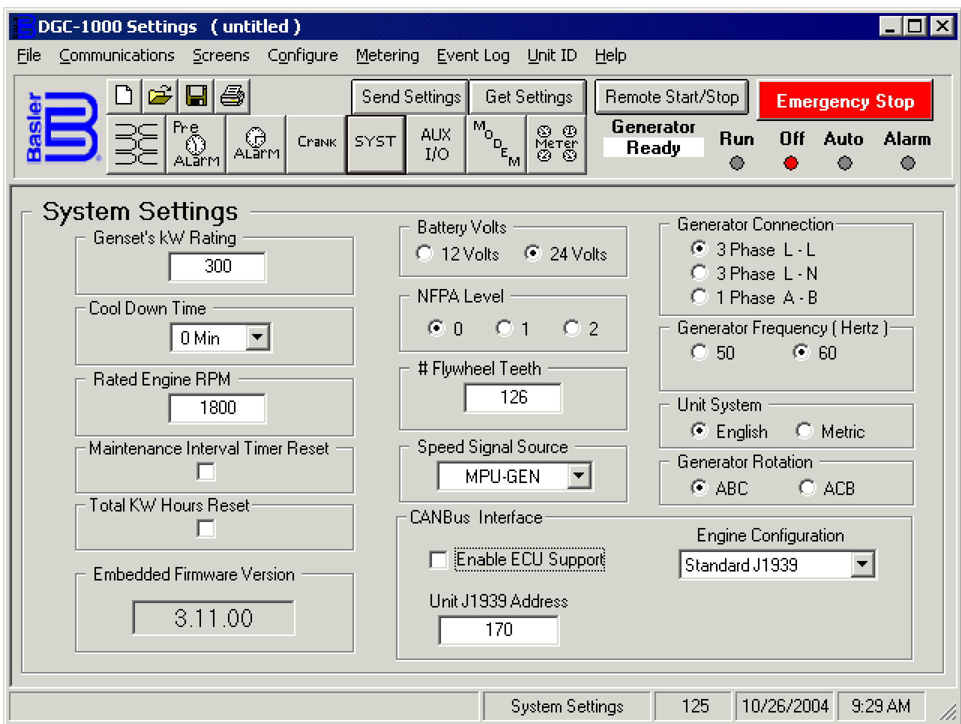

Figure 6-17. System Settings Screen

Genset's kW Rating. The generator power rating is entered in this field. A genset kW rating of 10 to 9,999 may be entered.

Cool Down Time. This setting selects the time between when the generator load is removed and the engine is stopped by a remote shutdown. A cool-down time of 0 to 60 minutes may be entered.

Rated Engine RPM. This setting selects the rated rotating speed of the engine. A value of 750 to 3,600 rpm may be entered.

Maintenance Interval Timer Reset. Selecting this checkbox terminates the maintenance interval pre-alarm and resets the maintenance interval timer back to the programmed value. The **Send Settings** button must be clicked for the reset to take effect.

Embedded Firmware Version. This read-only field displays the DGC-1000 firmware version.

Total kW Hours Reset. Selecting this checkbox resets the accumulated kilowatt-hours to zero. The **Send Settings** button must be clicked for the reset to take effect.

Battery Volts. This setting selects either 12 Vdc or 24 Vdc as the starting battery nominal voltage.

NFPA Level. This setting selects whether or not NFPA (National Fire Prevention Association) requirements are in effect. If NFPA compliance is not required, a setting of 0 can be selected to disable the feature. Selecting NFPA level 1 or 2 affects DGC-1000 operation in the following ways.

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

 # Flywheel Teeth. This setting selects the number of teeth on the engine flywheel. A value of 50 to 500 may be entered.

Speed Signal Source. This setting selects from three sources for obtaining the engine speed. The speed signal source can be obtained from the magnetic pickup (MPU), generator frequency, or derived from both the MPU and generator frequency. When both the MPU and generator frequency are selected as the speed signal source, the MPU has priority. If both MPU and generator frequency are selected and the MPU fails, generator frequency is used as the speed signal source and a non-programmable MPU sender failure pre-alarm is annunciated.

Generator Connection. This setting selects the configuration of the generator voltage sensing circuitry. Three-phase line-to-line, three-phase line-to-neutral, or single-phase A-phase to B-phase sensing may be selected.

Generator Frequency. This setting selects either 50 hertz or 60 hertz as the nominal generator frequency.

Unit System. This setting selects either the English or metric unit system for displaying the oil pressure and coolant temperature parameters in BESTCOMS and the DGC-1000 HMI.

NOTE

CANBus Interface settings are disabled (and grayed out) unless OEM-level password access is obtained. See *Password Protection* for information regarding password access levels.

Generator Rotation. This setting selects either ABC or ACB phase rotation.

CANBus Interface – Enable ECU Support. This setting enables and disables the DGC-1000 CAN interface. When enabled, the CAN interface allows the DGC-1000 to communicate with an engine control unit (ECU). The mode of J1939 communication depends on the Engine Configuration setting selected.

CANBus Interface – Engine Configuration. This setting selects one of three CAN interface configurations: Standard J1939, Volvo Penta EDC III, or MTU MDEC.

CANBus Interface – Unit J1939 Address. This setting, enabled only for an Engine Configuration setting of Standard J1939 or Volvo Penta EDC III, selects the address to be used by the DGC-1000 for SAE J1939 communication. A value of 0 to 253 may be entered.

CANBus Interface – Speed Select. This setting, enabled only for an Engine Configuration setting of Volvo Penta EDC III, configures the Volvo Penta EDC III to operate the engine at the primary or secondary base speed. If the engine is configured by Volvo for 60 hertz applications, the primary base speed is 1,800 rpm and the secondary base speed is 1,500 rpm. If the engine is configured by Volvo for 50 hertz applications, the primary base speed is 1,500 rpm and the secondary base speed is 1,800 rpm.

CANBus Interface – Accelerator Position. This setting, enabled only for an Engine Configuration setting of Volvo Penta EDC III, is expressed as a percentage and tells the Volvo Penta EDC III where to set the engine speed (trim) relative to the base speed. The range of the setting is the base speed ±120 rpm. A setting of 0% will cause the engine to run at 120 rpm below the base speed, a setting of 50% will cause the engine to run at the base speed, and a setting of 100% will cause the engine to run at 120 rpm above the base speed. The Accelerator Position setting is linear with a gain of 2.4 rpm/%. This setting is not saved in nonvolatile memory and defaults back to 50% after DGC-1000 operating power is cycled.

CANBus Interface – Module Type. This setting, enabled only for an Engine Configuration setting of MTU MDEC, selects one of four MDEC ECU types: Module 201, Module 302, Module 303, or Module 304.

CANBus Interface – Speed Demand Source. This setting, enabled only for an Engine Configuration setting of MTU MDEC, selects one of six speed demand sources for the MDEC ECU: Analog CAN, Up Down ECU, Up Down CAN, Analog ECU, Frequency, or No CAN Demand.

CANBus Interface – Engine RPM. This setting, enabled only for an Engine Configuration setting of MTU MDEC, selects the rated rpm for the engine.

Input/Output Settings

Click the **AUX I/O** button to access the Input/Output Settings screen or click **Screens** on the menu bar and click **Input/Output Settings**. The Input/Output Settings screen consists of two tabs: Programmable Input Contact Setup and Aux Output Setup.

Programmable Input Contact Setup Tab

The Programmable Input Contact Setup tab settings of the Input/Output Settings screen consists of four identical groups of settings for each of the four programmable inputs. Tab settings are shown in Figure 6-18 and described in the following paragraphs.

Programmable Input – Function. This setting selects the function type that is used to trigger the corresponding programmable input. The functions available for triggering a programmable input are No Function, Auxiliary Input, Single-Phase Override, and 4 Wire Delta.

"4 Wire Delta" refers to the application of a 12-lead generator whose output windings are connected in a delta, and the mid-point of one side of the delta is connected to the voltage neutral terminal on the DGC-1000. For example, if a generator with 120-volt windings were connected to a DGC-1000 in this fashion, and the mid-point between phases B and C is connected to a DGC-1000's voltage neutral terminal, the metered voltages would be as follows: V_{AN} = 208 V, V_{BN} = V_{CN} = 120 V, and V_{AB} = V_{BC} = V_{CA} = 240 V.

Programmable Input – Auxiliary Configuration. Either the Alarm or Pre-Alarm checkbox can be selected to

NOTE

In order for the four-wire delta voltage sensing mode to function when an appropriately programmed auxiliary input closes, the Generator Connection setting on the *System Settings* screen must be set for 3 Phase L-N.

annunciate an alarm or pre-alarm when the selected function triggers the programmable input.

Programmable Input – Auxiliary Input Label. This setting field is enabled only when Auxiliary Input is selected as the programmable input function. A user-assigned label (eight characters, maximum) can be entered for the corresponding programmable input.

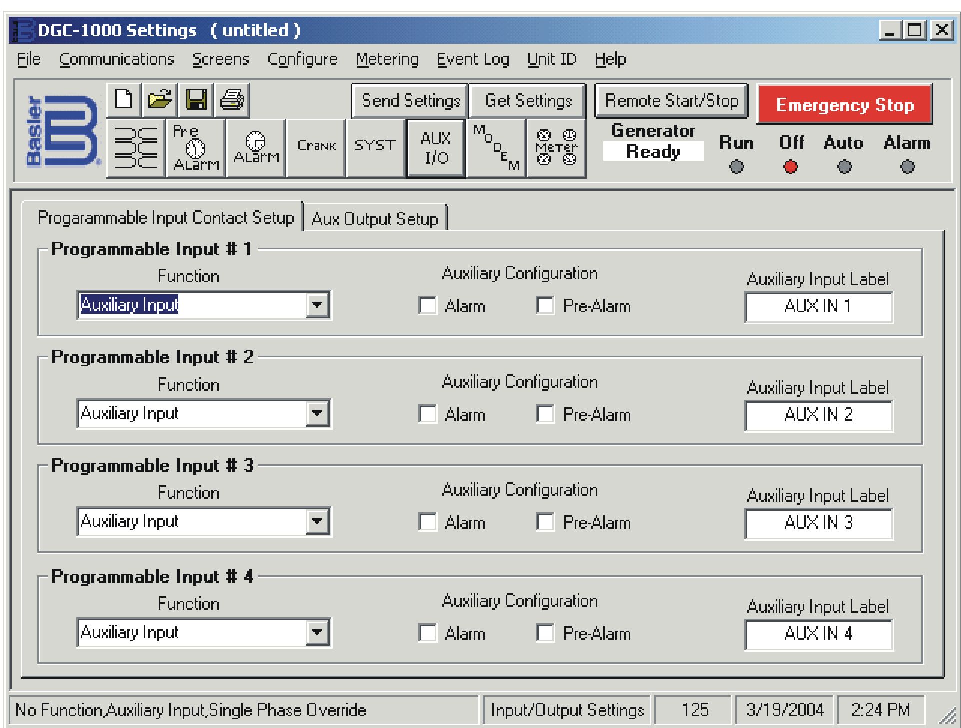

Figure 6-18. Input/Output Settings Screen, Programmable Input Contact Setup Tab

Aux Output Setup Tab

The Aux Output Setup tab settings of the Input/Output Settings screen are shown in Figure 6-19. (Not all settings are visible in the illustration.) The Aux Output Setup tab consists of a list of pre-alarms, alarms, and conditions that can be assigned to close programmable outputs 1 through 8. An output is selected by clicking the checkbox in the appropriate row and column. The following pre-alarms, alarms, and conditions can be assigned to one of the eight programmable outputs.

