

# PowerWizard



**Level 1.0 &  
Level 2.0  
Control Systems  
Training**

# Systems Comparison

	Level 1	Level 2	Level 3	Level 4
Current Systems			<i>Solutions</i>	
New Systems			PowerWizard Level 3.0	PowerWizard Level 4.0

# Overview

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 Common parts from 10 – 2000kVA;

- 9 – 32vdc Operating range

 2 Display Languages;

- Technician English or Customer language

 Common Engine wiring system

 Programmed using standard EST Service tool

 Sheet steel module

 Spare fault channels

 J1939 communication with Electronic Control Modules

# Level 1.0 Control System

☒ Alarm / Shutdown Protection - Fail to Start, Low Oil Pressure, High Coolant Temperature, Overspeed and;

- Low / High Battery Volts
- Static Battery Charger Failure
- Underspeed
- Loss of Speed signal detection
- 2 spare fault channels

☒ 20 Event Fault log

☒ J1939 CAN 1 data link for Service tool

☒ No remote communications

☒ AC Metering – Volts, Amps, Frequency

☒ DC Metering – Battery Volts, Hours Run, Engine Jacket Water Temperature, Lube Oil Pressure, Engine Speed



# Control Architecture – Level 1.0



Hardwired senders on  
mechanical engines

J1939 on electronic engines

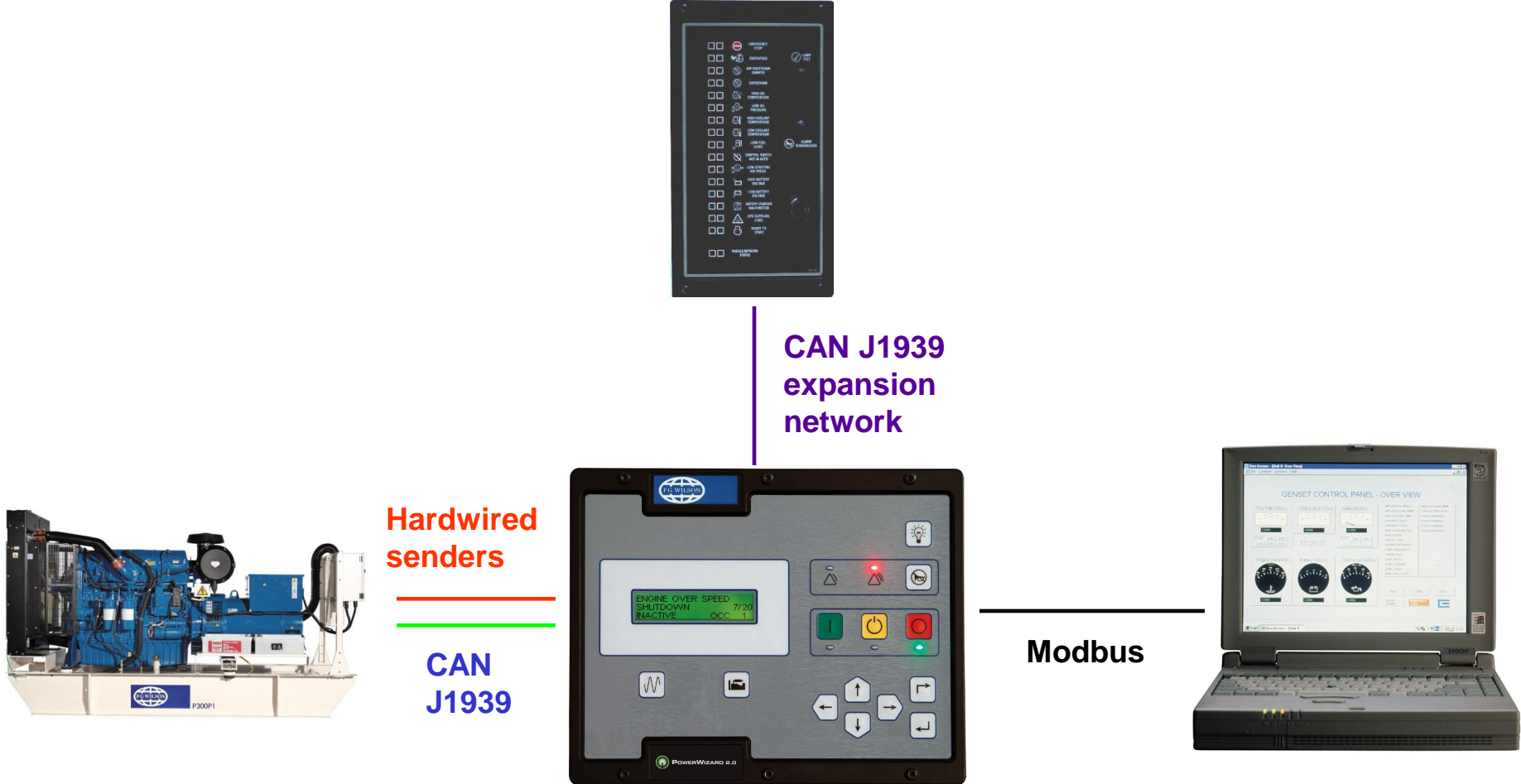


# Level 2.0 Control System

- 🗄️ Auto Start controls, protection and metering as Level 1.0 and;
- 🗄️ AC Metering – kW, kVA, kVar, Power Factor, kW hours, kVar hours
- 🗄️ DC Metering – Crank Attempt counter, Start counter
- 🗄️ Alarm / Shutdown Protection - Under / Over Volts, Under / Over Frequency, Overcurrent
- 🗄️ 4 spare fault channels
- 🗄️ CAN 2 J1939 Accessory Data Link
- 🗄️ Digital I/O modules
  - Remote Annunciator
- 🗄️ Real time clock
- 🗄️ Service interval counter
- 🗄️ Modbus remote communications using RS485 (2 wire)



