Installation and Operations Manual for
iGUARD™ Digital Generator Set Controller
Version 1.40+

Please read the following information before installing. A visual inspection of this product for damage during shipping is recommended before mounting. It is your responsibility to have a qualified person install this unit and make sure it conforms to NEC and local codes.

GENERAL INFORMATION

WARNING
BEFORE BEGINNING INSTALLATION OF THIS MURPHY PRODUCT
✔ Disconnect all electrical power to the machine.
✔ Make sure the machine cannot operate during installation.
✔ Follow all safety warnings of the machine manufacturer.
✔ Read and follow all installation instructions.

Description
The iGUARD controller is a high performance, state of the art, digital generator set controller. This robust controller features high speed microprocessors, and high accuracy AC measurements. The iGUARD is a menu driven system, organized by "stacks", with "sub-stacks" where required. User connections are made via the plug in connectors on the rear of the controller. The iGUARD controller has a textured finish, UV stabilized polycarbonate injection molded housing, sealed with a "o" ring to help protect the iGUARD from the environment. There is a back cover protecting the Energy monitoring Board (EMB) to prevent contact with circuit board components and potentially harmful AC voltage wiring. Do not remove or lose this cover.

Standard Components:
- 24 - Digital inputs
- 7 - Analog inputs
- Inputs for up to three phases and neutral of AC voltage
- Inputs for 3 CT’s for current monitoring
- 1 - Magnetic pickup input
- 8 - 20A Form “C” relays
- 1 - RS232 port
- 1 - RS485 port
- 1 - RS232/RS485 port
- 1 - J1939 port
- 1 - 64 x 128 pixel full graphic LCD with backlight
- 1 - 12 position keypad

Keypad Functions
The keypad on the iGUARD is a capacitive touch sensing system. There are no mechanical switches to wear or stick, and the technology has been time proven in many applications. It operates in extreme temperatures, with gloves, through ice, snow, mud, grease, etc., and it allows complete sealing of the front of the iGUARD. It does operate slightly differently than a membrane keypad, in that there is no tactile feedback. The ‘key is pressed’ feedback is provided by momentarily beeping the audible alarm. The keys on the keypad do the following functions:
- Start - In Manual mode pressing the start pad will cause the engine to start. In automatic mode the screen will display an error message that system must be in manual mode to start with the start button
- Stop - In automatic or manual mode pressing the stop pad will stop the set. The system is forced into a manual mode, and will not autostart until returned to automatic mode.
- Auto/Manual - Selects manual (sometimes called local) operation or automatic mode (system monitors a digital input for a start signal)
- Acknowledge/Alarm - For warnings that do not cause a shutdown, pressing this pad will clear the alarms active at that moment. If the conditions subsequently clear and re-occur or if additional warnings occur, the common alarm output will come back on.
- Up / Down Arrows - In program mode scrolls the menu selections and also scrolls through the choices for a given parameter.
- Left / Right Arrows - In normal operation steps forward/backward through the screens available in the active submenu
- Next - In normal operation steps forward through the main menu selections
- Back - In normal operation steps backward through the main menu selections
- Enter - In program mode pressing enter will allow a variable to be changed, and pressing enter again will accept the displayed /new value.
- Exit - In normal operation returns the system to the main (default) screen. In program mode cancels any changes made unless the "enter" pad has already been pressed.

Specifications
Mounting (Cut-out) Dimensions:
7.05 x 5.25 x 2.76 in. (179 x 133 x 70 mm)

Mounting Screws: 4, #6-32 screws and nitrile rubber o-ring are supplied to meet NEMA4 specs.

Case Material: Black Polycarbonate, textured finish, UV stabilized.

Connection: 600V rated multi-wire quick connect for DC and AC connections, suitable for wire harnessing.

Power supply: Operates from any DC supply for 8-35VDC continuous. Brownout (5V) ride through is 5 seconds and a total blackout (0V) ride through of 100 milliseconds.

Vibration/Survivability: 3g, 3 axis, frequency swept 10-1000 Hz.

Operating/Storage Temperature Range: -40/+185°F (–40/+85°C).


I/O’s: Designed to meet NFPA110/NFPA 99 plus offers additional inputs.

Performance Specifications: NFPA110, NFPA 99, SAE Load Dump Test

Pending Approvals: UL, cUL.

Shipping Dimensions: 10 x 9 x 6 in. (254 x 229 x 152 mm)

Shipping Weights: 2 lb. (910 g.)

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Section 75
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Mechanical Installation and Mounting

Please make sure that the controller was not subjected to abusive handling during shipping and that all the components are included.

You should receive the iGUARD controller, any accessories ordered such as wire harnesses, CT’s, PT’s, senders, and this document.

The iGUARD controller is designed to be mounted within a customer supplied panel. It can also be installed in an optional set-top control box, or in the ‘doghouse’ of an AC alternator.

When the iGUARD is used as a standalone device, it must be mounted within a protective housing. Refer to the cutout schematic (below) for layout of the cutout and mounting screw holes.

Once the holes are cut, check to make sure that there is adequate clearance - so that the edges of the iGUARD housing mounts flat and flush against the outside surface of your enclosure. Be sure to check that there are no loose metal shavings, or other conductive debris that may fall into or get blown into the circuit boards of the iGUARD.

CAUTION: Recommended torque for tightening the mounting screws is 9 inch pounds. Only Polycarbonate compatible thread lock should be used for the iGUARD mounting screws.

Insert the iGUARD controller from the front side of the panel and install the four mounting screws and lock washers. Ensure that there is a good seal between the controller, the “O” ring and the mounting panel. Plan the iGUARD mounting for easy wiring and access.
The iGUARD Controller Components

1. Bezel / Faceplate
2. “O” Ring
3. User Interface Board
4. I / O Board
5. Energy Monitoring Board
6. Cover
7. Standoffs
Electrical Installation (Hook up)

There are several wire harnesses or wire harness plug-in connectors that may be shipped with the controller.

- **Two (2), 10-position connector**: for J1939, RS485 / RS232
- **One (1), 16-position connector**: for Digital Inputs
- **One (1), 18-position connector**: for Digital Inputs
- **One (1), 24-position connector**: for Analog Inputs
- **One (1), 6-position connector**: for Current Transformer Inputs
- **One (1), 4-position connector**: for AC Voltage and Neutral Inputs
- **One (1), 4-position connector**: for DC supply

Additionally there is a 2-position connector for normally closed Emergency Shutdown switch that is shipped installed on the controller. There are three (3), 1/4" blade type push on terminals for each of the eight (8) form "C" relays. They are Normally Open, Normally Closed, and Common. These contact outputs are dry. The dual row white connectors are all intended for low voltage.

**J1** - is the power connector

**J2** - is the communications connector that supports J1939 and Modbus server (slave)

**J3** - is the communications connector that supports RS-232 for programming the controller with the iGCON software tool, modem connection and the Modbus client (master) connection

**J5** - is digital inputs 1-8

**J6** - is digital inputs 9-24.

Signals for the digital inputs 1-24 must be in the in the range of +V battery and ground. With the inputs wired as show (this is the default), they will be active when there is a ground applied to the respective input. They can be connected to be active when +V battery is applied, but the connections are different. See the section on "Alternate signal polarity".