- High coolant temperature alarm
- Low oil pressure alarm
- Coolant temperature sender failure alarm
- Oil pressure sender failure alarm
- Loss of voltage sender failure alarm
- Speed sender failure alarm
- Low fuel alarm
- Low coolant level alarm
- Overcrank alarm
- Emergency stop alarm
- Overspeed alarm
- Low fuel pre-alarm
- Low coolant temperature pre-alarm
- Battery overvoltage pre-alarm
- kW overload pre-alarm
- High coolant temperature pre-alarm
- Low oil pressure pre-alarm
- Low battery voltage pre-alarm
- Weak battery voltage pre-alarm
- Battery charger failure pre-alarm
- Scheduled maintenance pre-alarm
- Switch not in Auto position
- Fuel leak/sender failure pre-alarm
- Cool down timer active
- Auxiliary input 1 closed
- Auxiliary input 2 closed
- Auxiliary input 3 closed
- Auxiliary input 4 closed
- Load button 1
- Load button 2
- Load button 3
- Load button 4

The last four items of the list are the four programmable load buttons that appear on the metering screen. These four buttons may be configured to operate any combination of the eight auxiliary output contacts. Load buttons 1 and 2 have fixed labels of Load 1 and Load 2. Load buttons 3 and 4 have programmable labels. Each label can consist of six alphanumeric characters, maximum. Refer to the *Metering* paragraphs for more information about using the Load buttons.

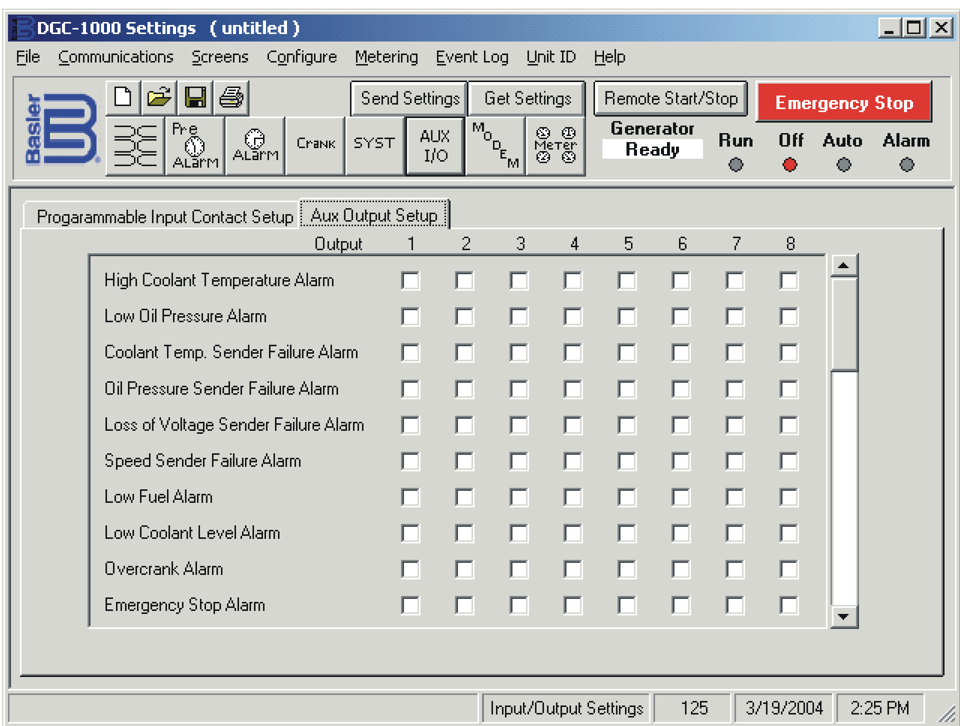

Figure 6-19. Input/Output Settings Screen, Aux Output Setup Tab

Modem Settings

If equipped with a modem (style X1X or X2X), the DGC-1000 can dial an alphanumeric pager when any of the selected inputs are activated or selected events occur. Click the **MODEM** button to access the

Modem Settings screen or click **Screens** on the menu bar and click **Modem Settings**. The Modem Settings screen consists of two tabs: Modem Setup and Modem Dialout Conditions.

> **NOTE**
>
> Upon completion of DGC-1000 setup, communication with BESTCOMS must be closed to enable modem dial-in and dial-out.
>
> When a fault occurs for which dial-out has been programmed, the modem will dial out and send a message. During the dial-out time, neither dial-in nor local RS-232 access is available. Access is available after the message has been sent or during the modem off-line delay. If no access is allowed, removing the fault and cycling the power to the DGC-1000 resets the DGC-1000 and allows access.

Modem Setup Tab

The Modem Setup tab settings are shown in Figure 6-20 and described in the following paragraphs.

Phone Number #1, #2, #3, and #4. These four setting fields contain the telephone numbers that the DGC-1000 dials when the selected input is activated. The numbers are dialed in sequence until a connection is obtained.

Pager ID Number. These four setting fields contain the numbers that identify the specific pager that is being addressed when the corresponding telephone number (Phone Number #1, #2, #3, or #4) is dialed by the DGC-1000.

Site Information. This programmable label identifies the source of the pager message. It is sent to the pager when the dial-out connection is made. Up to eight alphanumeric characters may be entered.

Inter Dialout Time Delay. This setting selects the length of time between dial-out attempts. The delay allows time for the modem to reset. A setting of 15, 30, 60, or 120 seconds may be entered.

Rings for Modem Answer. This setting selects the number of rings allowed before the modem picks up the line and negotiates a connection. Permitting several rings to occur before the modem picks up provides time for an operator to answer a telephone using the same line as the modem. This allows the modem and a telephone to share one line. A setting of 1 to 9 rings may be entered.

Page Buffer Limit. This setting is set equal to, or less than the specific pager buffer size. If the message length exceeds the Page Buffer Limit, another call is made and the message is continued. A setting of 80, 120, 160, or 200 characters may be entered.

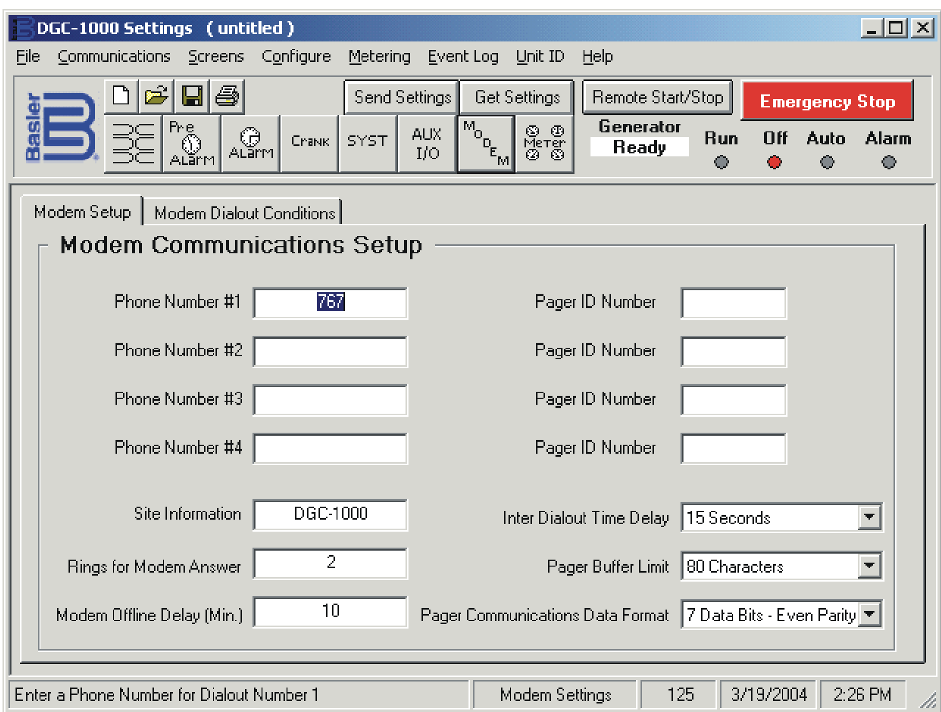

Figure 6-20. Modem Settings Screen, Modem Setup Tab

Modem Offline Delay (Min.). This setting controls the amount of time allowed between DGC-1000 dial-out attempts. The Modem Offline Delay setting allows time for a user to dial into the DGC-1000. A setting of 1 to 240 minutes may be entered.

Pager Communication Data Format. This setting controls the data format for the modem. Telelocator alphanumeric protocol (TAP version 1.7) is implemented by the DGC-1000 for communication with a pager. The protocol specifies seven data bits with even parity. A setting of eight data bits with no parity may also be selected.

Modem Dialout Conditions Tab

The Modem Dialout Conditions tab settings are shown in Figure 6-21. (Not all settings are visible in the illustration.) The Modem Dialout Conditions Tab consists of a list of alarms, pre-alarms, and conditions that can be assigned to cause the DGC-1000 to dial out. An output is selected by clicking the checkbox in the appropriate row. The following alarms, pre-alarms, and conditions can be selected to cause the DGC-1000 to dial out.

- Active DTC pre-alarm
- Auxiliary input 1 closed
- Auxiliary input 2 closed
- Auxiliary input 3 closed
- Auxiliary input 4 closed
- Battery charger failure pre-alarm
- Battery overvoltage pre-alarm
- Coolant temperature sender failure alarm
- Cool-down timer active
- ECU protective shutdown alarm
- Emergency stop alarm
- Fuel leak/sender failure pre-alarm
- High coolant temperature alarm
- High coolant temperature pre-alarm
- kW overload pre-alarm
- Loss of ECU communication alarm
- Loss of ECU communication pre-alarm
- Loss of voltage sender failure alarm
- Low battery voltage pre-alarm
- Low coolant level alarm
- Low coolant temperature pre-alarm
- Low fuel alarm
- Low fuel pre-alarm
- Low oil pressure alarm
- Low oil pressure pre-alarm
- MPU Speed Sender Failure alarm
- Oil pressure sender failure alarm
- Overcrank alarm
- Overspeed alarm
- Scheduled maintenance pre-alarm
- Switch not in Auto position
- Weak battery voltage pre-alarm

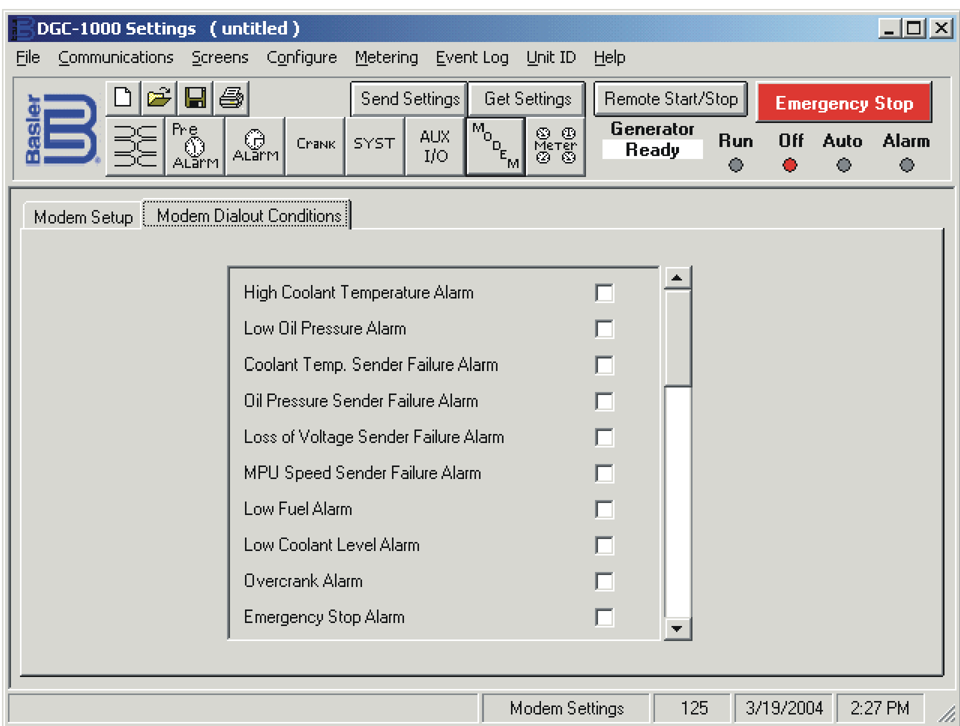

Figure 6-21. Modem Settings Screen, Modem Dialout Conditions Tab

Metering

Click the **Meter** button to access the Metering screen or click **Screens** on the menu bar and click **Metering**. The Metering screen consists of nine tabs.

