DYNAGEN®

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TG350AMF User Manual

TOUGHSeries
Digital Generator Controllers

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Software Revision: 1.2
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1 Introduction

The TOUGH series controllers are designed to provide complete control, protection, AC volts metering, and engine instrumentation for both standard and electronic engines. The module is easily configured using either the front panel buttons or our PC Configurator software. TOUGH series controllers are ideally suited for severe duty applications where reliability is critical such as mobile and stationary generators.

Features and Functions:

- 5 Year Warranty
- SAE J1939 CANbus Protocol
- RPM via J1939, Magnetic Pickup, or Generator
- Speed control offset for electronic engines
- Autostart on low battery and other sensors
- Trim feature for AC voltage inputs and sensors
- Maintenance counter
- Exerciser Clock
- 100 Event Log
- Conformally coated for protection against moisture and contaminants
- Gasket for water ingress protection IP65
- Free PC Configurator Software
- Fast and rugged installation clips
- Passcode protected
- Automatic shutdowns and warnings
- Manual and remote start
- Momentary start/stop inputs
- Pre-heat and many configurable timers
- Accepts common senders (VDO, Datcon, Murphy, and more)
- Custom senders configurable with PC software

Displays:

- Oil Pressure
- Engine Temperature
- Fuel Level
- Oil Level
- Hour Meter
- RPM
- Real Time Clock
- AC Volts and Hz
- Battery Voltage
- J1939 DTC codes with custom text
- 2 Custom Sensors

FEATURE	INCLUDED
J1939 CANbus	✔
Magnetic Pickup Input	✔
100 Event Log	✔
Clock / Exerciser	✔
Generator Metering	3-Phase
Mains Metering (AMF + ATS)	3-Phase
Configurable Switched Inputs	5
Resistive Sensors	3
Universal Sensor (Resistive, 0-5V, 4-20mA)	1
User Configurable Switched Outputs (+Fuel and Crank)	4

1.1 Specifications

Testing Specifications:

The TOUGH Series controllers were rigorously tested to ensure durability, reliability and functionality. The following specifications are a brief summary of the standards to which the controller has been tested. For complete details on the testing performed please contact DynaGen.

SPECIFICATION	RATING
Electrical Transients	SAE1113-11
Thermal Shock and Cycling	SAE1455
Vibration Profiles	SAE1455
Electric Static Discharge	SAE1113-13

Physical Specifications:

SPECIFICATION	RATING
Operating Temperature	-40 to +158°F (-40 to +70°C)
LCD Viewing Temperature	-4 to +158°F (-20 to +70°C)
Weight (With Relay Pak)	1.32lb (0.6kg)
Dimensions (With Relay Pak) (Height x Width x Depth)	4.41" x 6.79" x 3.33" 11.20cm x 17.25cm x 8.46cm

Electrical Specifications:

SPECIFICATION	RATING
Operating Voltage	5.5 - 36VDC
Standby Current	50mA
Switched Inputs	+Battery, Ground, Open, Closed
Switched Outputs	+Battery @ 1A Max
Low Resistance Sensor (Ports B and C)	0 - 750Ω
High Resistance Sensors (Port A)	0 - 7,500Ω
Universal Sensor (Port D)	0 - 750Ω, 0 - 7,500Ω, 0 - 5VDC, 4 - 20mA
Magnetic Pickup	10 - 10,000Hz at 1 - 50VAC
AC Voltage (Line-To-Line)	50 - 575VAC True RMS Accuracy: 1% Full Scale
Communications	SAE J1939 (Tier II, III, IV) and USB

1.2 Accessories

The following items are available to be purchased from DynaGen to be used with the TOUGH Series controllers.

ACCESSORY	PART NUMBER	DESCRIPTION
Relay Pak	RP100	Snap-on Relay Pak with 3 x 12V @ 40A relays
Enclosure (NMEA 1)	ENC0080	Steel enclosure with cutout and vibration mounts
Silicon Gasket	ENC0059	Replacement Silicon Gasket
Mounting Clip	ENC0068	Replacement Mounting Clip
12V Relays	RLY0053	Replacement 12V Relays
24V Relays	RLY0054	Replacement 24V Relays
USB Cable	ACC0084	Programming and firmware update cable
Temperature Sensor	ACC0027	Datcon 100-280C, 1/8”- 27 NPTF
Temperature Sensor	ACC0098	Datcon 100-280C, 3/8” – 18 NPTF
Temperature Sensor	ACC0099	Datcon 100-280C, 1/2” – 14 NPTF
Oil Pressure Sensor	ACC0108	S & W (2798) 100 PSI, 240 ohm, 1/8”- 27 NPTF

Pre-assembled Harnesses

The following DynaGen's harnesses are pre-assembled and sold separately. Each wire on the harness is 4 feet in length unless otherwise specified in the harness drawings.