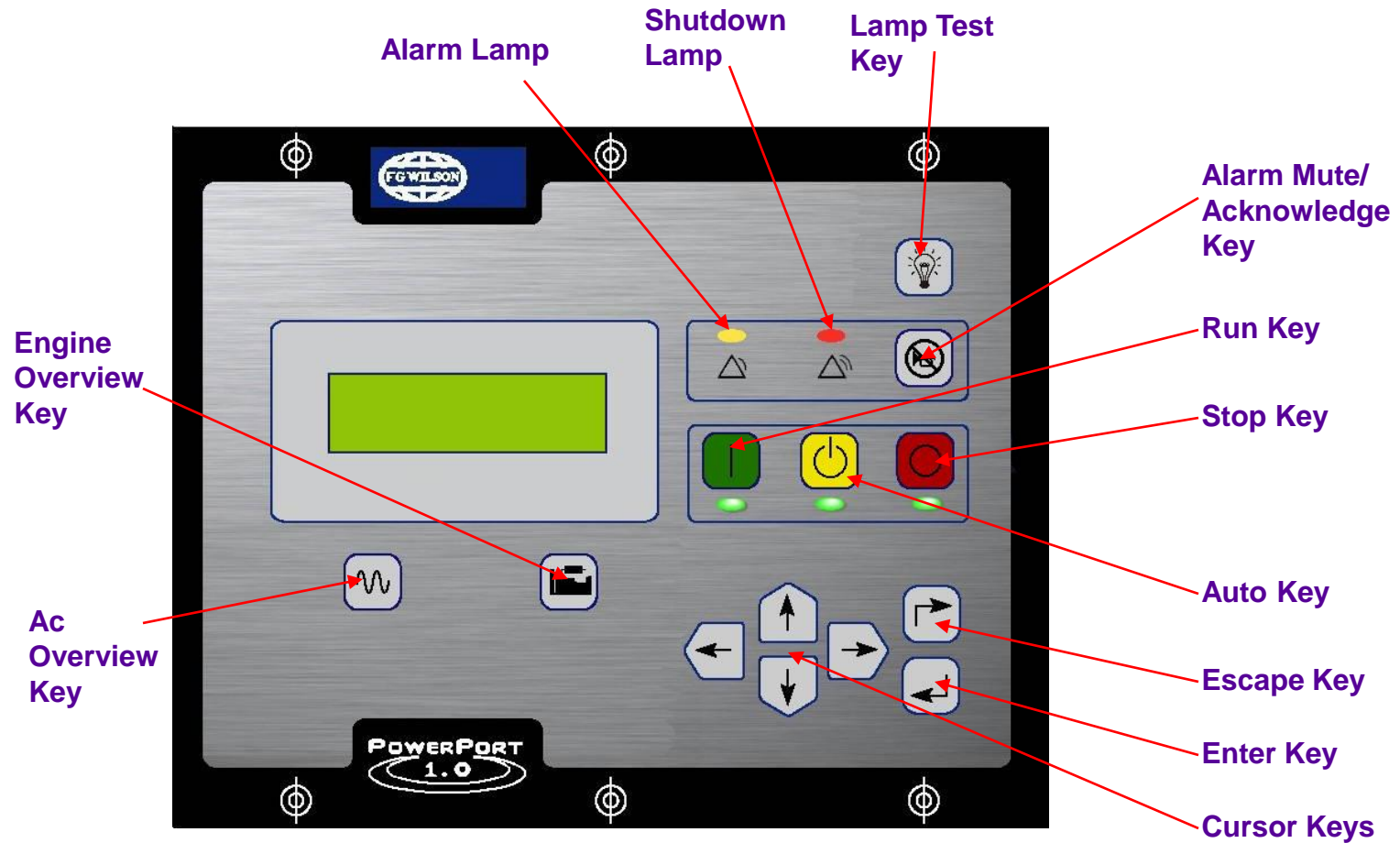
# Control Architecture – Level 2.0







# Panel Layout



# Navigation Keys

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**AC Overview** – The “AC Overview” key will navigate the display to first screen of AC information.

**Engine Overview** – The “Engine Overview” key will navigate the display to the first screen of engine information.

**Alarm Acknowledge / Mute** – Pressing the “Mute / Acknowledge” key will cause the horn relay output to turn off and silence the horn. Pressing the key will also cause any yellow or red flashing lights to turn off or to become solid depending on the active status of the alarms. The “Acknowledge” key may also be configured to send out a “Global Alarm Silence” on “J1939 Data Link” which will silence horns on annunciators.

**Lamp Test** – Pressing and holding the “Lamp Test” key will cause all of the LED’s and the display screen pixels to turn on until the key is released.

**RUN** – Pressing the “RUN” key will cause the engine to enter the “RUN” mode.

**AUTO** – Pressing the “AUTO” key will cause the engine to enter the “AUTO” mode.

**STOP** – Pressing the “STOP” key will cause the engine to enter the “STOP” mode.

**Escape** – The “ESCAPE” key is used during menu navigation in order to navigate up through the menu structure. Each key press causes the user to move backwards/upwards through the navigation menus. The “Escape” key is also used to cancel out of data entry screens during setpoint programming. If the “Escape” key is pressed during setpoint programming, none of the changes made on screen will be saved to memory.

**Enter** – The “Enter” key is used during menu navigation to select menu items in order to navigate forward/downward in the menu/sub-menu structure. The “Enter” key is also used during setpoint programming in order to save setpoints changes. Pressing the “Enter” key during setpoint programming causes setpoint changes to be saved to memory.



# Alarm Indicators

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**Yellow Warning Light** – A flashing yellow light indicates that there are unacknowledged active warnings. A solid yellow light indicates that there are acknowledged warnings active. If there are any active warnings the yellow light will change from flashing yellow to solid yellow after the Alarm Acknowledge key is pressed. If there are no longer any active warnings, the yellow light will turn off after the “Acknowledge” key is pressed.

**Red Shutdown Light** – A flashing red light indicates that there are unacknowledged active shutdown events. A solid red light indicates that there are acknowledged shutdown events active. If there are any active shutdown events the red light will change from flashing red to solid red after the Alarm Acknowledge key is pressed. Any condition that has caused a shutdown event must be manually reset. If there are no longer any active shutdown events, the red light will turn off.