- System
- Voltage
- Current
- Power
- General
- Summary
- Alarms
- ECU DTC Info
- ECU Data
- MTU MDEC

The ECU DTC Info and ECU Data tabs are visible and enabled only when ECU support is enabled on the BESTCOMS System Settings screen and the Engine Configuration is Standard J1939 or Volvo Penta EDC III.

The MTU MDEC tab is visible and enabled only when ECU support is enabled on the BESTCOMS System Settings screen and the Engine Configuration is MTU MDEC.

When viewing the Metering screen, metering can be enabled and disabled by clicking the **Meter** button. When viewing other screens, metering can be enabled and disabled through the **Metering** menu on the menu bar

System Tab

System tab metering values are shown in Figure 6-22 and described in the following paragraphs.

Coolant Temp. Two metering fields display engine coolant temperature in degrees Fahrenheit and degrees Celsius.

Oil Pressure. Two metering fields display engine oil pressure in pounds per square inch and kilopascals.

Battery Voltage. This metering value indicates the battery voltage level.

Fuel Level. This metering value indicates the percentage of remaining fuel.

Speed. This metering value indicates the rotational speed of the engine in revolutions per minute.

Load. This metering value, expressed as a percentage of the genset power rating, indicates the genset load. The genset power rating is entered through the Genset's kW Rating setting on the System Settings screen.

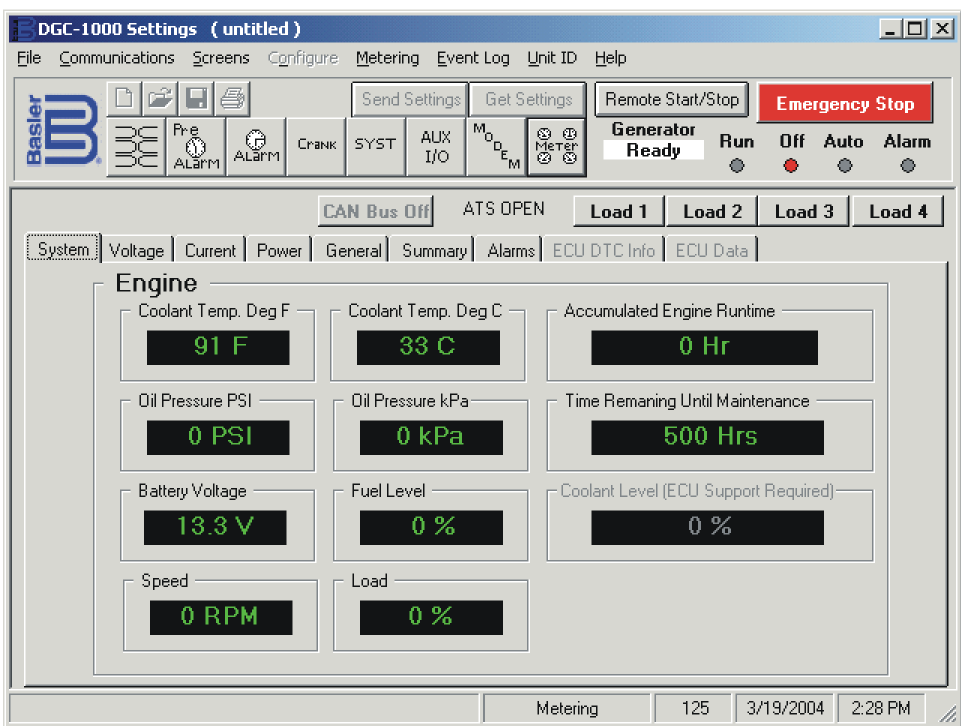

Figure 6-22. Metering Screen, System Tab

Accumulated Engine Runtime. This metering value indicates the total, accumulated hours of engine runtime. Accumulated engine running time can be adjusted by a user with OEM-level password access. See *Run Time and KW Hours* for more information.

Time Remaining Until Maintenance. This value indicates the engine runtime left until the next scheduled maintenance.

Coolant Level. This metering value, expressed as a percentage of total coolant capacity, indicates the fluid level of the engine cooling system. ECU support is required to enable this metering value.

Programmable Buttons

These four buttons, labeled Load 1, Load 2, Load 3, and Load 4, may be configured (through the Input/Output Settings screen Aux Output Setup tab) to operate any combination of the eight auxiliary output contacts. When one of the buttons is clicked, the corresponding auxiliary output changes state. A button's color changes from gray to red when the controlled output is closed and changes from red to gray when the controlled output is opened.

Buttons Load 1 and Load 2 have fixed labels. The labels on buttons Load 3 and Load 4 can be changed to a user-selected label consisting of up to six alphanumeric characters.

If the DGC-1000 is in Off mode or has an alarm, the programmable buttons have no effect on the auxiliary output contacts.

ATS Status Indicator

The ATS status indicator, located to the left of the Load 1 button, displays *ATS OPEN* when the automatic transfer switch contact input is open. *ATS CLOSED* is displayed when the automatic transfer switch contact input is closed.

ECU Status/Control Button

This button indicates the status of ECU communication and is used to pulse the ECU when ECU support is enabled.

When ECU support is disabled, the button is grayed out and indicates *CAN Bus Off*.

When ECU support is enabled (through the System Settings screen) and the ECU is offline, the button indicates *ECU Offline*. When this condition exists and the button is clicked, the ECU is pulsed.

Voltage Tab

Metering values displayed on the Voltage tab (Figure 6-23) depend upon the Generator Connection setting of the System Settings screen.

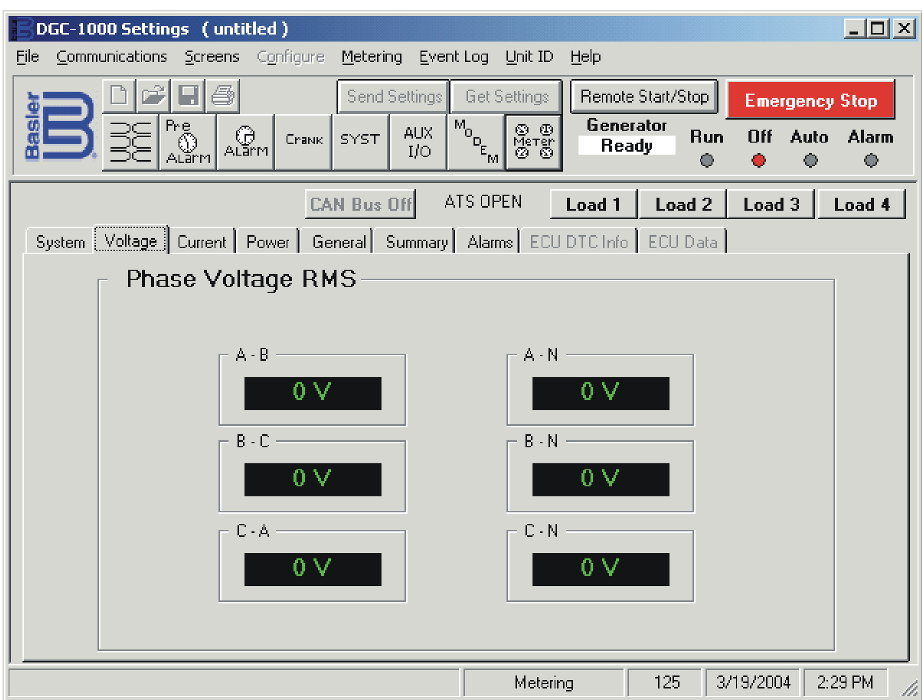

Figure 6-23. Metering Screen, Voltage Tab

When the Generator Connection setting is 3 Phase L-L, the Voltage tab displays rms voltage for A-phase to B-phase, B-phase to C-phase, and C-phase to A-phase.

When the Generator Connection setting is 3 Phase L-N, the Voltage tab displays rms voltage for A-phase to B-phase, A-phase to Neutral, B-phase to C-phase, B-phase to Neutral, C-phase to A-phase, and C-phase to Neutral.

When the Generator Connection setting is 1 Phase A-B, the Voltage tab displays rms voltage for A-phase to B-phase, A-phase to Neutral, and B-phase to Neutral.

Current Tab

Metering values displayed on the Current tab (Figure 6-24) depend upon the Generator Connection setting of the System Settings screen.

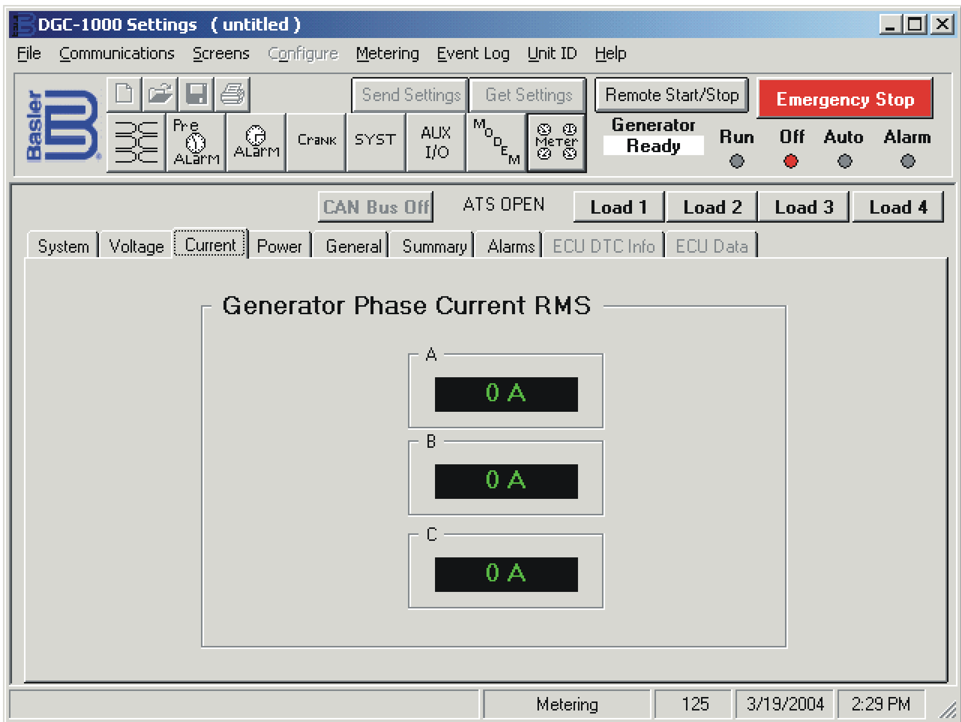

Figure 6-24. Metering Screen, Current Tab

When the Generator Connection setting is 3 Phase L-L or 3 Phase L-N, the Current tab displays rms current for phases A, B, and C.