**J7** - is the connector for analog inputs and the magnetic pickup input. The first 4 analog inputs have current sources for driving standard resistive senders. For best accuracy, and most noise immunity, senders should be of the two wire type, with the return wire coming back to the appropriate sender ground. NOTE: Murphy recommends the use of two wire senders, with the sender return connected to the analog channel.

If single ended senders are used, with ground provided at the sender itself, there can be a number of problems that may or may not affect any given installation. Since the sender body/threads provides sender ground, the use of thread tapes and compounds may give erratic operation. Additionally, the grounds may not be completely common between different parts of the engine, alternator, and skirt because there may be ground resistance between parts of the generator caused by paint, sealing compounds, rust, debris etc., and there always exists a greatly increased chance for noise and interference to affect the controller operation.

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Be aware that the iGCON software tool will be unable to update the operating firmware unless the J8 jumper is either open or removed.

The 8 relays mounted on the I/O board are pre-programmed at the factory to:

**J8** - is the positive emergency stop. From the factory there is a loop from terminal 1 to terminal 2. The controller will power up, but will not operate the relays without this connection. If your application requires a true positive emergency stop, we recommend that you install a normally closed type switch between terminals 1 & 2. In the event of an emergency stop, actuating the switch will remove power to the relays which will then return to their un-powered state. Be aware that the iGCON software tool will be unable to update the operating firmware unless the J8 jumper is either open or removed.

Relays may be re-assigned to any of the other desired functions at will from the front panel.
Energy Monitoring Board (EMB)
From the rear of the unit, there is a smaller board on the left side. This is the energy monitoring board. All the AC connections are made here. It has two single row black connectors labeled J9 & J10.

**J9** - is the AC voltage connections.

- V Phase A
- V Phase B
- V Phase C
- Neutral

In 3 phase applications apply:
- phase A to terminal 1
- phase B to terminal 2
- phase C to terminal 3
- neutral to terminal 4.

In single phase applications apply:
- phase A to terminal 1
- phase B to terminal 2
- neutral to terminal 4.

In Center Tapped Delta applications, apply:
- phase A to terminal 1
- phase B to terminal 2
- phase C to terminal 3
- neutral to terminal 4.

In fully differential connections, wire CT1+ to J10-1 to J10-2, etc. For “commoned” CT connections bring CT1+ to J10-1, CT2+ to J10-3 and CT3+ to J10-5. Connect CT1-, CT2-, and CT3- together and then connect to AC neutral. There is no need to jumper J10-2, 4 and 6 to anything, although you can connect them to AC neutral if you wish.

There is a software selection in the iGUARD that must be set appropriate to the connection method you are using. See Operating Sequence Section, p-7.

The measuring method in the iGUARD controller requires that AC neutral and earth remain with 1/2 VDC for accurate measurements, and within 6 VDC to prevent damage to the Energy monitoring board (EMB). The controller offers a low impedance path to neutral (≈0.025 Ω) so the common mode voltage will be within a safe range.

**AGCOM Board**
(See AGCOM Board Appendix on page 20)

**Commercially Available Connectors**
Connections to the iGUARD are via Molex connectors, MiniFit Jr. (for white/opaque white signal level connectors), and Sabre series (for black EMB AC voltage and current connectors). 12 foot long harnesses are available from Murphy (see “Options and Accessories” section). If you elect to build your own wire harnesses the following manufacturers part numbers will be of use:

**Connector Part Numbers**
The MiniFit Jr. series of connectors requires a crimping tool (such as a universal crimper) to properly terminate the connectors. When terminating multiple wire harnesses, contact your local Molex distributor for information on automated termination tooling. An extractor tool might also be necessary in case of a broken wire, mis-inserted terminal, or when a wire needs to be removed.

<table>
<thead>
<tr>
<th>Plug - Low voltage</th>
<th>Molex Part Number</th>
<th>Molex 16 ga crimp on terminal</th>
<th>Diogkey Part Number - plug</th>
<th>Murphy PN Plug</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 conductor</td>
<td>9907-2020</td>
<td>39-00-0098</td>
<td>WM3700-ND</td>
<td>WM2501-ND</td>
</tr>
<tr>
<td>4 conductor</td>
<td>9907-2040</td>
<td>39-00-0098</td>
<td>WM3701-ND</td>
<td>WM2501-ND</td>
</tr>
<tr>
<td>10 conductor</td>
<td>9907-2100</td>
<td>39-00-0098</td>
<td>WM3704-ND</td>
<td>WM2501-ND</td>
</tr>
<tr>
<td>16 conductor</td>
<td>9907-2160</td>
<td>39-00-0098</td>
<td>WM3707-ND</td>
<td>WM2501-ND</td>
</tr>
<tr>
<td>18 conductor</td>
<td>9907-2180</td>
<td>39-00-0098</td>
<td>WM3708-ND</td>
<td>WM2501-ND</td>
</tr>
<tr>
<td>21 conductor</td>
<td>9907-2240</td>
<td>39-00-0098</td>
<td>WM3711-ND</td>
<td>WM2501-ND</td>
</tr>
</tbody>
</table>

In applications where the CT’s are commoned together (4 wires - CT1+, CT2+, CT3+ and CT common) the system will only read 1/2 of the current signal, unless the iGUARD is programmed to reflect commoned CT’s.

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Molex and Digikey are registered trademarks of their respective corporations.
iGUARD Operating Sequence

The iGUARD controller, while reprogrammable, follows a standard operating sequence. This operating sequence is basically a set of machine states that happen in a pre-determined order.

Machine states can be set to zero if not needed, or adjusted to fit the application. See page 23 (Sequence Appendix) for basic operating sequence.

The iGUARD operating sequence includes the following modes:

- **Ready to Start Mode** - Automatic start mode ready for a contact closure to initiate an automatic start and run sequence.

- **Prestart Delay Mode** - A timer used to prevent nuisance starts, or to warn nearby personnel that automatic equipment is about to start (set to 0 to 0 to bypass).

- **Prelube Mode** - In larger generators there may be a requirement for automatic lubrication prior to cranking (set to 0 to bypass).

- **Preheat** - Timer set to provide the correct amount of prerun operation of the air intake heaters used to facilitate starting in cold conditions (set to 0 to bypass).

- **Cranking / Crank Rest Mode** - Engine is attempting to start and will go through the number of selected starting attempts.

- **Crank Disconnect / Engine Running Mode** - Engine speed is greater than the crank disconnect.

- **Warmup Mode** - Timer to allow system to run unloaded for selected time (set to 0 to bypass).

- **At Load Mode** - Generator is running at load.

- **Power Good Mode** - This mode is to prevent nuisance start/stops. The controller continues running but monitors the remote start contact while in this mode. The power good timer must expire before the system can proceed to cooldown. Any further call to run resets the power good mode timer to its preset value.

- **Cooldown Mode** - Generator runs unloaded for a preset time.

- **Energized to Stop** - The Energized to Stop timer is ON and the Energized to Stop output is active.

- **Stopped Mode** - Generator has come to a complete stop.

- **Postlube Mode** - In larger generators there may be a requirement for automatic lubrication after a normal start/run/stop cycle before the engine can be restarted (set to 0 to bypass).

- **Shutdown / Lockout with Cooldown Mode** - In the case of some faults the controller will open the "at load" contact and then go through a normal cooldown and stop sequence, but will not allow an automatic restart without a system reset.