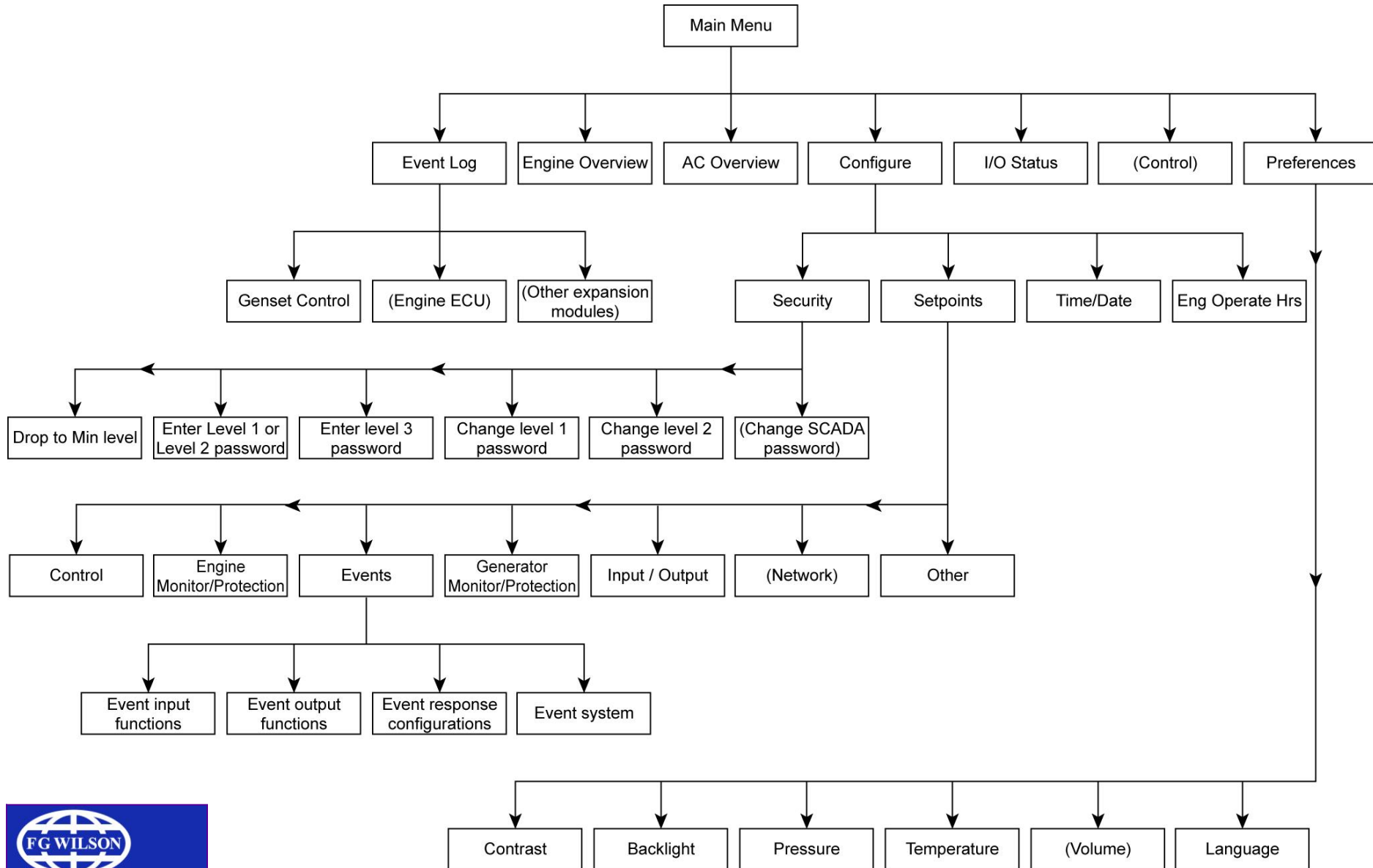


# Panel Configuration

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- 📁 The control module is software configured
- 📁 Set points can be adjusted by the operator or service engineer from the front of the module or by using the service tool depending on the password level required
- 📁 Set points are password protected
- 📁 Display language is controlled by the base flash file. Each file contains a customer language and technician English
- 📁 The service tool can be used to download new base flash files to the module
  - The base flash files are referenced by the panel serial number and can be e-mailed from FG Wilson for that serial number
- 📁 Control modules cannot be reprogrammed to different levels

# Menu Tree



# Password Protection

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-  There are 3 levels of password protection on the PowerPort control panel.
-  The level of password protection that is required for each setpoint is identified on the parameter setpoint entry screen. A security level identification number “1”, “2”, or “3” next to a padlock symbol is displayed on the parameter setpoint entry screen.
-  If the password level is currently at the required level of protection when viewing a parameter, the padlock will not appear.

## Drop to Minimum Security Level

The first option on the security screen is “DROP TO MIN LEVEL”. This would be used when leaving the control. If it is not initiated manually, the controller will automatically revert to minimum level after 10 minutes.

From the “MAIN MENU”, select the “CONFIGURE” menu.

- a. Press the “ENTER” key in order to select “CONFIGURE”. “SECURITY” will be highlighted.
- b. Press the “ENTER” key in order to select “SECURITY”. “DROP TO MIN LEVEL” will be displayed.
- c. Press the “ENTER” key to select “DROP TO MIN LEVEL”
- d. The system will now be at the minimum level of security

**Note:** The current level of security is displayed at the top of the display any time the system is in the “SECURITY” screen.