When the Generator Connection setting is 1 Phase A-B, the Current tab displays rms current for phases A and B.

Power Tab

The Power tab (Figure 6-25) displays generator apparent power (kVA) and generator real power (kW). Metered power values depend upon the Generator Connection setting of the System Settings screen.

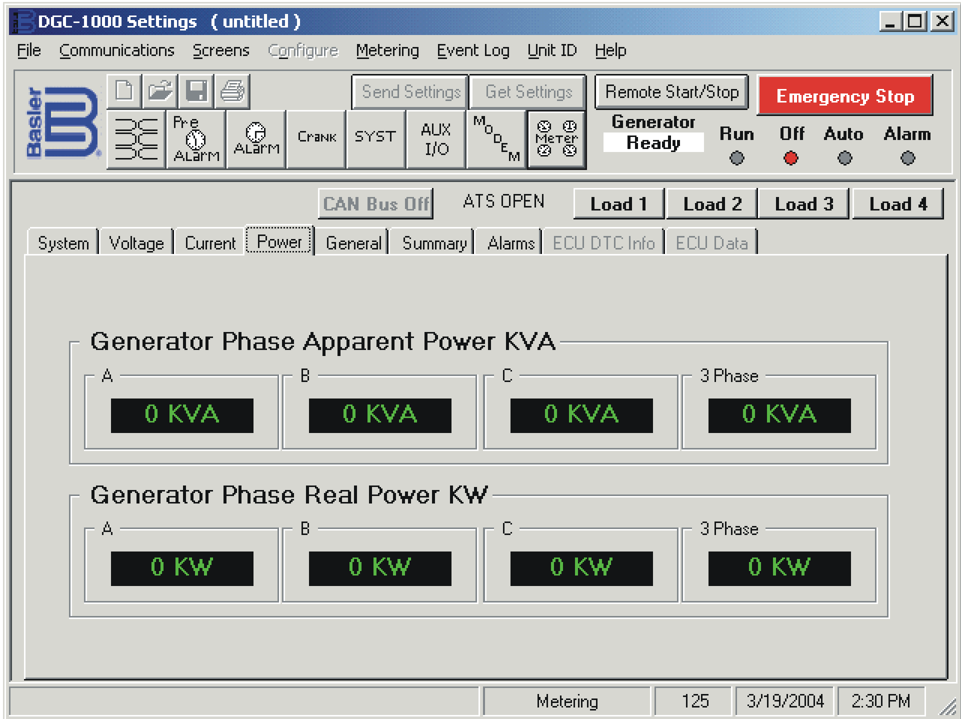

Figure 6-25. Metering Screen, Power Tab

When the Generator Connection setting is 3 Phase L-L or 3 Phase L-N, metered power values are displayed for phases A, B, C, and all phases combined.

When the Generator Connection setting is 1 Phase A-B, metered power values are displayed for phases A, B, and both phases combined.

General Tab

General tab metering values are displayed in Figure 6-26 and described in the following paragraphs.

Power Factor. This value is the calculated result of the real generator power divided by the apparent generator power (W ÷ VA).

Gen Frequency. This metering value indicates the frequency, in hertz, of the monitored generator voltage.

Total KW Hours. This metering value displays the accumulated generator kilowatt-hours. Total kilowatt-hours can be reset through the Total KW Hours Reset checkbox on the System Settings screen. Total kilowatt-hours can also be adjusted by a user with OEM-level password access. See *Run Time and KW Hours for* more information.

Summary Tab

The Summary tab (Figure 6-27) displays all of the metering values contained on the System, Voltage, Current, Power, and General tabs. Voltage, current, and power metering values displayed on the Summary tab depend upon the Generator Connection setting of the System Settings screen.

Alarms Tab

Alarms tab indicators (Figure 6-28) are divided into four categories: Pre-Alarms, Alarms, Sender Failure Alarms, and EPS.

Pre-Alarms, Alarms, and Sender Failure Alarms. When a pre-alarm or an alarm becomes active, the indicator next to the pre-alarm or alarm label changes from gray to green. In order for a pre-alarm to be annunciated, it must be enabled through the settings of the Pre-Alarms screen. In order for an alarm or sender failure alarm to be annunciated, it must be enabled through the settings of the Alarms screen.

EPS – Supplying Load. When the generator is supplying current to the load, this indicator changes from gray to green.

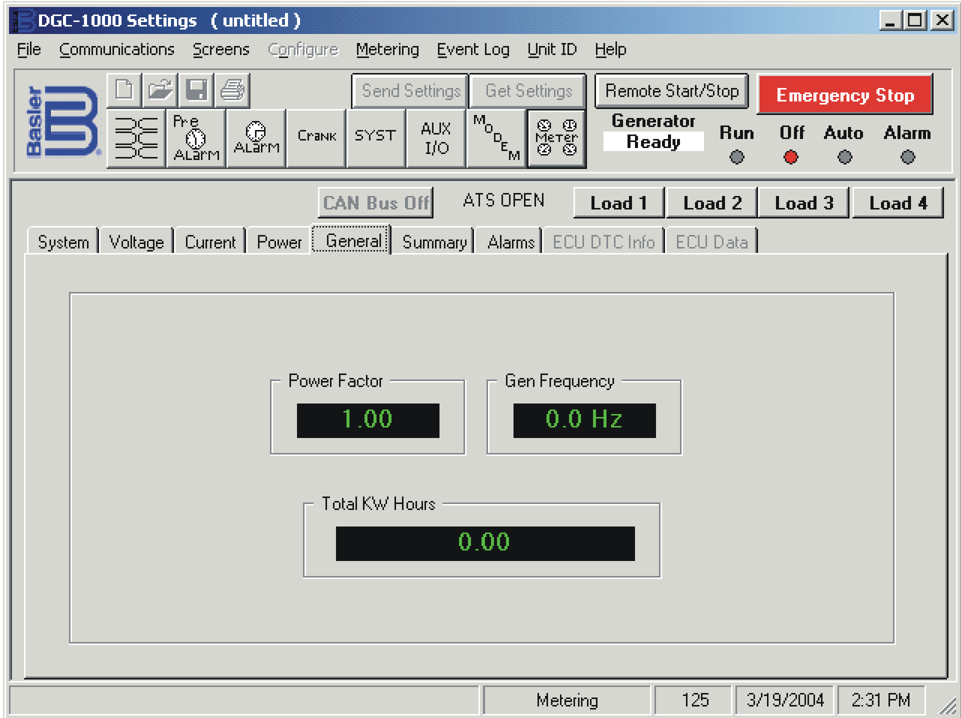

Figure 6-26. Metering Screen, General Tab

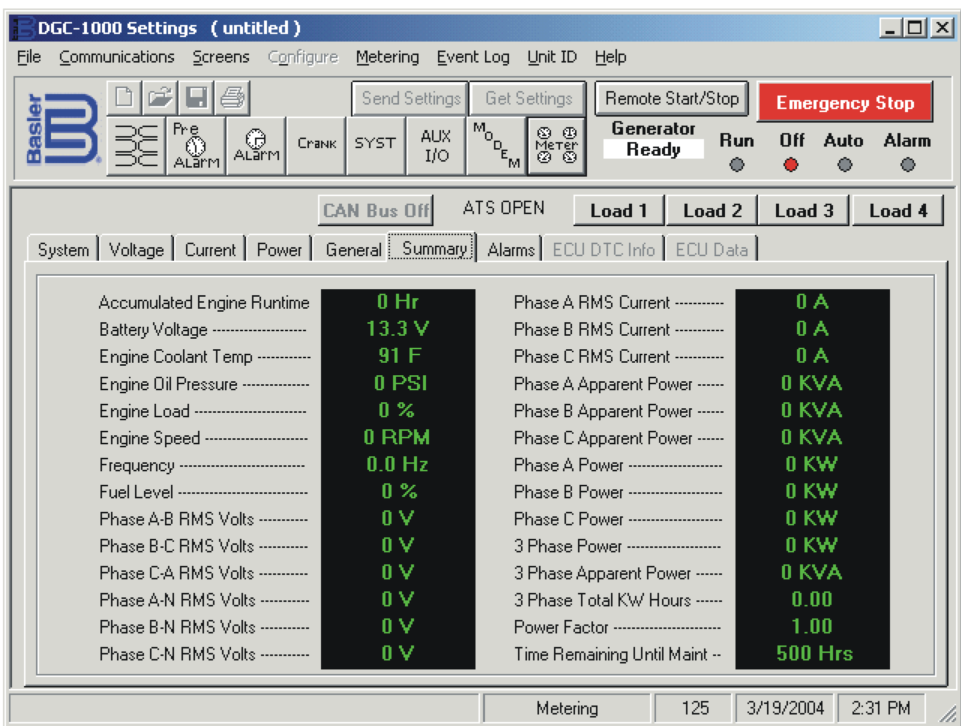

Figure 6-27. Metering Screen, Summary Tab

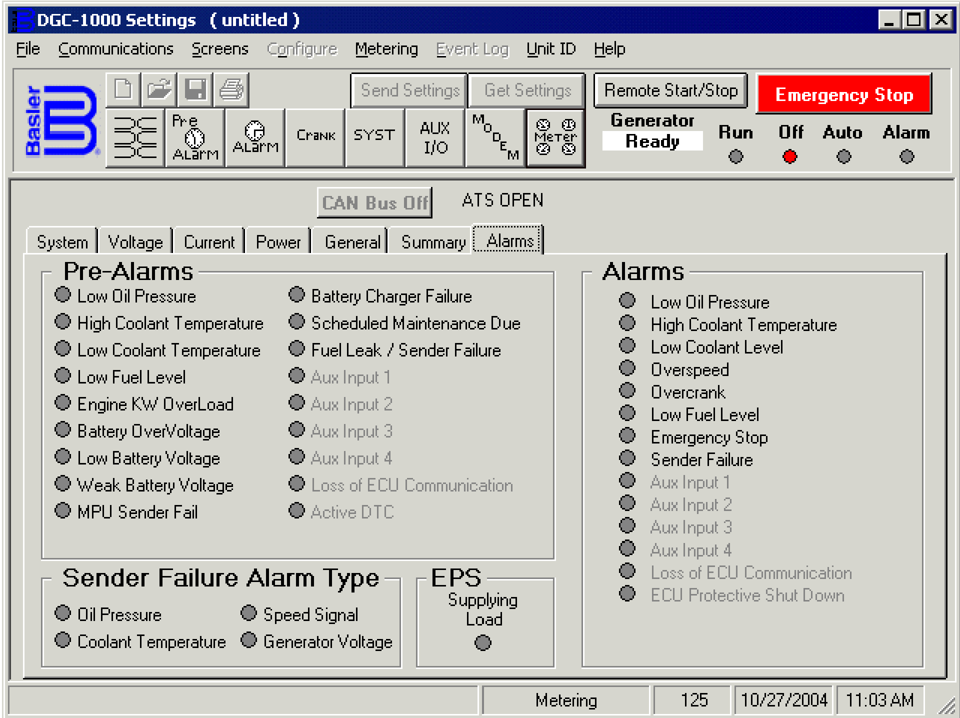

Figure 6-28. Metering Screen, Alarms Tab

ECU Data Tab

The ECU Data tab displays parameters obtained by the ECU (engine control unit) and reported through the SAE J1939 interface to the DGC-1000. Access to the ECU Data tab is enabled only when the Enable ECU Support checkbox of the System Settings screen is selected. Parameters displayed on the ECU Data tab are shown in Figure 6-29.