- **Immediate Shutdown/Lockout (no Cooldown) Mode** - Because of the severity of most faults, the controller will cause an immediate Shutdown/Lockout without a cooldown period, and will not allow an automatic restart without a system reset.

Programming the iGUARD from the Keypad

The iGUARD controller can be programmed in two separate ways. Most setup can be done from the front panel. There are some parameters, such as changing passwords, that require the use of the iGCON software tool.

The iGUARD programming menus can be accessed at any time by pressing the left and right arrows at the same time. This will bring up the password menu:

- **Access Security** - Allows input of 4 character security code.
  - **PAS9** - No operational Access. It allows viewing of the data screens but parameters cannot be edited.
  - **PAS1** - Operational Access. It allows Manual Start and Stop but parameters cannot be edited.
  - **PAS2** - Parameter View Access. Allows for viewing of all parameters and editing of the following parameter settings:
    - Change Language
    - Key Sensitivity Level
    - Back Light On/Off
    - Ack Maintenance Timers
    - Enable Beeper
    - Select Pressure Units
    - Select Temperature Units
    - Modify Date
    - Edit Clock Start and Stop Timers
  - **PAS3** - Parameter Edit Access. Allows for viewing and parameter editing but does not allow calibration of AC.
  - **PAS4** - Calibration Access. Allows calibration of the AC parameters.
  - **PAS5** - kW Limit Edit and Config Select Access. Allows editing of kW limits and various communication addresses.

What to do if you lose your password?

Press NEXT until you see the screen with a graphic display of the Murphy logo. Press NEXT once to go to the system information screen.

Write down the serial number, the current date, and time showing on the real time clock display, and contact us (918) 317-4100, ask for technical support. We will provide a temporary password that will allow you to access the system to recover the passwords.

Acknowledging Maintenance Timers

**Status/Warning Screen**

You may see this warning/status message:

This is information that one or more of your maintenance reminders timers has expired. To acknowledge the warning and reset the timer, enter the programming mode, and go to the Miscellaneous Parameters screen.
Acknowledging Maintenance Timers (continued)

Press enter, and the screen should change to this display with the number quantity flashing:

Press the right arrow to reset and the display should change to:

Each timer can be acknowledged as it expires, or whenever the maintenance is done, if it precedes the timer reaching 0.

Displaying Data

Use the Auto scroll function.

To turn the Auto scroll function ON, press the ENTER and NEXT keys at the same time. There are three Auto scrolling speeds, temporarily displayed on the top line each time ENTER and NEXT keys are pressed. (4 seconds, 8 seconds, 12 seconds) To select a different speed, simultaneously press the ENTER and NEXT keys again to go to the next speed section. To turn off the Auto scroll function press the EXIT and NEXT keys at the same time.

If the iGUARD is left on a non-scroll screen (like the warnings/status screen) it will display only the warning/status screen.

When Programming:

Touching the left arrow takes you immediately to the “TOP” of the program selection list. The right arrow takes you immediately to the “BOTTOM” of the selection list.

Settings and Definitions

Operating Parameters

<table>
<thead>
<tr>
<th>OPERATION PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-ACCESS SECURITY</td>
</tr>
<tr>
<td>ENTER CHANGE PASSWORD</td>
</tr>
<tr>
<td>2- SELECT CONFIGURATION</td>
</tr>
<tr>
<td>3- LANGUAGE</td>
</tr>
<tr>
<td>4- DRIVEN EQUIPMENT TYPE</td>
</tr>
<tr>
<td>← MORE MENUS</td>
</tr>
</tbody>
</table>

To bring up the iGUARD Programming Screen, press the Left and Right ←→ arrow keys simultaneously. After gaining access to this screen, you can use the Left, Right, Up and Down ←→↑↓ keys to navigate from column to column and to adjust the values or change characters displayed. Press Enter when password is correct. The security level is shown on the bottom of the display. Press Exit to bring up the Parameters screen.

   - **Level 0** - No operational Access. It allows viewing of the data screens but parameters cannot be viewed or edited.
   - **Level 1** - Operational Access. It allows Manual Start and Stop but parameters cannot be viewed or edited.
   - **Level 2** - Parameter View Access. Allows for viewing of all parameters and editing of the following parameter settings:
     - Change Language
     - Key Sensitivity Level
     - Back Light On/Off
     - Ack Maintenance Timers
     - Enable Beeper
     - Select Pressure Units
     - Select Temperature Units
     - Select Temperature Units
     - Date Display Format
     - Modify Date
     - Edit Clock Start and Stop Timers
   - **Level 3** - Parameter Edit Access. Allows for viewing and parameter editing but does not allow calibration of AC.
   - **Level 4** - Calibration Access. Allows calibration of AC parameters.
   - **Level 5** - kW Limit Edit and Config Select Access. Allows editing of kW limits and various communication addresses.

2. Language - Allows selection of language used to display text.
   - a. **English (Default)**
   - b. Spanish
   - c. etc. (future)

3. Driven Equipment Type - Allows selection of type of equipment that is driven by the engine.
   - a. **None (engine only, ignores all AC parameters)**
   - b. **AC Alternator (Genset) (Default)**

4. Key Sensitivity Level - Determines how sensitive the touch pad keys are for your application.
   - a. **Low**
   - b. **Normal (Default)**
   - c. **High**

5. Default Screen - When the system is running this selects the screen that will show.
   - a. **Event History**
   - b. **Warnings / Status**
   - c. **Engine / Gen Status**
   - d. **Meters**
   - e. **Nominal Meter**
   - f. **Splash Screen**
   - g. **Information**

*Newer versions of the controller/software will not have a “LOW” sensitive selection.*
6. Lamp Test - Tests LCD.

7. LCD Backlight - Turns the iGUARD display backlight off, unless an error condition activates the common visual alarm.
   a. Disabled
   b. Enabled (Default)

8. Guard Beep - Keypress indication and/or audible warning buzzer.
   a. Disabled
   b. Enabled (Default)

9. Pressure Units - User selection of display units.
   a. PSI (Default)
   b. kPa
   c. bar

10. Temperature Units - User selection of display units.
    a. Fahrenheit (Default)
    b. Celsius

11. Date Display Format Selectable.
    a. American Style (Default)
    b. European Style

12. Event Types to record
    a. All events (Default)
    b. Shutdown events only

13. Clear Event History - Erases all stored history events.

14. Standby Mode Timer - When the timer expires, the system goes into a lower power standby mode. After it times out the LCD screen changes to a text message, the blue LCD backlight is turned off, and the Energy Monitoring board is de-powered. Any keypress, or a remote call to run wakes the unit up. Value can be set between 30 seconds and 59 minutes 30 seconds or can be set to OFF.

15. Run to Destruct - When run to destruct is enabled the system will only sound alarms for errors, instead of shutting down. Since this could lead to the destruction of the equipment or the load, there is both a menu selection and a jumper that must be physically cut (see schematic, below), making this a deliberate choice.
   a. Disabled (Default)
   b. Enabled

16. Edit Time and Date - Allows user to adjust time and date of iGUARD.

17. Input - Output Test - Shows the status of the analog inputs, digital inputs, and relay outputs.
   a. The analog input screen shows any change in the inputs. For example if the resistance value of a resistive sender changes, the counts will change.
      i. analog channel number
      ii. name/setup label
      iii. actual value
   b. The digital input screen shows the status of the digital inputs
      i. digital input number
      ii. Name/setup label
      iii. Made/open
   c. Relay output status allows the forcing of any relay out. The screen shows:
      i. Relay output number
      ii. Name/setup label
      iii. State

18. Reset Configuration - Allows user to force a complete reset to a known state. Clears all programming and customization.