# Password Protection

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## Enter Level 1 or 2 Password

From the “MAIN MENU”, select the “CONFIGURE” menu.

- a. Press the “ENTER” key in order to select “CONFIGURE”. “SECURITY” will be highlighted.
- b. Press the “ENTER” key in order to select “SECURITY”. “DROP TO MIN LEVEL” will be highlighted.
- c. Press the “DOWN” key in order to highlight “ENTER LEVEL 1 OR 2”
- d. Press the “ENTER” key in order to select “ENTER LEVEL 1 or 2”. “ENTER PASSWORD FOR DESIRED LEVEL” is displayed. Also shown is a 16 digit display with 0 highlighted at the far right.
- e. Press the “UP” or “DOWN” key in order to select the desired number.
- f. Press the “RIGHT” key in order to highlight the next character to be entered. Press the “UP” or “DOWN” key in order to select the desired number.
- g. Continue until the correct password has been entered for the corresponding level. When all digits of the password are correctly entered press the “ENTER” key. The current level of password protection is displayed and parameters can be set.

**Note:** The panel will go to the highest level of security authorized by the password.

**Note:** Passwords can have to 16 digits but can use as few as 1 digit.



# Password Protection

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## Enter level 3 password

From the “MAIN MENU”, select the “CONFIGURE” menu.

- a. Press the “ENTER” key to select “CONFIGURE”. “SECURITY” will be highlighted.
- b. Press the “ENTER” key in order to select “SECURITY”. “DROP TO MIN LEVEL” will be displayed.
- c. Press the “DOWN” key in order to highlight “ENTER LEVEL 3”. Press “ENTER” to select “ENTER LEVEL 3”.
- d. A 16 digit number is shown and “ENTER RESPONSE” is highlighted. Copy this number and call the factory to obtain the password, *do not exit from this screen*.
- e. When the factory response is received, press “ENTER” to select “ENTER RESPONSE”. “ENTER RESPONSE” is displayed. Also shown is a 16 digit entry field where the password will be entered.
- f. Press the “UP” or “DOWN” key in order to increase or decrease the highlighted digit to the correct password.
- g. Press the “RIGHT” key in order to highlight the next character to be entered. Press the “UP” or “DOWN” key in order to increase or decrease the highlighted digit to the correct password.
- h. Continue to set all 16 digits until the factory provided password is displayed.
- i. When all digits of the factory password are correctly entered, press the “ENTER” key. The current level (LEVEL 3) of security is displayed and parameters can be set.



# Password Protection

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## Change level 1 or level 2 password

From the “MAIN MENU”, select the “CONFIGURE” menu.

- a. Press the “ENTER” key in order to select “CONFIGURE”. “SECURITY” will be highlighted.
- b. Press the “ENTER” key in order to select “SECURITY”. “DROP TO MIN LEVEL ”will be highlighted
- c. Make sure that the current level of security is at least as high as the level of the password to be changed.
- d. Press the “DOWN ” key to highlight “CHANGE LEVEL 1 PSWD.” Press the “ENTER” key to select “CHANGE LEVEL 1 PSWD”
- e. “CHANGE LEVEL 1 PSWD” is displayed. Use the cursor keys to set the new password.
- f. Press the “RIGHT” key in order to highlight the next character to be entered. Press the UP or “DOWN” key in order to increase or decrease the highlighted digit to the desired number.
- g. Continue until the desired password is displayed.
- h. Press the “ENTER” key. The password is now set.

**Note:** To change level 2 password, substitute “CHANGE LEVEL 2 PSWD” for “CHANGE LEVEL 1 PSWD” in step 1.d above.

**Note:** To disable a security level, set the password to a single zero.




# Digital Inputs

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**There are 6 digital inputs on Level 1.0 and 8 digital inputs on Level 2.0;**

 **4 of these inputs will always be used;**

- **Digital Input #1** – Is used for the emergency stop.
- **Digital Input #2** – Is used for remotely starting and stopping the generator set. If the input is active and the engine mode switch is in AUTO, the engine will attempt to start and run. Once the input becomes inactive the engine will enter into cooldown (if programmed) and then stop.
- **Digital Input #3** – Is used for High Engine Temperature shutdown
- **Digital Input #4** – Is used for Low Oil Pressure shutdown

 The remainder of the inputs can be configured. The main purpose for the other Digital Inputs is to add additional monitoring capabilities. The inputs can be configured by going to the “*Event I/P Functions*” parameter under the “*Setpoints*” menu. The Digital Input parameter can only be set to “Active High” or “Active Low” in order to initiate a High Warning, Low Warning, High Shutdown, Low Shutdown, or Status.