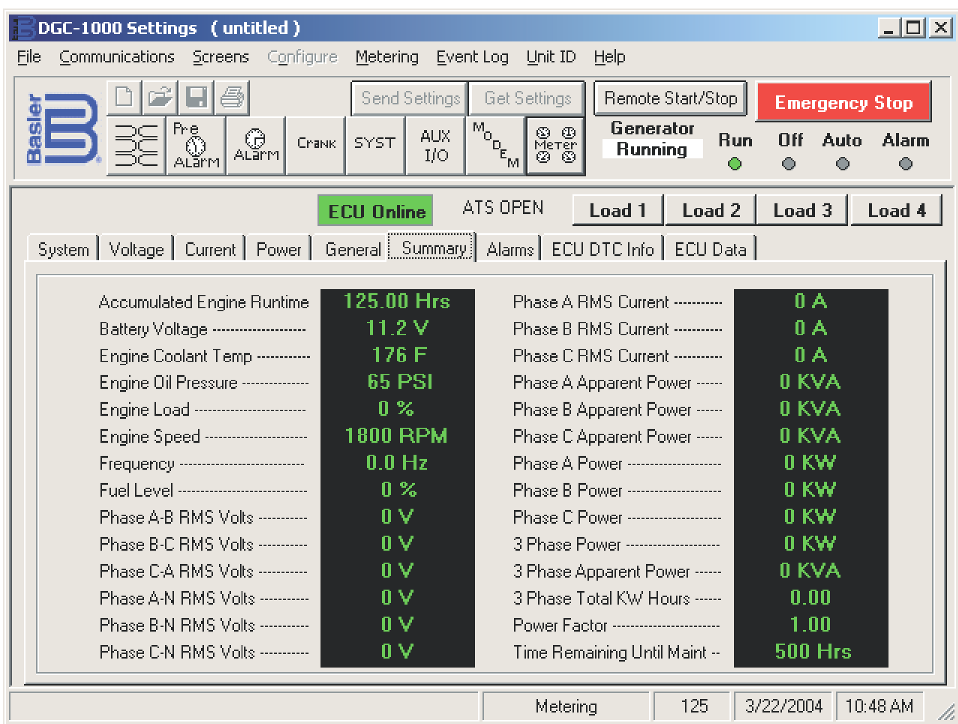

Figure 6-29. Metering Screen, ECU Data Tab

Clicking the **View Engine Configuration** button on the ECU Data tab displays the Engine Configuration screen shown in Figure 6-30. This screen displays a list of specifications that are specific to the engine being controlled by the ECU.

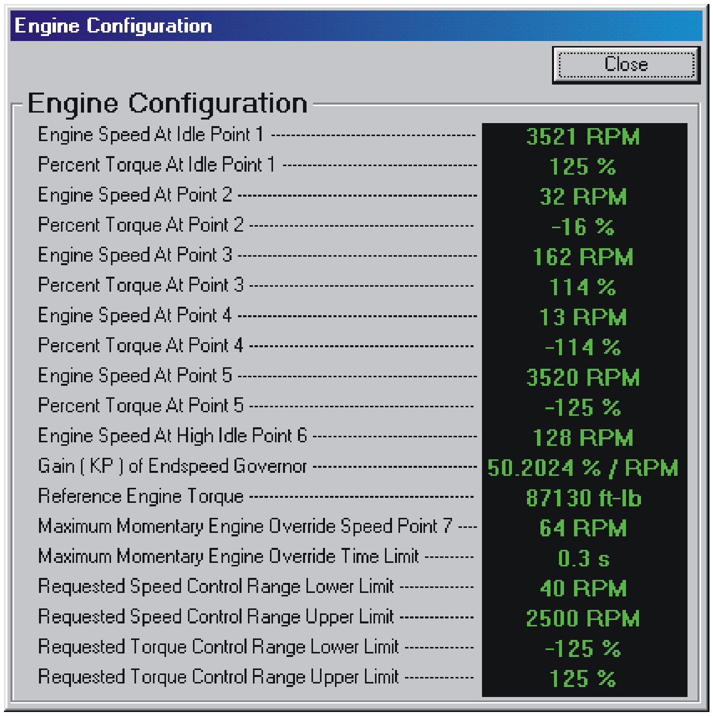

Figure 6-30. Engine Configuration Screen

ECU DTC Info Tab

The ECU DTC Info tab (Figure 6-31) displays both active and previously logged diagnostic trouble codes (DTCs) obtained from the ECU. ECU DTC Info tab indicators and controls are described in the following paragraphs.

Lamp Status – Stop. This indicator lights when DTC information warrants stopping the engine.

Lamp Status – Warning. This indicator lights when DTC information indicates an engine problem that is significant, but does not require immediate shutdown of the engine.

Lamp Status – Malfunction. This indicator lights when an emission related DTC is logged.

Lamp Status – Protect. This indicator lights when DTC information points to a problem that is probably not related to the engine's electronic subsystem.

Clear Previous DTC Information. Clicking this button clears the previously logged DTC information from the ECU DTC Info tab.

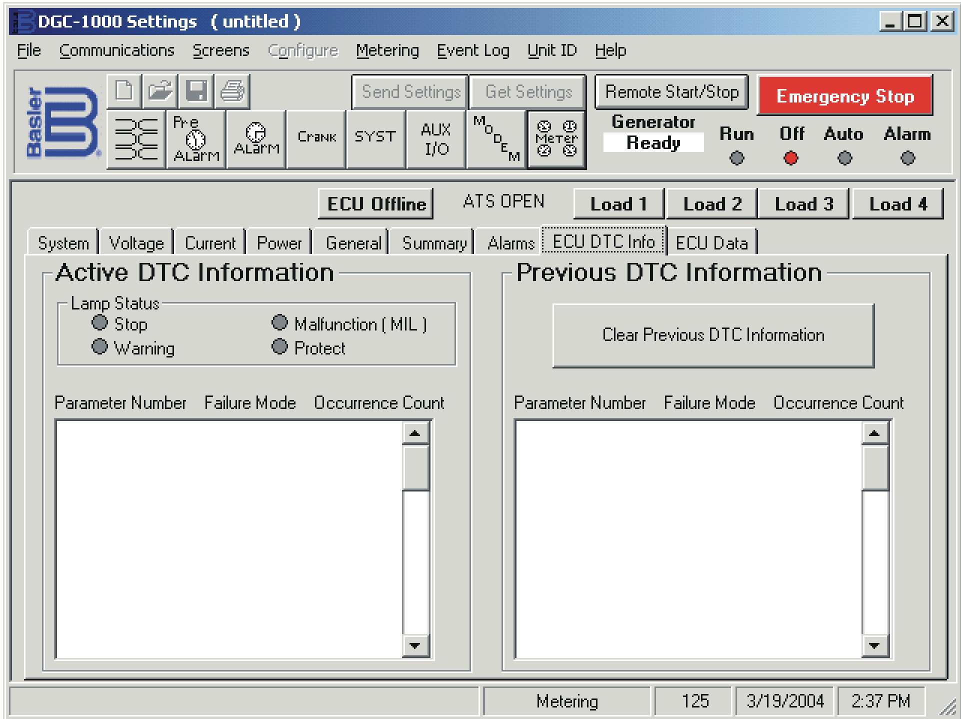

Figure 6-31. Metering Screen, ECU DTC Info Tab

<u>*MTU MDEC Tab*</u>

The MTU MDEC tab (Figure 6-32) displays pre-alarms, alarms, and fault code messages issued by the MDEC ECU. When the MDEC ECU issues an alarm or pre-alarm, the indicator next to the alarm or pre-alarm label changes from gray to red. Fault code messages issued by the MDEC ECU are displayed in the Active Faults window of the MDEC ECU tab. Clicking the Refresh button updates the Active Faults list by clearing all inactive fault messages. A list of possible fault code messages is provided in Section 3, *Functional Description*. Your MDEC ECU documentation should be consulted when diagnosing ECU fault codes.

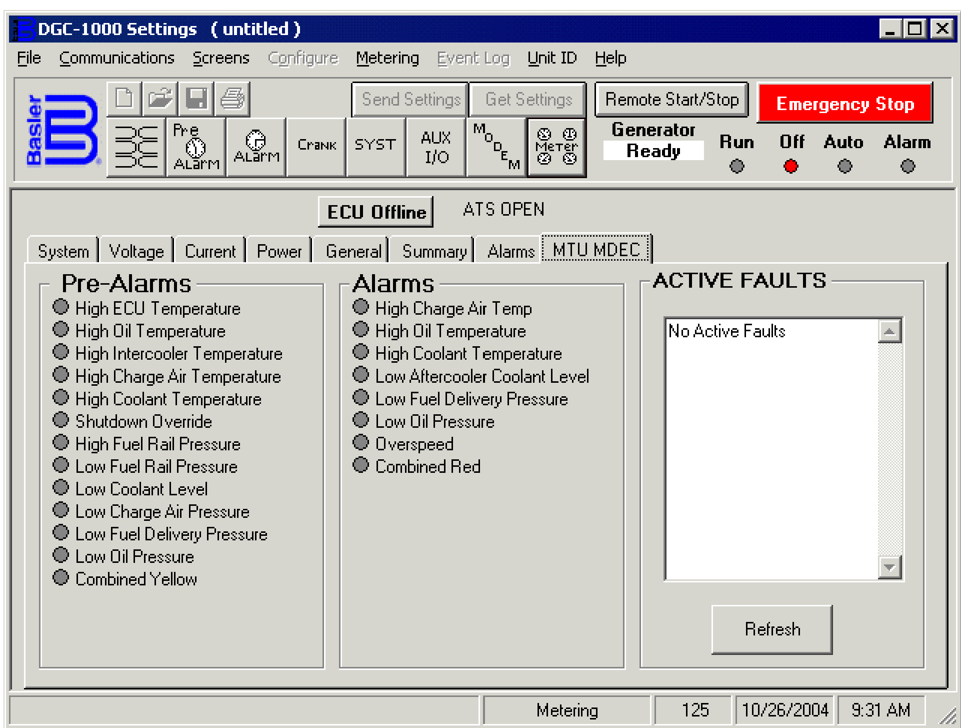

Figure 6-32. Metering Screen, MTU MDEC Tab

REAL-TIME CLOCK

The DGC-1000 real-time clock settings can be adjusted and verified through the Set Real Time Clock dialog box (Figure 6-33). Click **Configure** on the menu bar and click **Real Time Clock**.

To set the DGC-1000 real-time clock with the PC's time and date settings, perform the following steps.

1. Click the **Display PC Date and Time** button. The PC's clock settings are displayed in the date and time fields. (The date and time fields of the Set Real Time Clock dialog box cannot be changed manually.)
2. Select the **Automatically adjust for Daylight Savings Time** checkbox if automatic compensation for daylight savings time is desired.
3. Click the **Send to DGC** button to set the DGC-1000 real-time clock with the PC's time and date.