19. Operation Mode
    b. Manual, Auto No Warning - It disables the Not-In-Auto alarm.
    c. Manual Mode Only - Can only be started from the front keypad.

20. Duplicate Senders - Allows ‘one only’ or more than one sender for engine pressures and temperatures.

21. Repeater #1 (set to Mimic as Default)
    a. Set as Mimic Allows control capabilities without programming.
    b. Set as Annunciator Allows viewing without control.

22. Repeater #2 (set to Mimic as Default)
    a. Set as Mimic Allows control capabilities without programming.
    b. Set as Annunciator Allows viewing without control.

23. Winter/Summer Setpoint
    a. Set Above Setpoint
    b. Set Below Setpoint
    c. Set as Annunciator
    d. Set as Mimic

24. Operation Mode
    b. Manual, Auto No Warning - It disables the Not-In-Auto alarm.
    c. Manual Mode Only - Can only be started from the front keypad.

25. Communication Parameters
   1. J2 Protocol type - Selects the function that the selectable comm. port on J2 will perform
      a. RS-232 iGUARD config
      b. RS-485 Modbus server

   2. Modbus Server (SLAVE)’s address - Sets the address of the Modbus server (247 is default)

   3. RS-485 Server (SLAVE)’s bit frame - Sets the number of start, data & stop bits for serial communications via RS-485 Modbus
      a. 10 bits N-8-1
      b. 11 bits N-8-2

   4. Server (SLAVE) Baud Rate - sets the number of start, data & stop bits for serial communications via RS-485 Modbus
      a. 9600
      b. 19200
      c. 38400 (Default)

   5. RS-485 Client (MASTER)’s bit frame - sets the number of start, data & stop bits for serial communications via RS-485 Modbus
      a. 10 bits N-8-1
      b. 11 bits N-8-2

   6. Client (MASTER)’s Baud Rate - communication speed on the RS-485 Client (Master) port
      a. 9600
      b. 19200
      c. 38400 (Default)

   Be aware that when using the iGUARD to drive PowerView analog gages or the Remote I/O board, those devices only operate at 38400 baud.

   7. Modem Connection - Sets the com port for RS-232 based modem communications
      a. Enabled
      b. Disabled (Default)
**Miscellaneous Parameters**

Review the materials supplied with the engine/ECU by the manufacturer to become familiar with the specifics of your engine.

<table>
<thead>
<tr>
<th>1. Engine ECU Type</th>
<th>None (mechanically governed/controlled engine) (Default)</th>
<th>J1939</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Engine Manufacturer</td>
<td>Caterpillar, Cummins, Deere, Detroit, Deutz, Ford, GM, Hatz, Isuzu, Kubota, Lister-Petter, Mercedes, Perkins, Volvo</td>
<td></td>
</tr>
<tr>
<td>3. Fuel Level Source</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>4. Oil Life</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>5. J1939 Crankcut Count</td>
<td>5sec</td>
<td></td>
</tr>
</tbody>
</table>

**Engine Parameters**

<table>
<thead>
<tr>
<th>1. Pre-Start Delay</th>
<th>5sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Preheat Type</td>
<td>None</td>
</tr>
<tr>
<td>3. Pre-Lube Time</td>
<td>None</td>
</tr>
<tr>
<td>4. Preheat Time</td>
<td>None</td>
</tr>
<tr>
<td>5. Purge Crank Time</td>
<td>None</td>
</tr>
<tr>
<td>6. Crank Time</td>
<td>None</td>
</tr>
<tr>
<td>7. Crank Rest Time</td>
<td>None</td>
</tr>
</tbody>
</table>

*Note: Caterpillar, Cummins, Deere, Detroit, Deutz, Ford, GM, Hatz, Isuzu, Kubota, Lister-Petter, Mercedes, Perkins, Volvo are registered trademarks of their respective corporations.*
### iGUARD OPERATING SEQUENCE / SETTINGS AND DEFINITIONS

**8. Start Attempts** - The maximum number of times that the engine cranking motor is energized without a successful engine start. (Default 3 cycles)

**9. Startup Bypass Time** - Temporarily disables the low oil pressure, high engine temperature and various other shutdown faults until the engine can come to a running condition. (Default 15 sec.)

**10. Warm-Up Load Delay** - How long the engine /generator runs before it closes the "AT LOAD" contacts. (Default 0 sec.)

**11. Nominal RPM** - Nominal operating RPM (1800 RPM for 60 Hz, 1500 RPM for 50 Hz). (Default 1800)

**12. Engine Overspeed** - Engine overspeed setpoint. (Default 1980 RPM [110%])

**13. Engine Underspeed** - Engine underspeed setpoint. (Default 1620 RPM [90%])

**14. Engine Cooldown** - How long engine will run after the remote run demand is removed. There are some Generator faults that will also go through a normal cool down and proceed to lockout. (Default ø min.)

**15. Post-Lube Time** - Length of time after the genset has completed a normal run that any post-run lubrication system is to be activated. Set will not restart until timer expires. (Default is 0 sec.)

**16. Flywheel Tooth Count** - Number of Flywheel teeth. (Default 168)

**17. Crank Termination RPM** - Speed to stop cranking the engine. Also considered the minimum engine run speed. (Default 600 RPM)

**18. Oil Pressure Warning** - Oil pressure at which the controller activates a warning indication. (Default 25 PSI)

**19. Oil Pressure Shutdown** - Oil pressure at which the controller shuts down the system due to low oil pressure. (Default 20 PSI)

**20. High oil temperature warning** - Oil temperature at which the controller will activate a high oil temperature warning alarm. (Default 245°F)

**21. High oil temperature shutdown** - Oil temperature at which the controller shuts down the system due to high oil temperature. (Default 250°F)

**22. Low Eng. Temp. Warning** - Coolant temperature at which the controller will activate a low temperature warning alarm. (Default 70°F)

**23. High Eng. Temp. Warning** - Coolant temperature at which the controller activates a warning indication. (Default 215°F)

**24. High Eng. Temp. Shutdown** - Coolant temperature at which the controller shuts down the system due to high temperature. (Default 220°F)

**25. Battery Weak** - Voltage setpoint for average battery voltage during cranking. Battery voltage that falls below this setpoint usually indicates either a bad battery or bad connections. (Default 8 VDC)

**26. Battery Low Warning** - Low battery voltage setpoint. Voltage equal to or less than this setpoint in normal (non-cranking) operation indicates battery needs charging. (Default 11.5 V)

### Generator Parameters

- **1. Crank Termination AC** - When using the AC frequency for a speed source, this is the equivalent to crank termination RPM. (Default 20 Hz)

- **2. AC Speed Signal Delay** - Delay to allow excitation of the alternator. (Default 3 sec.)

- **3. Power Good Timer** - A timer to avoid nuisance start/stop cycles. At the end of a normal automatic cycle, when the remote start signal is no longer active, this timer must expire before the system will proceed to cool down. (Default ø sec.)