# Data Links

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**The digital module has up to three different data links depending on level:**

## Two CANBUS (J1939) Data Links

- Used for local communication among modules associated with a single genset e.g. ECM, Annunciators etc.
- Operates at speeds up to 250kbps
- CAN 1 is used to connect from the digital module to an ECM
  - The service tool should be connected to the Can 1 connection to enable programming of the digital module
- CAN 2 is used by the Remote Annunciator
  - The service tool should be connected to the CAN 2 connection to enable programming of the Annunciator if the Annunciator is connected

## One RS485 SCADA (Systems Control And Data Acquisition) Data Link

- Uses MODBUS protocol at speeds up to 2.4kbps
- Can be used to connect remotely through a modem using a RS485 to RS232 converter
- Half Duplex connection (2 wires)
- Password levels are to restrict access

# Additional I/O Modules

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## Annunciator Module

- 📄 16 channel display unit for remote information about the current system status.
  - Can be used to announce faults and/or status signals, it also allows the operator to silence the horn or acknowledge faults to the system.
  - Connects to the CAN2 J1939 data link on the PowerWizard Level 2.0 module
- 📄 There are 17 pair of LEDs on the annunciator's front panel;
  - 16 pairs of LEDs are used to announce events, diagnostics, and ready signals
  - 17th pair of LEDs is used as combined network/module status LED to inform operator of a problem with the data link connection.
  - Each pair of LEDs consists of two of the following 3 colors: green, yellow, and red.
    - E.g. A pair of red and yellow LEDs may be configured for Engine Oil Pressure. If a low engine oil pressure Warning is read over the data link, the Annunciator will flash the Yellow LED and the siren will sound. If the low engine oil pressure Shutdown is read over the data link, the Annunciator will flash the Red LED and the siren will sound.
- 📄 Maximum distance 240metres from generating set
- 📄 Programmed using Electronic Service Tool
  - In the the “Configuration” screen. Each LED pair has four settings: Suspect Parameter Number (SPN), Trigger Type, Trigger Severity Level, and Failure Mode Identifier (FMI).

# Additional I/O Modules

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## Thermocouple Module

-  The Thermocouple Module (TC) is capable of reading twenty inputs from thermocouples and is also capable of generating diagnostics. The diagnostics that are generated by this Module are maintained in non-volatile memory
-  The Thermocouple Module will read the inputs and then calculate the temperature in Celsius. The Thermocouple Module will then broadcast the information onto the “J1939” data link. The PowerPort Module will read the information from the Thermocouple Module and display the information on the display screen.
-  The Thermocouple Module is capable of storing twenty diagnostics log entries. The log can be viewed from the PowerPort Module. All of the diagnostic messages are broadcast on the “J1939” data link. The PowerPort Module reads these messages and reacts depending on its settings. Any of the inputs can be disabled to prevent unnecessary diagnostic faults.
-  The Thermocouple Module is configured by using EST on the primary data link.

# Additional I/O Modules

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## Discrete Input/Output Module

- 📁 This Module is capable of reading twelve discrete inputs, operating eight relay outputs and can be mounted on the genset or remotely. It is configured using EST.
- 📁 The Module has twelve inputs with four return channels. These inputs can be activated by either switching to a return or to battery negative.
- 📁 Inputs that generate a warning message will auto-reset whenever the input is removed. Inputs that generate a shutdown message will continue until the input returns to a non-active state and a reset message is received on the J1939 Data Link.
- 📁 The Discrete I/O Module has eight " Form C" relay outputs. Each output can be configured for either general or specific events.
  - For general events, each output activates whenever any "Alarm Condition", "Shutdown Condition", or "Alarm and/or Shutdown Condition " exists.
  - For specific events, each output activates when the diagnostic message contains the SPN and FMI combination that matches the SPN and FMI combination that is programmed for that particular output.