The DGC-1000 real-time clock settings can be viewed and verified by clicking the **Display DGC Settings** button.

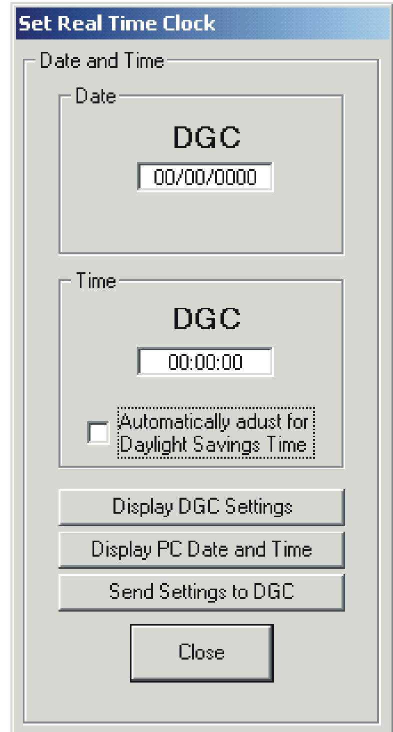

Figure 6-33. Set Real Time Clock Screen

PROGRAMMABLE SENDERS

Click **Configure** on the menu bar and click **Programmable Senders** to access the Programmable Senders screen. (If the Metering screen is being viewed, metering will need to be disabled to access the Configure menu.)

The Programmable Senders screen has three tabs: Coolant Temperature, Oil Pressure, and Percent Fuel Level. Because the setting fields and buttons of each tab are so similar, only the Coolant Temperature tab settings (Figure 6-34) are described here.

Get Cool. Data From DGC. If communication with a DGC-1000 is enabled, clicking this button retrieves the sender data points from the DGC-1000 and refreshes the graph.

Send Cool. Data To DGC. Clicking this button sends the displayed data points to the DGC-1000.

Load Cool. Settings File. Clicking this button displays an Open dialog box where a sender file containing sender data points can be retrieved. Some standard data point files for the three senders are included with BESTCOMS. Coolant temperature sender files have a CS1 extension, oil pressure sender files have an OS1 extension, and fuel level sender files have an FS1 extension.

Create Cool. Settings File. Clicking this button displays a Save As dialog box where the transducer data points created in BESTCOMS can be saved in a sender file. While it is possible to create individual sender files for each transducer, it is not necessary. The data for all three senders is automatically saved with the DGC-1000 configuration file. The *Settings Files* sub-section contains information about creating DGC-1000 configuration files.

Resistance. The 11 resistance points in this column are not adjustable. The DGC-1000 has been factory calibrated at these points to maximize accuracy.

Degrees F/Degrees C. Temperature values entered in this column must always maintain a descending order. If English units are used, adjacent coolant temperature points must be separated by at least 2°F. If metric units are used, adjacent oil pressure points must be separated by at least 7 kPa. The coolant temperature range is 32 to 400°F or 0 to 240°C. The oil pressure setting range is 0 to 250 psi or 0 to 1,725 kPa. The fuel level setting range is 0 to 100%.

Sender Slope. If a sender requires a positive slope, Positive can be selected to invert the values in the Resistance column.

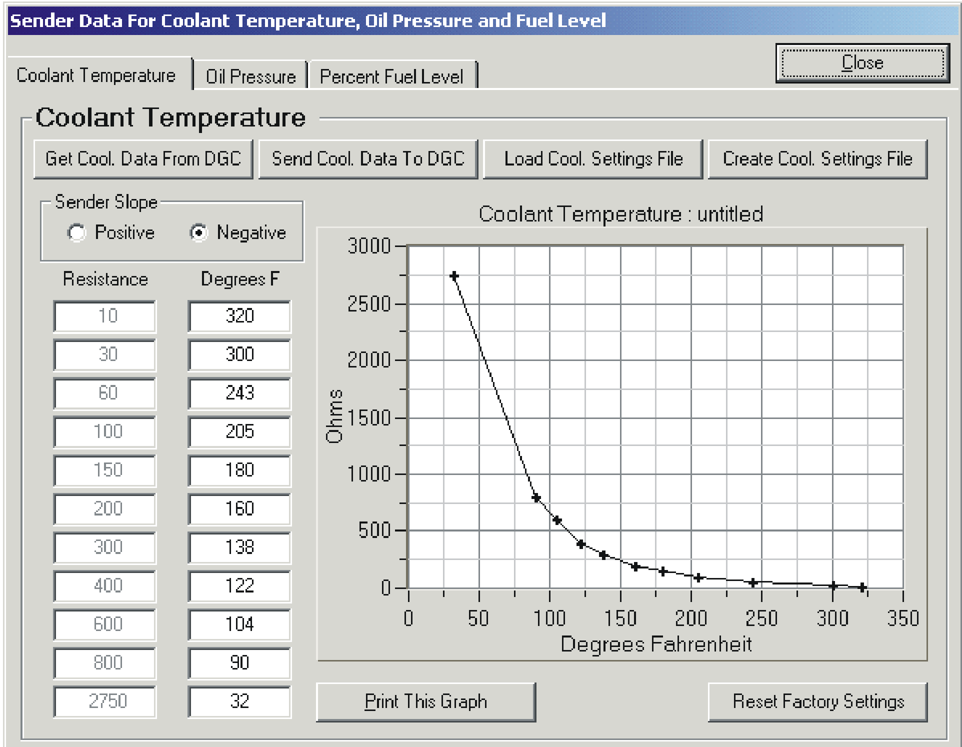

Figure 6-34. Programmable Senders Screen, Coolant Temperature Tab

Print This Graph. Clicking this button displays a print preview screen that allows selection of a printer, page orientation, and graph image magnification. Clicking **Print** sends the graph image to the target printer. Clicking **Close** returns to the Programmable Senders screen.

Reset Factory Settings. Clicking this button restores the factory default data points in the Degrees

NOTE

When metric values are used and changes are made to the oil pressure sender data points, undesirable internal rounding of some data points can occur. For example, select 700 kPa for one data point, create a sender file, and the value is rounded to 697. Rounding that occurs will never be greater than 4 kPa.

F/Degrees C column and graph. This does not update the data points in the DGC-1000. the DGC-1000 is updated by clicking the **Send Cool. Data to DGC** button.

RUN TIME AND KW HOURS

The accumulated running time and kilowatt-hours for a genset can be adjusted by accessing the Run Time and KW Hours dialog box shown in Figure 6-35. Click **Configure** on the menu bar and click **Engine Runtime & KW Hours**. Unless access is gained by using the OEM-level password, the Engine Runtime & KW Hours selection will not appear in the Configure pull-down menu.

To adjust the accumulated engine run time, enter the desired time in the Hours and Minutes fields and click the **Update DGC Accumulated Engine Runtime** button.

To adjust the genset total kilowatt-hours, enter the desired value in the KW Hours field and click the **Update DGC Total KW Hours** button.

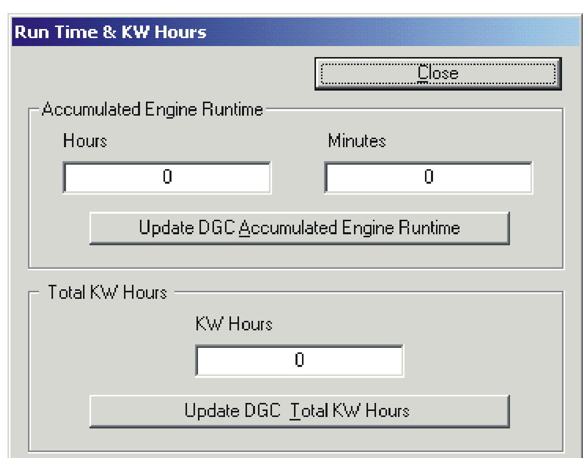

Figure 6-35. Run Time and KW Hours Dialog Box

ENGINE CONTROL UNIT (ECU) INTERFACE

For J1939 applications, the interface between the DGC-1000 and ECU is configurable. First, the output contact used to power up the ECU (for non-continuously powered ECU applications) is selectable. Second, periodic communication with the ECU (also referred to as pulsing the ECU) may be disabled if the application requires it. Third, the timers associated with pulsing the ECU are programmable. The settings used to configure the ECU interface are adjusted through the ECU Control dialog box. This dialog box is accessed by clicking **Configure** on the menu bar and clicking **ECU Control**. The ECU interface settings of the ECU Control dialog box are shown in Figure 6-36 and described below.

ECU Contact Control – Output Select. This setting selects the DGC-1000 output that is used to power up the ECU in J1939 applications where the ECU is not continuously powered. If the pre-start contact is selected, the fuel contact will still close during cranking and running of the genset to provide a separate indication that the genset is running.

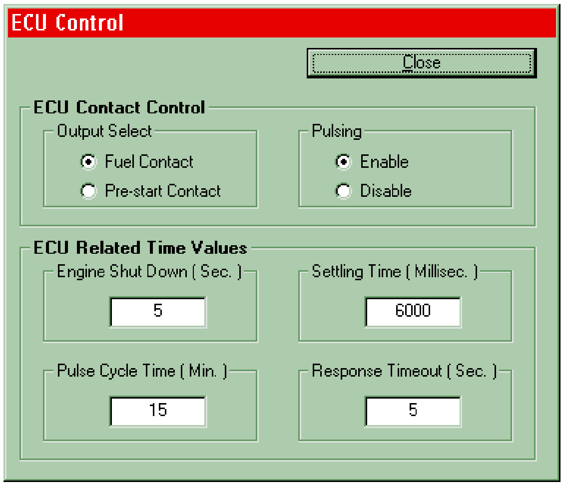

Figure 6-36. ECU Control Dialog Box

ECU Contact Control – Pulsing. In J1939 applications where the ECU is not continuously powered, the DGC-1000 will normally pulse the ECU periodically to update its engine monitoring data. For applications where this periodic pulsing is not desired, this setting allows the pulsing feature to be disabled.

ECU Related Time Values – Engine Shut Down (Sec.). When going from Running to Shut Down, this setting adjusts the length of time that the DGC-1000 stays disconnected from the ECU before starting the first pulse. The Engine Shut Down setting range is 1 to 60 seconds.

ECU Related Time Values - Setting Time (Millisec.). This setting adjusts the time to gather data after connecting to the ECU during the pulsing state. This allows all metered values to be sent and ramp up. Metered values are sent by the ECU at different rates as designated by the SAE J1939 protocol. Values sent by the ECU may be low initially; the ECU takes time to average its own data. The Setting Time setting range is 5,500 to 30,000 milliseconds.

ECU Related Time Values - Pulse Cycle Time (Min.). This setting adjusts the time that the DGC-1000 waits to pulse the ECU again. The Pulse Cycle Time setting range is 1 to 60 minutes.

ECU Related Time Values - Response Timeout (Sec.). This setting controls the time that communication is attempted with the ECU while the DGC-1000 is in the Pulsing or Connect*ing* state. The Response Timeout setting range is 1 to 50 seconds.

EVENT LOG

The event log provides a historical record of events detected by the DGC-1000. Click **Event Log** on the menu bar to access the event log screen (Figure 6-367).