- **4. CT Ratio** - Current transformer ratio (xxx:5). (Default is 300:5) The iGUARD uses standard 5A output CT’s.

- **5. Load Bypass Timer** - Timer for bypass of load related alarms to allow load stabilization. (Default 5 sec.)

- **6. Calibration Voltage** - Allows field recalibration of AC voltage inputs. AC voltages here are always measured Line to Neutral, even if the normal display is set for line to line.


- **8. Grounded CT’s** - The energy monitoring board allows termination of the CT’s in two ways. The CT’s may be wired with both leads from each CT brought back to the EMB, or by bringing one lead from each CT, tying the other leads together, and grounding them. This is called grounded or commoned CT’s. If your installation can bring all six leads back to the EMB, or by bringing one lead from each CT all tied together, then this selection needs to be set to "YES".
  - a. No (Default)
  - b. Yes

- **9. Nominal Voltage Source** - Allows selection of display voltage as line to line or line to neutral.
  - a. Line - Line (Default)
  - b. Line - Neutral
10. **Indicate Reverse Power** - Allows user to mask CT orientation alarms by disabling reverse power/current indication  
   a. Yes (Default)  
   b. No  

11. **Phase Selection** - Common generator configurations.  
   a. 3Ph High Wye  
   b. 3Ph Low Wye  
   c. 3Ph Wye (Default)  
   d. 3Ph Delta  
   e. Center Tap Delta  
   f. Single Phase  

There are a number of ways to connect AC to the iGUARD. It is important to understand the options and their meaning. 

In the case of reconnectable alternators, the AC voltage and current are measured at the non-neutral junction of the coils, and if “3ph high wye” is selected the coils are connected in series. The actual output voltage will be 480 VAC, but the voltage measured at the coil junction will be 240 VAC. The reading must be multiplied by 2 to display the output voltage correctly. 

In the case of a “3ph low wye”, the AC voltage and current are still measured at the non-neutral junction of the coils, but the coils are arranged in parallel. The AC voltage output is 240 VAC but, the current is twice the reading from the CT. 

When using a non-reconnectable alternator, or the application doesn’t include a voltage output select switch, “3ph wye” displays output voltage and output current directly (default setting). 

When using a Center Tapped Delta (3 phase output is 240VL-L, but L-N is 120,208,120L1, L2,L3 respectively) this is the setup to select. Single phase (two lines and a neutral) of any configuration.

12. **Generator Over Freq** - Over-frequency shutdown setpoint. (Default is 65 Hz)  

13. **Generator Under Freq** - Under-frequency shutdown setpoint. (Default is 55 Hz)  

14. **Nominal Voltage** - “OK” voltage as measured at the “Nominal Voltage source”. (Default is 480VAC)  

15. **Over-Voltage Trip** - Over voltage shutdown setpoint. (Default is 110%)  

16. **Under-Voltage Trip** - Under-voltage shutdown setpoint. (Default is 90%)  

17. **Power Factor Limit** - Maximum limit for power factor. Will shutdown generator if setpoint is exceeded. (Default 0.8 set to OFF to bypass)  

18. **IDMT Curve** - Thermal protection for AC Alternator Off (Default) inverse; very inverse; extremely inverse; long time inverse.  

19. **IDMT Pickup Current** - Current setpoints for Thermal Protection to start (Default is 300A)  

20. **Maximum Inst. Over-Current** - Over-current shutdown setpoint. (Default is 300A) Instantaneous 

21. **PT Ratio** - In system with L-L voltages > 600V, Potential transformers must be used to prevent voltages greater than design from being applied to the energy monitoring board. (xxx:1) 4200V:120V = 35:1 ratio, 480:240=2 ETC. (Default is 1.00:1)  

22. **kVA Limit** - Limits kVA output of generator. Requires level 5 password. (Default is 200 kVA.)  

23. **Over freq. Warn time** - Delay timer before system shuts down on over frequency (Default is 3 sec)  

24. **Over voltage warn time** - Delay timer before system shuts down on over voltage. (Default is 3 sec)  

25 **UF, UV, OC warn time** - Delay timer before system shuts down on Under Frequency, Under voltage or Over current. (Default is 3 sec)  

**Digital Inputs and/or Relay Outputs**  

When wired to control the voltage regulator and the warmup speed, the Run/idle switch input (or the warmup timer) essentially inhibits AC speed detection in the idle and/or warmup mode. NFPA-110 requires a secondary speed signal source to prevent crank re-engagement, so if the iGUARD is being used in an NFPA-110 / 99 application and there is a low speed warmup/idle required, the AC frequency cannot be used as a primary nor secondary speed signal source. 

As this implies, there are no AC frequency or voltage based alarms or shutdowns available during the low speed idle or warmup period. Since NFPA applications assume that there is no warmup period (the requirement for a minimum - and therefore externally maintained jacket coolant temperature) this should pose no problem for NFPA-110/NFPA-99 applications, unless the application is in some way special, or the local inspector is making exceptions based on intended use, or some other special circumstance. 

The speed signals can come from the ECU, a magnetic pickup, or a separate speed switch type device. 

When using a low speed idle (a run/idle switch input) for warmup in non-NFPA applications, there are no special requirements for a secondary speed signal source.

**Input Parameters - (Defaults Shown)**

![Image](https://via.placeholder.com/150)
**Possible Menu Selection for Digital Inputs**

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Disabled</td>
</tr>
<tr>
<td>2.</td>
<td>Remote Call to Run</td>
</tr>
<tr>
<td>3.</td>
<td>Remote Alarm Acknowledge</td>
</tr>
<tr>
<td>4.</td>
<td>Engine Overspeed</td>
</tr>
<tr>
<td>5.</td>
<td>Crank Termination</td>
</tr>
<tr>
<td>6.</td>
<td>Low Fuel Level (warning)</td>
</tr>
<tr>
<td>7.</td>
<td>Fuel Leak</td>
</tr>
<tr>
<td>8.</td>
<td>Fuel Filter Restriction</td>
</tr>
<tr>
<td>9.</td>
<td>Air Damper Closed</td>
</tr>
<tr>
<td>10.</td>
<td>Air Filter Restriction</td>
</tr>
<tr>
<td>11.</td>
<td>Low Lube Oil Level</td>
</tr>
<tr>
<td>12.</td>
<td>Battery Charger Fail</td>
</tr>
<tr>
<td>13.</td>
<td>Low Coolant Level</td>
</tr>
<tr>
<td>14.</td>
<td>Emergency Stop N/O</td>
</tr>
<tr>
<td>15.</td>
<td>Emergency Stop N/C</td>
</tr>
<tr>
<td>16.</td>
<td>Oil Filter Restriction</td>
</tr>
<tr>
<td>17.</td>
<td>Gen Config 1 - 6</td>
</tr>
<tr>
<td>18.</td>
<td>Gen Config 1</td>
</tr>
<tr>
<td>19.</td>
<td>Gen Config 2</td>
</tr>
<tr>
<td>20.</td>
<td>Gen Config 3</td>
</tr>
<tr>
<td>21.</td>
<td>Gen Config 4</td>
</tr>
<tr>
<td>22.</td>
<td>Gen Config 5</td>
</tr>
<tr>
<td>23.</td>
<td>Gen Config 6</td>
</tr>
<tr>
<td>24.</td>
<td>Digital Input 24</td>
</tr>
<tr>
<td>25.</td>
<td>Digital Input 23</td>
</tr>
<tr>
<td>26.</td>
<td>Digital Input 22</td>
</tr>
<tr>
<td>27.</td>
<td>Digital Input 21</td>
</tr>
<tr>
<td>28.</td>
<td>Digital Input 20</td>
</tr>
<tr>
<td>29.</td>
<td>Digital Input 19</td>
</tr>
<tr>
<td>30.</td>
<td>Digital Input 18</td>
</tr>
<tr>
<td>31.</td>
<td>Digital Input 17</td>
</tr>
<tr>
<td>32.</td>
<td>Digital Input 16</td>
</tr>
</tbody>
</table>