# Additional I/O Modules

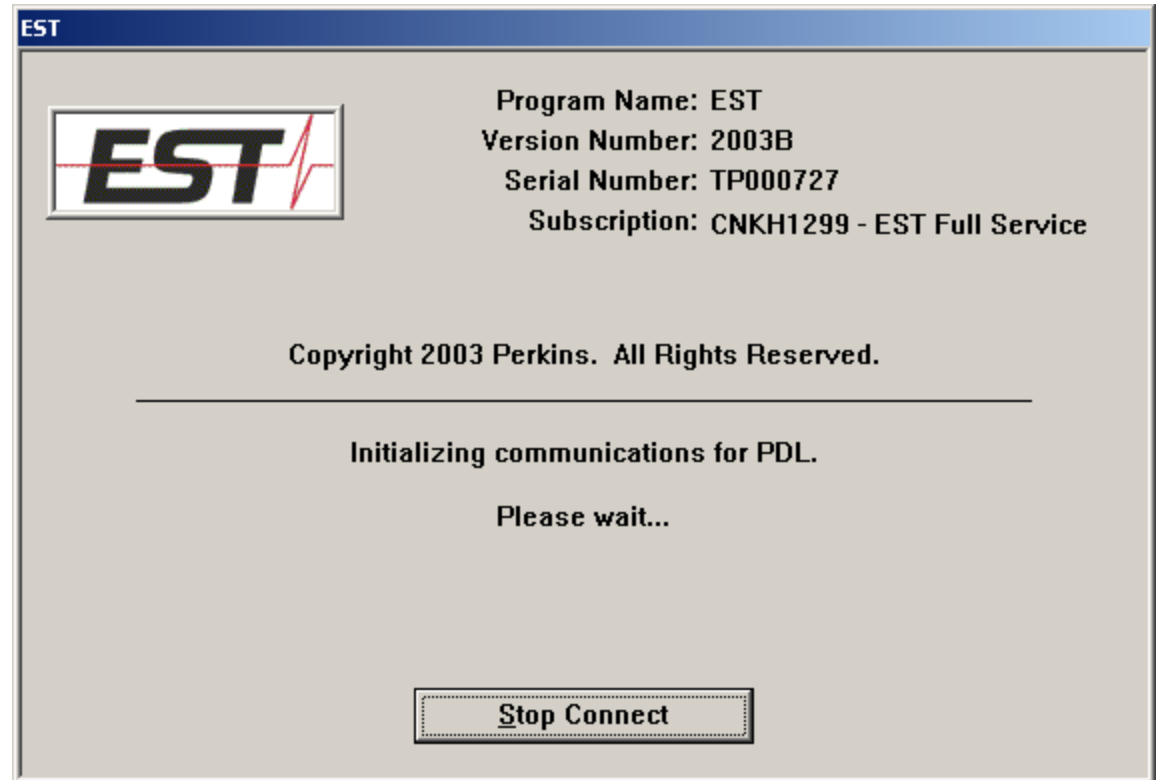
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## Resistive Temperature Device Module

- 📄 This Module is a temperature scanner capable of reading eight Platinum RTD inputs. The eight Platinum RTD inputs can have two, three, or four-wire configurations.
- 📄 The Module is also capable of generating diagnostics. The diagnostics that are generated by the RTD Module are maintained in non-volatile memory. The RTD Module is capable of storing the twenty diagnostic log entries.
- 📄 The Resistive Temperature Device (RTD) Module will read the inputs and then calculate the temperature in “Celsius”. The RTD Module will then broadcast the information onto the “J1939” data link.
- 📄 Each of the 8 inputs have sensor diagnostics in order to detect open or short circuits that go to the RTD sensors. Over temperature warnings and Shutdowns as well as Under temperature warnings are detected by comparing the measured temperature to the Low Warning, the High Warning, the High Shutdown temperatures stored in the module.

# Service Tool

 The new control modules will be supported by Perkins EST Tools



# CANBus J1939 Codes

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## **Failure mode identifier (FMI)**

- 📄 Type of failure that has been experienced by the component

## **Suspect Parameter Number (SPN)**

- 📄 The SPN is a number that identifies the specific component of the electronic control system that has experienced a diagnostic code.

## **Parameter Group Numbers (PGN)**

- 📄 Parameter Groups are organized according to Generator, Utility, and Bus related parameter quantities.

# Summary

## Quality, Increased Functionality and Growth

- ❏ Differentiated, integrated solution
- ❏ Competitively priced, 21<sup>st</sup> century product
- ❏ Increased feature bundling
- ❏ Consistent direction
- ❏ Increased quality and reliability
- ❏ Industry leading family of control systems