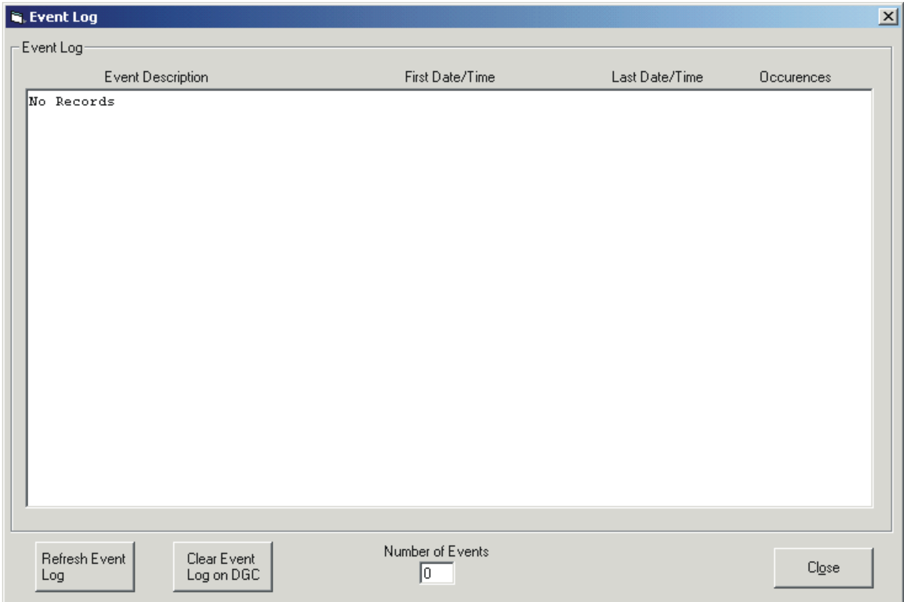

Figure 6-37. Event Log Screen

Any of the conditions in the following list will trigger an event log. Alarms and pre-alarms will not trigger an event log unless enabled through the Alarm Settings and Pre-Alarm Settings screens in BESTCOMS.

- Active DTCs pre-alarm
- ATS closed
- Auxiliary input contact 1 closed
- Auxiliary input contact 2 closed
- Auxiliary input contact 3 closed
- Auxiliary input contact 4 closed
- Battery charger failure pre-alarm
- Battery overvoltage pre-alarm
- BESTCOMS Load 1 button closed
- BESTCOMS Load 2 button closed
- BESTCOMS Load 3 button closed
- BESTCOMS Load 4 button closed
- CAN Bus failure alarm
- CAN Bus failure pre-alarm
- Coolant level sender failure
- Coolant temperature sender failure alarm
- DGC-1000 protective shutdown
- Emergency stop alarm
- Engine start
- Fuel leak/sender failure pre-alarm
- High coolant temperature alarm
- High coolant temperature pre-alarm
- kW overload pre-alarm
- Low battery voltage pre-alarm
- Low coolant level alarm
- Low coolant level alarm
- Low coolant level pre-alarm
- Low coolant temperature pre-alarm
- Low fuel level alarm
- Low fuel pre-alarm
- Low oil pressure alarm
- Low oil pressure pre-alarm
- MPU speed sensor sender failure alarm
- Normal shutdown
- Oil pressure sender failure alarm
- Overcrank alarm
- Overspeed alarm
- Scheduled maintenance pre-alarm
- ECU protective shutdown
- Voltage sender failure alarm
- Weak battery voltage pre-alarm

The event log screen lists the 20 most recent events recorded by the DGC-1000. When 20 events are logged, subsequent events overwrite the oldest events in the list. Each event listed has a description, the number of occurrences for the event, and a date/time stamp for the first and last occurrences of the event.

CHANGING THE COMMUNICATION PARAMETERS

When communication is established between a PC and DGC-1000, changes in BESTCOMS to the communication parameters affect both the PC and DGC-1000. When communication between a PC and DGC-1000 is closed, changes in BESTCOMS to the communication parameters affect only the PC.

Communication parameters are viewed and adjusted through the Communications Configure dialog box. This dialog box is accessed by clicking **Configure** on the menu bar and clicking **RS232**. The Communications Configure dialog box settings are illustrated in Figure 6-378 and described in the following paragraphs.

Baud Rate. This setting selects the communication rate. A baud rate of 1200, 2400, or 9600 may be selected.

Parity. This setting enables and disables summation checking of data transmitted between the PC and DGC-1000. A setting of No Parity, Odd Parity, or Even Parity can be selected.

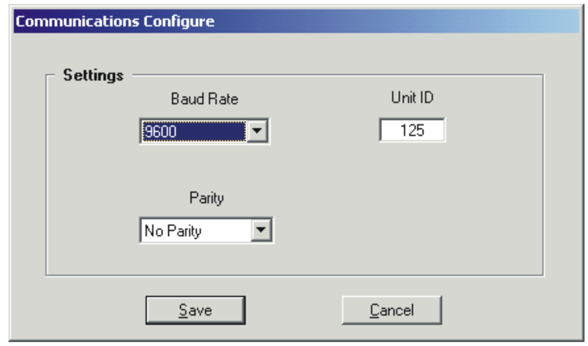

Figure 6-38. Communications Configure Dialog Box

Unit ID. This setting allows an identification number to be assigned to a DGC-1000 for polled communication. A number between 1 and 247 may be selected.

PASSWORD PROTECTION

Password protection guards against unauthorized changing of DGC-1000 settings. DGC-1000 passwords are case sensitive. Three levels of password protection are available. Each level is described in the following paragraphs.

- *Limited Access.* This password level allows all DGC-1000 settings to be read, but prevents any changes to settings. The default, limited-access password is *DGC*.
- *Full Access.* This password level allows all DGC-1000 settings to be read and allows all settings except Accumulated Engine Runtime and Total KW Hours to be changed. The default, full-access password is *DGC1000*.
- *OEM Access.* This password allows all DGC-1000 settings to be read and allows all settings to be changed. It also allows the DGC-1000 embedded firmware to be upgraded. The default, OEM-access password is *OEMLVL*.

Changing Passwords

Passwords can be changed only after communication between the PC and DGC-1000 is established. Changes to passwords are made through the Change Password dialog box. To access the Change Password dialog box, click **Communications** on the menu bar and click **Change Password**.

The content of the Change Password dialog box depends on the password level used when accessing the dialog box. For example, someone logged in with a full-access password will be able to change only the limited-access and full-access passwords—not the OEM-access password. Figure 6-389 illustrates the Change Password dialog box with all three access levels shown.

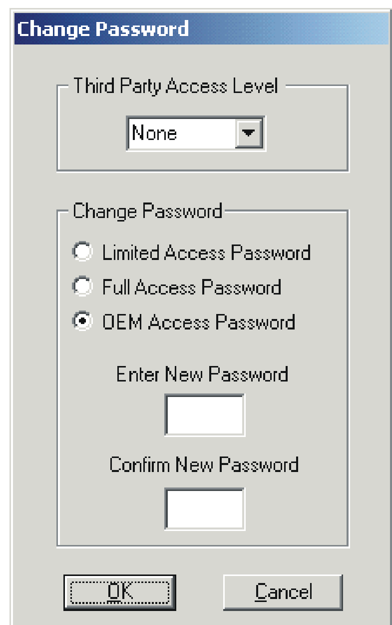

Figure 6-39. Change Password Dialog Box

A password is changed by selecting the access level, entering the new password, and then re-entering the new password to confirm the entry.

Once a password is changed, it should be stored in a secure location. If a user-defined password is lost or forgotten, contact Basler Electric for instructions on regaining password access.

Third Party Access Level

This setting determines the level of access that third party Modbus programs are allowed to have without going through the logon process. There are three levels of third party access: None (no access), Read Only, and Read/Write. The default level is None. The Third Party Access Level setting is accessible through the Change Password dialog box only when OEM-level access is obtained.

SETTINGS FILES

BESTCOMS software enables you to print a list of DGC-1000 settings, save DGC-1000 settings to a file, and open a settings file and upload those settings to a DGC-1000.

Printing Settings Files

A printout of DGC-1000 settings can be useful for record keeping or comparison purposes. Click the **Print Settings File** button or click **File** on the menu bar and click **Print** to access the Print DGC-1000 Settings screen. This screen contains a print preview pane and settings for selecting the printer, content of the printout, and the printout orientation. DGC-1000 settings are divided into five print sections: General, Auxiliary I/O, Modem, Input Sender, and ECU Timers. Any combination of sections can be selected for printing.

New Settings File

Clicking this button resets the settings displayed in BESTCOMS to the factory default values. The settings displayed in BESTCOMS can also be reset by clicking **File** on the menu bar and clicking **New**. If changes to settings have not been saved, you will be given the opportunity to save the changes in a DGC-1000 settings file.

Saving Settings Files

Saving DGC-1000 settings in a file for uploading to other DGC-1000 units saves setup time when configuring multiple units with the same settings. A settings file can also be created in BESTCOMS without being connected to a DGC-1000. The settings of the desired screens can be changed and these settings can then be saved in a file.

A settings file is created by clicking the **Save Settings File** button or clicking **File** on the menu bar and clicking **Save**. A file properties box appears and allows you to enter genset information and other pertinent notes about the settings. Next, a Save As dialog box prompts you to select the name and location of the settings file. All DGC-1000 settings files are automatically given a DG1 file extension by BESTCOMS.

Opening Settings Files

To open a DGC-1000 settings file, click the **Open Settings File** button or click **File** on the menu bar and click **Open**. An Open dialog box will appear and enable you to select a DGC-1000 settings file (DG1 extension) for retrieval into BESTCOMS.

TERMINATING COMMUNICATION

DGC-1000 communication is terminated by clicking **Communications** on the menu bar and clicking **Close**. If unsaved settings changes were made, you are prompted to save the changes in a new or existing settings file. When you execute the close communication command, with or without saving settings, communication with the DGC-1000 is terminated. If you choose to exit BESTCOMS (by clicking **File** on the menu bar and then **Exit**) without first closing communication, you are still given the opportunity to save any settings changes.

EMBEDDED FIRMWARE

Embedded firmware is the operating program that controls the actions of the DGC-1000. The DGC-1000 stores firmware in nonvolatile flash memory that can be reprogrammed through the RS-232 communication port. It is not necessary to replace EPROM chips when updating the firmware with a newer version.

Updating Firmware

Future enhancements to DGC-1000 functionality may make a firmware update desirable. Because default settings are loaded when DGC-1000 firmware is updated, your settings should be saved in a file prior to upgrading firmware. DGC-1000 firmware can be updated by performing the following steps.

> **CAUTION**
>
> If power is lost or communication is interrupted during file transfer, the DGC-1000 will cease operating and will not recover.

1. Connect a communication cable between the RS-232 connector of the DGC-1000 and the appropriate communication port of your PC. Start BESTCOMS-DGC-1000, open communication, and gain password access with the OEM-access password.
2. Place the DGC-1000 in Off mode. This can be accomplished by double-clicking the **Off** indicator on any of the BESTCOMS screens or by pressing the **Off** button on the DGC-1000 front panel.
3. Click **Configure** on the menu bar and click **Upgrade Embedded Firmware**. The Embedded Firmware Upgrade screen of Figure 6-40 will appear.