**Generator Steering**

In applications where there is a voltage reconnection switch for reconfiguring the alternator from 480V 3 phase 4 wire to 240V 3phase 4 wire or 240V single phase 3 wire, the steering inputs allow a means to track which configuration is currently selected. This is done by means of selecting (grounding) the appropriate input via an auxiliary contact on the reconnection switch. There are up to 6 selections available from the iGUARD controller. Each is fully independent (except for the CT selection) from the others.

Some 480/240V reconnectable applications look like this schematic:

![Schematic Diagram](image-url)
The low wye will read full output voltage (L-N) and half of the current (per phase). The high wye will read half of the output voltage (L-N) and full current (per phase).

The CT’s have to be sized to read the current in the high wye configuration. The current through a conductor is identical throughout the conductor. A series connection adds voltage but not current, and the low wye configuration. A lot of confusion occurs because switching from windings in parallel to windings in series (and vice versa) basically means that the measurement points always see exactly the same current and voltage, but the “output” current and voltage differ.

The simplest way to keep track of this is to remember that in series - The output voltages add but currents remain the same, while in parallel, output currents add but the voltages remain the same.

For example, assume that we are in a high wye configuration. If we are loaded such that the coil T7-T10, T8-T11, and T9-T12 are all producing 50A, the measurement points will read nominal 240V and 50 A, but the output connections as measured at T1, T2, & T3 will read 480V but still be 50 A. In a high wye the voltages add but the series coil currents remain the same.

Now assume a low wye - If we are loaded such that the coil T7-T10, T8-T11, and T9-T12 are all producing 50A, the measurement points will read nominal 240V and 50 A, but the output connections as measured at T1, T2, & T3 will read 240V and the output current will be 100 A. In a low wye the voltages add but the series coil currents remain the same.

A more easily understood method is to connect the iGUARD to the output terminals, with the CTs sized for maximum current in the low wye configuration. This way, the controller can read what is actually coming out of the generator, without any need to interpolate and assume. This will offer increased accuracy, and is generally easier to understand.

Output Parameters

<table>
<thead>
<tr>
<th>RELAY OUTPUT PARAMETERS</th>
<th>RELAY OUTPUT PARAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1~ RELAY 1</td>
<td>1~ RELAY 1</td>
</tr>
<tr>
<td>2~ RELAY 2</td>
<td>2~ RELAY 2</td>
</tr>
<tr>
<td>3~ RELAY 3</td>
<td>3~ RELAY 3</td>
</tr>
<tr>
<td>4~ RELAY 4</td>
<td>4~ RELAY 4</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>PREHEAT</td>
<td>PREHEAT</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Relay 1 - Preheat.
2. Relay 2 - Crank.
4. Relay 4 - Common Alarm.
5. Relay 5 - Common Alarm.
6. Relay 6 - Remote Alarm.
7. Relay 7 - Enable ECU.
8. Relay 8 - Not in Auto.

Possible Output States:

1. Not Used
2. Preheat - Relay follows the selected preheat state.
3. Crank - Relay follows the crank setting.
4. Fuel - Relay operates as "Energized to run" suitable for fuel control.
5. Shutdown Lockout - Relay is active when system has shutdown on a fault and is energized until reset.
6. At Load Contactor - Relay operates when controller goes to "AT LOAD".
7. Shutdown - Activated only by a fault shutdown.
8. Common Alarm - Any warning or shutdown condition will activate the relay.
9. Remote Alarm - Any alarm condition will actuate this output, can be de-energized by an ACK or by a reset condition.
10. Air Damper N/De-energized - Relay operates when system goes into overspeed or if emergency shutdown is active.
11. Not in Auto - Relay operates when system is not in auto mode - Self clearing.
12. Low Oil Pressure Warning - Relay operates when the engine oil pressure is below the warning setpoint - Self clearing.
13. Low Oil Pressure Shutdown - Relay operates when the engine oil pressure is below the warning setpoint - Requires reset to clear.
14. Low Eng. Temp. - Relay operates when the low coolant temperature is below the setpoint - Self clearing. Coolant temperature is below the setpoint - Self clearing.
15. High Eng. Temp. Warning - Relay operates when the engine coolant temperature is above the warning setpoint - Self clearing.
16. High Eng. Temp. Shutdown - Relay operates when the engine coolant temperature is above the shutdown setpoint - Requires Reset to clear.
17. Over-Speed - Relay operates when engine speed exceeds the setpoint - Requires Reset to clear.
18. Over Frequency - Relay operates when AC frequency exceeds the setpoint - Requires Reset to clear.
19. Under Speed - Relay operates when the engine RPM falls below the setpoint - Self clearing.
20. Under Frequency - Relay operates when the AC frequency falls below the setpoint - Self clearing.
21. Low Battery - Relay operates when steady state DC voltage falls below the setpoint - Self clearing.
22. Weak Battery - Relay operates when DC voltage during the crank cycle falls below the setpoint - ACK or reset to clear.
23. High Battery - Relay operates when steady state DC voltage rises above the setpoint - Self clearing.
24. Low AC Voltage - Relay operates when AC voltage falls below the setpoint - ACK or reset to clear.
25. High AC Voltage - Relay operates when AC voltage rises above the setpoint - ACK or reset to clear.
26. Over Current - Relay operates when AC current rises above the setpoint - ACK or reset to clear.
27. PF Out of Range - Relay operates when the power factor is less than the setpoint.
28. kW Limit - Relay operates when the calculated kW is greater than the setpoint - ACK or reset to clear.
29. Remote Contact 1 - 3 - When remote communications have been established, the remote user can remotely actuate/de-actuate the relays. Relays maintain their state until either the remote user changes them again or the unit is reset.

30. Digital Input 1 - 24 - Relays follow the input state of the respective digital input.

31. ECU Enable - Relay operates to enable the engine ECU. ECU enable will open during STANDBY.

32. Prelube / Post Lube - Relay operates to activate for both, pre and post lube cycles.

33. Prelube - Relay operates to activate prelube cycle.

34. Post Lube - Relay operates to activate postlube cycle.

35. Prestart Delay - Delay to prevent nuisance starts or to give warning when equipment is about to run.

36. Oil Level Low Warning - Relay operates when low oil level input active.

37. Coolant Level Low Warning - Relay operates when low coolant level input active.

38. Excite Engine Alternator - Relay output to activate engine alternator excitation.

39. Engine Running No Load - Relay output active when engine running without load.

40. Idle Engine - Relay active when idle engine digital input active.

41. Crank Retries Exceeded - Engine did not start within programmed number of tries. (Also called 'overcrank')

42. Fuel N/C - Inverted logic from normal fuel relay operation

43. Running Warmup

44. Running Cooldown

45. Air Damper N/Energized

46. Run to Destruct Enabled

47. Energized to Stop - Relay turns ON at shutdown and stays on for length of ETS timer.

48. Engine Running - Engine speed is above crank disconnect speed

49. Battery Charger Fail

50. Oil Temp. High - Oil temperature is above warning setpoint.

51. Fuel Level Low Warning

52. Modem Power Enable - Used to turn modem on/off to force a known state

53. Running Warm-up and Cool-down - Reply turns on in both warm-up and cool-down

54. Not in Standby/Aux. Device

55. IDMT Warning (above pickup coweet)

56. IDMT Shutdown

57. Shunt Trip Alarm

---

**Analog Inputs**

There are 7 analog inputs. The first four analog inputs can be used with both resistive senders as well as 0-5VDC & 4-20mA devices, and the last three analog inputs are configured in such way that they may only be used with 4-20mA or 0-5VDC type signals.

The iGUARD uses variable precision current sources to accommodate many different brands of resistive senders as well as true detection of open/missing sender and sender shorted to ground.

---

**Menu Selection for Analog Inputs:**

1. Disabled
2. 4 - 20mA Oil Sender
3. 0 - 5 VDC Oil Sender
4. 4 - 20mA Temp Sender
5. 0 - 5 VDC Temp Sender
6. 4 - 20mA Fuel Sender
7. 0 - 5 VDC Fuel Sender
8. 4 - 20mA Oil temperature
9. 0 - 5VDC Oil Temperature
10. 0 - 5VDC VDO Temp special (Optional output board Required)
11. 0 - 5VDC VDO Pressure special (Optional output board Required)
12. 0 - 5VDC current
13. Datcon Oil Sender
14. Murphy Oil Sender
15. VDO 7 Bar Oil Sender
16. VDO 5 Bar Oil Sender
17. Datcon Temp
18. Murphy Temp
19. VDO A Temp
20. VDO B Temp
21. BMI Temp
22. Datcon Fuel
23. Murphy Fuel
24. VDO Fuel
25. Datcon Oil Temp
26. Murphy Oil Temp
Battery active' operation.

if terminal 9 is tied to ground, applying +V battery to terminal 1 will activate the input. (DEFAULT METHOD)

If terminal 9 is tied to +V battery, applying ground to terminal 1 will activate the input.

**Alternate Signal Polarities for the Digital Inputs**

Most applications will require that ground be applied as the signal that an input is active. The standard iGUARD connection diagrams show this type of connection. However, some applications either require or are much easier to implement using a positive +V battery signal to indicate the input is active.

If terminal 9 is tied to +V battery, applying ground to terminal 1 will activate the input. (DEFAULT METHOD)

Inputs 9 - 24 are ganged together. They have a common that may be tied to ground.

Digital Input 1 return and polarity select

**Clock Start Stop Parameters**

1. Press Enter to display the first start day and time screen. The default is Off.
2. Press the Right and Left arrows to select a day of the week.
3. Press the UP and DOWN arrows to select a time.
4. Press Enter to save.
5. Use the Down Arrow to move to the First Stop day and time screen. The default is Off. Press the Right and Left arrows to select a day of the week.
6. Press the UP and DOWN arrows to select a time.
7. Press Enter to save. Repeat for start/stop times 2 and 3 if needed.

**Using iGUARD with ECU Controlled Engines**

In most Tier 2 compliant engines, the manufacturers have elected to move to electronic controls to meet the exhaust emissions requirements mandated by the various air quality boards. These controls allow for very precise control of the engine to limit emissions to the legal level or below. One side effect is that there no need for the user to supply any senders when using the iGUARD with a J1939 Engine Control Unit or Electronic Control Unit (ECU) equipped engine, and that there is a large amount of useful data available from the engine ECU.

In genset applications, the simplest implementation is to treat the engine ECU like a fuel solenoid in a non-ECU equipped engine.

When there is a call to run:

1. The iGUARD closes the ECU enable relay, applying power or logic enable to the ECU.
2. The iGUARD waits a short time for the ECU to power up and stabilize.
3. The iGUARD communicates with the ECU to see if there are any "Wait to start" conditions, such as:
   - Important variables not at their "ready to start values".
   - The ECU is sending out a Wait to Start message.
4. If there are no "Wait to start" conditions, the iGUARD begins a normal start cycle, or if there are one or more "Wait to Start" signals, the iGUARD waits for them to clear before proceeding.

To use the iGUARD controller with an ECU equipped engine you must make the following selections in the programming stacks:

**In the miscellaneous parameters stack:**

- Select the type of ECU (J1939).
- Select the manufacturer of the engine/ECU.

**In the relay programming stack:**

- Program a relay for "ECU enable". (relay 7 is default)

On SAE-J1939 equipped engines, the data connection will read any available status messages, and if there is a wait to start message, the iGUARD will delay cranking until the engine ECU clears that message.

The ECU broadcasts the data over the J1939 data connection and the iGUARD uses the following parameters to operate:

- Oil pressure
- Coolant temperature
- Engine RPM
- Battery voltage
- Hours

Plus a number of status bits - such as wait to start, and the lamp codes (Shutdown, warning, maintenance).

The iGUARD displays active fault codes*. Additionally, the engine faults and severity for the most common faults and warnings are displayed not only as the Suspect Parameter Number, (SPN) and failure mode indication (FMI) but also in plain text.

This is intended to help with any troubleshooting.

The numeric fault codes are always available, in case the fault or warning message is not one of the ones supported by text description.

The iGUARD will show messages in the Warnings/faults status screen. There is a J1939 screen that shows specific J1939 fault codes, status of the indicator lamps etc. This screen only shows up when the iGUARD is set up to run from ECU data.

---

*Applicable if the ECU manufacturer supports Active Fault
As of May, 2003 here are known manufacturers wiring guides and some peculiarities associated with each manufacturer:

**Detroit Diesel DDEC IV ECU**
- Install any/all ECU connections as per the DDEC manual.
- Program relay 7 on the iGUARD to be "ECU enable".
- Run a wire from the common of relay 7 to +V battery.
- Run a wire from relay 7, normally open terminal to the DDEC IV wire 439.

**Notes:**
- DDEC systems prior to December 2002 did not broadcast DM2 (stored) fault codes.
- DDEC II systems are not SAE-J1939 equipped.
- Detroit engines having more than 8 cylinders use multiple ECU’s in a master/slave relationship. This will require that the address claim selection be enabled in the J1939 setup screen.

**John Deere ECU**
- Install any/all ECU connections as per your ECU manual.
- Program relay 7 on the iGUARD to be "ECU enable".
- Run a wire from the common of relay 7 to +V battery.
- Run a wire from the normally open contact of relay 7 to terminal G on the 21 pin instrument panel connector.

**Notes:**
- John Deere originally implemented J1939 revision 2. When finalized, it implemented revision 4 of the standard. As long as the iGUARD is set to "DEERE" as a manufacturer, we can determine the ECU software revision and automatically accommodate for this version.

**Volvo PENTA series ECU**
- Install any/all ECU connections as per your ECU manual.
- Program relay 7 on the iGUARD to be "ECU enable".
- Run a wire from the common of relay 7 to +V battery.
- Run a wire from the relay 7, normally open contact to the ECU terminal P.