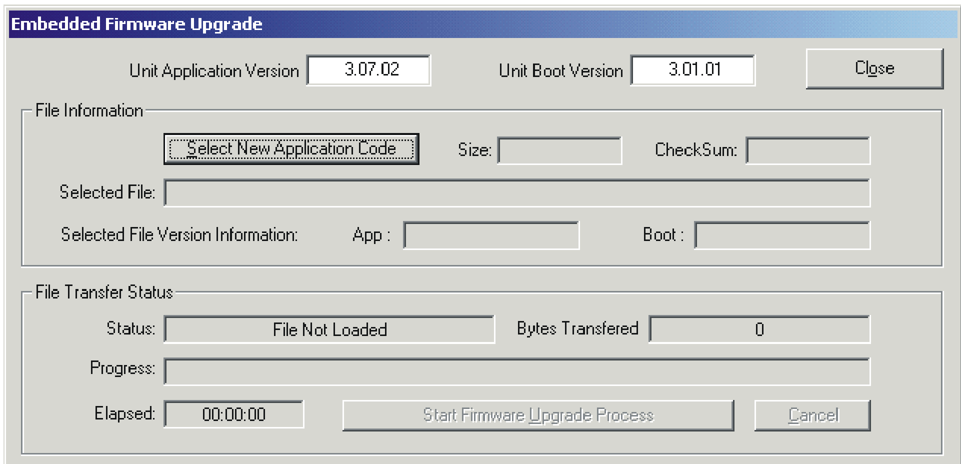

Figure 6-40. Embedded Firmware Upgrade Screen

4. Click the **Select new Application Code** button and then select the file (S19 file extension) to be used for updating the DGC-1000 firmware.
5. Click the **Start Firmware Upgrade Process** button to start the file transfer.
6. Once the file transfer is complete, close the Embedded Firmware Upgrade dialog box, open communication between the PC and DGC-1000, and gain password access to the DGC-1000 with the appropriate password.

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APPENDIX A • DGC-1000 SETTINGS RECORD

INTRODUCTION

This appendix lists all DGC-1000 parameter settings and their default values. This listing is in the form of a settings record that may be used to record information relative to your system. These settings sheets may be removed and photocopied.

DGC-1000 SETTINGS RECORD

Genset ID____**Date**______________________________

DGC-1000 Serial Number_________________________________**Software Version Number**___________

Sensing Transformer Settings

Setting Parameter	Default Setting	User Setting
Generator PT Primary Voltage	480 V	
Generator PT Secondary Voltage	480 V	
Generator CT Primary Current	500 A	

Pre-Alarm Settings

Setting Parameter	Default Setting	User Setting
Low Fuel Pre-Alarm Status	Disabled	
Low Fuel Pre-Alarm Threshold	25% of Full Tank	
Low Coolant Temp Pre-Alarm Status	Disabled	
Low Coolant Temp Pre-Alarm Threshold	50°F	
Battery Overvoltage Pre-Alarm Status	Disabled	
Battery Overvoltage Pre-Alarm Threshold	30.0 V	
Maintenance Interval Pre-Alarm Status	Disabled	
Maintenance Interval Pre-Alarm Threshold	500 h	
Engine kW Overload Pre-Alarm Status	Disabled	
Engine kW Overload Pre-Alarm Threshold	105% of Rated kW	
High Coolant Temp Pre-Alarm Status	Enabled	
High Coolant Temp Pre-Alarm Threshold	250°F	
Low Oil Pressure Pre-Alarm Status	Enabled	
Low Oil Pressure Pre-Alarm Threshold	25 psi	
Low Battery Voltage Pre-Alarm Status	Disabled	
Low Battery Voltage Pre-Alarm Threshold	20.0 V	
Low Battery Voltage Pre-Alarm Time Delay	10 s	
Weak Battery Voltage Pre-Alarm Status	Disabled	
Weak Battery Voltage Pre-Alarm Threshold	15.0 V	
Weak Battery Voltage Pre-Alarm Time Delay	2 s	
Audible Alarm	Enabled	
Battery Charger Failure Pre-Alarm	Disabled	
Fuel Level Sender Failure Pre-Alarm	Disabled	
Active DTC Pre-Alarm	Disabled	
Loss of ECU Communication Pre-Alarm	Disabled	

Alarm Settings

Setting Parameter	Default Setting	User Setting
High Coolant Temp Alarm Status	Enabled	
High Coolant Temp Alarm Threshold	275°F	
High Coolant Temp Alarm Time Delay	60 s	
Low Oil Pressure Alarm Status	Enabled	
Low Oil Pressure Alarm Threshold	15 psi	
Low Oil Pressure Alarm Time Delay	10 s	
Low Oil Pressure Alarm Status	Enabled	
Low Fuel Alarm Status	Enabled	
Low Fuel Alarm Threshold	2% of Full Tank	
Overspeed Alarm Status	Enabled	
Overspeed Alarm Threshold	110% of Rated	
Overspeed Alarm Time Delay	50 ms	
Coolant Temperature Sender Fail Alarm	Disabled	
Coolant Temp Sender Failure Alarm Time Delay	5 m	
Oil Pressure Sender Failure Alarm	Disabled	
Loss of Generator Voltage Alarm	Disabled	
Magnetic Pickup Failure Alarm	Enabled	
Global Sender Failure Alarm Time Delay	10 s	
Loss of ECU Communication Alarm	Disabled	

Cranking Settings

Setting Parameter	Default Setting	User Setting
Generator Cranking Style	Cycle	
Number of Crank Cycles	2	
Cycle Crank Time	5 s	
Continuous Crank Time	10 s	
Crank Disconnect Limit	30% of Rated	
Pre-Crank Delay	0 s	
Pre-Start Contact After Disconnect	Disabled	

System Settings

Setting Parameter	Default Setting	User Setting
Genset kW Rating	300 kW	
No-Load Cool Down Time	0 m	
Generator Engine RPM Rating	1800 rpm	
System Battery Voltage	24 V	

Setting Parameter	Default Setting	User Setting
NFPA Level	0	
Number of Flywheel Teeth	126	
Speed Signal Source	Magnetic Pickup & Gen	
Generator Connection	3 Phase, L-N	
Generator Frequency	60 Hz	
Unit System	English	
Generator Rotation	ABC	
CAN Bus Support	Disabled	
Engine Configuration	Standard J1939	
J1939 Source Address for this Unit	234	
Accelerator Pedal Position	50%	
Volvo Engine RPM Select	Primary	
MDEC Module Type	Module 302	
MDEC Speed Demand Source	Analog CAN	
Engine RPM	1800	

ECU Interface Settings

Setting Parameter	Default Setting	User Setting
ECU Contact Output Select	Fuel Contact	
ECU Pulsing	Enable	
Engine Shutdown Time	15 s	
ECU Settling Time	6000 ms	
ECU Pulse Cycle Time	15 m	
ECU Response Timeout	5 s	

Coolant Temperature Sender Curve Information

Resistance Value in Ohms	Default Setting	User Setting
10	320°F	
30	300°F	
60	242°F	
100	205°F	
150	180°F	
200	160°F	
300	138°F	
400	122°F	
600	104°F	

Resistance Value in Ohms	Default Setting	User Setting
800	89°F	
2750	32°F	

Oil Pressure Sender Curve Information

Resistance Value in Ohms	Default Setting	User Setting
0	150°F	
25	113°F	
50	83°F	
75	68°F	
100	52°F	
125	37°F	
150	26°F	
175	17°F	
200	10°F	
225	6°F	
250	0°F	

Fuel Level Sender Curve Information

Resistance Value in Ohms	Default Setting	User Setting
0	100%	
33	99%	
58	87%	
84	75%	
110	62%	
136	50%	
162	38%	
188	26%	
214	13%	
240	1%	
250	0%	

Programmable Input Contact Setup

	Default Setting	User Setting
Input 1 Function	Auxiliary Input	
Input 1 Auxiliary Configuration	Not Configured	
Input 1 Auxiliary Input Label	AUX IN 1	

	Default Setting	User Setting
Input 2 Function	Auxiliary Input	
Input 2 Auxiliary Configuration	Not Configured	
Input 2 Auxiliary Input Label	AUX IN 2	
Input 3 Function	Auxiliary Input	
Input 3 Auxiliary Configuration	Not Configured	
Input 3 Auxiliary Input Label	AUX IN 3	
Input 4 Function	Auxiliary Input	
Input 4 Auxiliary Configuration	Not Configured	
Input 4 Auxiliary Input Label	AUX IN 4	

Auxiliary Output Setup

Condition to Annunciate	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8
High Coolant Temperature Alarm								
Low Oil Pressure Alarm								
Coolant Temp. Sender Failure Alarm								
Oil Pressure Sender Failure Alarm								
Loss of Generator Voltage Alarm								
Speed Sender Failure Alarm								
Low Fuel Alarm								
Low Coolant Level Alarm								
Over-Crank Alarm								
Emergency Stop Alarm								
Overspeed Alarm								
Low Fuel Pre-Alarm								
Low Coolant Temp. Pre-Alarm								
kW Overload Pre-Alarm								
High Coolant Temp. Pre-Alarm								
Low Oil Pressure Pre-Alarm								
Low Battery Voltage Pre-Alarm								
Weak Battery Voltage Pre-Alarm								
Battery Charger Failure Pre-Alarm								
Scheduled Maintenance Pre-Alarm								
Unit Not in Auto								
Fuel Leak/Sender Failure Pre-Alarm								

Condition to Annunciate	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8
Cooldown Timer Active								
Auxiliary Input 1 Closed								
Auxiliary Input 2 Closed								
Auxiliary Input 3 Closed								
Auxiliary Input 4 Closed								
Load Button 1 Pressed								
Load Button 2 Pressed								
Load Button 3 Pressed								
Load Button 4 Pressed								

Modem/Dial-Out Settings

Setting Parameter	Default Setting	User Setting
First Telephone Number	-	
First Pager ID Number	-	
Second Telephone Number	-	
Second Pager ID Number	-	
Third Telephone Number	-	
Third Pager ID Number	-	
Fourth Telephone Number	-	
Fourth Pager ID Number	-	
Site Information	DGC-1000	
Rings Before Modem Answers	2	
Off-Line Delay	10 m	
Inter-Dial-Out Delay	15 s	
Pager Buffer Size Limit	80 characters	
Pager Communication Data Format	7 data bits, even parity	

Modem Dial-Out Conditions

Condition to Annunciate		Condition to Annunciate	
High Coolant Temperature Alarm		Weak Battery Voltage Pre-Alarm	
Low Oil Pressure Alarm		Battery Charger Failure Pre-Alarm	
Coolant Temp. Sender Failure Alarm		Scheduled Maintenance Pre-Alarm	
Oil Pressure Sender Failure Alarm		Unit Not in Auto	
Loss of Generator Voltage Alarm		Fuel Leak/Sender Failure Pre-Alarm	
Speed Sender Failure Alarm		Cooldown Timer Active	
Low Fuel Alarm		Auxiliary Input 1 Closed	

Condition to Annunciate		Condition to Annunciate	
Low Coolant Level Alarm		Auxiliary Input 2 Closed	
Over-Crank Alarm		Auxiliary Input 3 Closed	
Emergency Stop Alarm		Auxiliary Input 4 Closed	
Overspeed Alarm		Load Button 1 Pressed	
Low Fuel Pre-Alarm		Load Button 2 Pressed	
Low Coolant Temp. Pre-Alarm		Load Button 3 Pressed	
kW Overload Pre-Alarm		Load Button 4 Pressed	
High Coolant Temperature Pre-Alarm		Active Diagnostic Trouble Code Pre-Alarm	
Low Oil Pressure Pre-Alarm		Loss of ECU Communication Alarm	
Low Battery Voltage Pre-Alarm		Loss of ECU Communication Pre-Alarm	
		ECU Protective Shutdown	

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