**Notes:**
- Volvo PENTA does not appear to claim / allow claim of addresses on the J1939 databus. The iGUARD will automatically accommodate this when the iGUARD is set to "VOLVO" as the engine manufacturer. Recent ECU software upgrades for load sharing and synchronization require additional connections to the ECU - See the data supplied with the engine.
- The Volvo ECU also supports crank control directly from the ECU. This further simplifies connecting the iGUARD to the Volvo ECU.

**Caterpillar ECU**
- Install any/all ECU connections as per your ECU manual.
- Program relay 7 on the iGUARD to be "ECU enable".
- Run a wire from the common of relay 7 to +V battery.
- Run a wire from the normally open contact of relay 7 to pin 26 of the 40 pin connector on the ADEM 3 ECU.

**Notes:**
- The ADEM 3 ECU constantly broadcasts DM1 message "No error". Make sure that the manufacturer is set to "Caterpillar" to accommodate this.

**Deutz ECU**
- Install any/all ECU connections as per your ECU manual.
- Program relay 7 on the iGUARD to be "ECU enable".
- Run a wire from the common of relay 7 to +V battery.
- Run a wire from the normally open contact of relay 7 to pin 14 on the 25-pin EMR connector.

**Cummins QS series ECU**
- Install any/all ECU connections as per your ECU manual.
- Program relay 7 on the iGUARD to be "ECU enable".
- Run a wire from the common of relay 7 to +V battery.
- Run a wire from the normally open contact of relay 7 to:
  - Cummins QSB/QSC series: pin A on the 23-pin OEM connector (engine access connector)
  - Cummins QST-30 series: pin A on the 21-pin OEM connector

**Notes:**
- The Cummins G-Drive controllers (Except for the G-drive version of QSM) are not currently J1939 enabled. The existing G-Drives are MODbus protocol RS-485 connection, and are not currently (May 2003) supported by the iGUARD. This support will eventually be added in the planned phase two firmware release. Contact the factory (918) 317-4100 about availability.
**DM/A Mimic/Annunciator Versions 1.26 and higher**

The DM/A or Mimic/Annunciator is the repeater unit for the iGUARD (Master) controller. The Mimic/Annunciator features the front bezel display which includes the user interface board and Modbus device that communicates with the iGUARD (Master) controller and a wire cover. To operate the DM/A, power must be supplied to the J1 connector on the rear of the unit.

**J1 Power Connector:**
The iGuard Mimic / Annunciator is powered using the J1 connector. The connector is wired as shown below:

```
| J1   |
|---|---|---|---|
| +V BATT | 3 | 1 | -V BATT |
| +V BATT | 4 | 2 | -V BATT |
```

**J3 Communications Connector:**
The iGuard Mimic / Annunciator communicates with the host iGUARD controller via a RS485 two wire + shield connection. The connector is wired as shown below:

```
| J3   |
|---|---|---|---|---|
| Not Used | 6 | 1 | GROUND |
| Not Used | 7 | 2 | Not Used |
| RS485 A | 8 | 3 | RS485 B |
| Not Used | 9 | 4 | GROUND |
| RS-232 TX | 10 | 5 | RS-232 RX |
```

To configure the DM/A for a particular application do as follows:
- Press the BACK & NEXT keys at the same time.
- The screen will change to identify the hardware/software as configured.
- Press NEXT
- The top line will display the station number.

The menus are as follows:
1. Modbus server address - This is the address of this device as seen on the network. Default is 243.
2. Key sensitivity level - This sets the required amount of force to activate the keypad. Default is Normal
3. LCD backlight - This selects whether the LCD backlight is enabled or not. If disabled, the backlight will not come on. Default is enabled
4. iGUARD beeper - This selects whether or not the station beeper is enabled. If disabled, the station will not sound any audible alarm for faults or warnings. Default is enabled.
5. Interface type - hard coded to RS485 Modbus
6. RS485 bit frame - Sets the configuration of the data transmission. Default (to match the iGUARD default) is 10 bits N-8-1
7. RS485 baud rate - Selects the data transmission rate, and must match the rate settings on the iGUARD it is connected to. Default is 38400.

**NOTE:**
There are corresponding settings in the iGUARD for choosing how the station operates*. The selections are "Mimic" and "Annunciator"

In Mimic mode, the remote station is allowed to behave exactly as if it were the front panel of the actual iGUARD - the user may start and stop manually, change between automatic and manual modes, acknowledge alarms, and reset the system. The only thing that a mimic panel cannot do is change the programming on the master.

In Annunciator mode, the station may acknowledge its own alarms and look at data, but it cannot do any control functions.

* See page 9, 21 & 22 for specifics.
iGUARD WITH ECU CONTROLLED ENGINE

![Diagram of ECU Wiring]

Fuel sender and magnetic pickup are optional on ECU applications.

Flywheel housing
Starter ring gear

ES2F
MP3298
iGUARD THREE PHASE WIRING

**Note:**
Wire as shown for 227/480 V 3-Phase 4-Wire

iGUARD SINGLE PHASE WIRING

iGUARD in Center Tapped Delta Wiring

**Note:**
Wire as shown for 227/480 V 3-Phase 4-Wire
Gage Drive Board (AGCOM board)

Additionally your iGUARD may have an optional gage drive board (AGCOM board) attached in place of the standard EMB cover. This is easily recognizable because it is a green circuit board with additional connectors instead of the white plastic cover.

The AGCOM Board allows the iGUARD to read and use a standard oil pressure and coolant temperature sender and gage combination at the same time.

iGUARD controller with optional AGCOM Board installed:
4 connections either on the AGCOM Board or thru it. J9 & J10 are the AC voltage and Current connectors (Actually mounted on the Energy Monitoring board)

J11 & J 13 are the actual connections to the AGCOM Board itself.  
J11 is the supply and I/O for reading a standard gage/sender combo.  
J13 is all of the connections for J3 on the I/O board ported onto the AGCOM Board.

The connections for the AGCOM board used with a sender and gage are:

The connections when used with a standard sender only are:

(The iGUARD controller must be programmed for this.)
### Current Transformer Options

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00-00-2592</td>
<td>50:5A Current transformer, 12 inch (305 mm) leads</td>
</tr>
<tr>
<td>00-00-2707</td>
<td>60:5A Current transformer, 12 inch (305 mm) leads</td>
</tr>
<tr>
<td>00-00-4893</td>
<td>75:5A Current transformer, 12 inch (305 mm) leads</td>
</tr>
<tr>
<td>00-00-2372</td>
<td>100:5A Current transformer, 12 inch (305 mm) leads</td>
</tr>
<tr>
<td>00-00-2484</td>
<td>150:5A Current transformer, 12 inch (305 mm) leads</td>
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<tr>
<td>00-00-2485</td>
<td>200:5A Current transformer, 12 inch (305 mm) leads</td>
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<tr>
<td>00-00-2486</td>
<td>300:5A Current transformer, 12 inch (305 mm) leads</td>
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<td>1200:5A Current transformer, 12 inch (305 mm) leads</td>
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<td>1600:5A Current transformer, 12 inch (305 mm) leads</td>
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<td>00-00-2518</td>
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<tr>
<td>00-00-2519</td>
<td>3000:5A Current transformer, 12 inch (305 mm) leads</td>
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