HARNESS	PART NUMBER	DESCRIPTION
Main I/O Starter Harness	DWG1475	Battery, ground, 3 switched inputs, 3 switched outputs, and 3 resistive sensors.
Main I/O Starter Harness for Relay Pak	DWG1476	Battery, ground, 3 switched inputs, 3 resistive sensors, and connections from the switched outputs to the external Relay Pak connector.
Advanced I/O Harness	DWG1477	2 Switched Inputs, 3 Switched Outputs, and 1 Universal Sensor.
Magnetic Pickup / J1939 Interface Harness	DWG1478	J1939 and Magnetic Pickup
3-Phase AC Volts Harness (Genset or Mains)	DWG1479	AC Voltage Sensing. Two of these harnesses are required for genset and mains monitoring.
4 - 20mA	DWG1496	Required for universal sensor (Port D) to function as a 4 - 20mA input.

Custom Harness Component List

If DynaGen harnesses are not suitable for your application, custom harnesses can be created using the following part list:

COMPONENT	PART NUMBER	NOTES
Molex 2x3 Connector	39-01-2060	Used with Relay Pak harness.
Molex 2x4 Connector	39-01-2080	Used with Advanced I/O Harness.
Molex 2x5 Connector	39-01-2100	Used with Magnetic Pickup / J1939 Interface Harness.
Molex 2x7 Connector	39-01-2140	Used with Main I/O Starter Harness.
Molex Crimp Pins	39-00-0039	Used with all Molex connectors.
Molex Crimp Tool	63819-0900	Used with all Molex connectors.
Tyco 1x4 Connector	1-480702-0	Used with 3-Phase AC Volts Harness.
Tyco Crimp Pins	350536-1	Used with 3-Phase AC Volts Harness.
Tyco Crimp Tool	90546-1	Used with 3-Phase AC Volts Harness.
18 AWG Wire	N/A	Used with every harness.

2 Installation

Safety Precautions

Generator systems contain high voltage circuitry and precautions to protect against it should be taken. Failing to power down and lock out equipment can cause damage, injury or death.

WARNING: Wiring of this controller should be performed by qualified electricians only.

The following general electrical safety precaution should be followed:

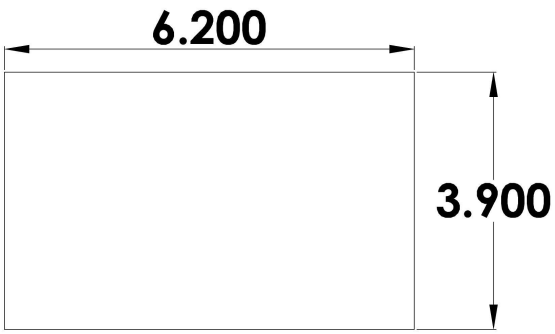
- Do a thorough inspection of the area before performing any maintenance.
- Keep fluids away from electrical equipment.
- Unplug connectors by pulling on the plug and not the cord.
- Use fuses where appropriate.
- Ensure all equipment is properly grounded.
- Provide support to wires to prevent stress on terminals.

Mounting the Controller

To ensure proper and safe operation, caution must be taken at the installation site to make sure it is free from excessive moisture, fluctuating temperature, dust and corrosive materials. Choose a mounting surface with the least amount of vibration and not more than **0.125"** thick.

To mount the controller follow these instructions.

1) Choose a suitable mounting location based on the criteria above.
2) Create a rectangular cutout in the panel that is 3.9" high and 6.2" wide.
3) If applicable, snap the Relay Pak (RP100) to the back of the controller. Place one side of the RP100s tabs into the slot on the back of the controller and without pushing on the relays, snap the other tab into place.
4) Place the controller into the panel cutout so that the LCD screen and buttons are facing out.
5) Place the mounting clips into the designated slots on the top and bottom of the controller.
6) Tighten the screws on the clips until controller is snug against the panel. Do not over tighten, the bottom of the screws should angle very slightly away from the controller.



Dimensions are in inches. Not to scale.

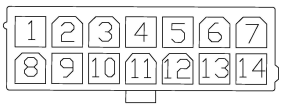
2.1 Main I/O Starter Harness

The Main I/O Starter Harness (or equivalent) is required to provide power to the controller. It also has inputs and outputs that can be interfaced to outside devices / components. There are 2 versions of this harness offered:

1. **Standard** - This version does not have the pre-wired connections to an external connector that plugs into the Relay Pak.

2. **Relay Pak** - This version has Ground and Switched Outputs A, B, and C wired to an external connector that plugs into the Relay Pak.

TERMINAL	FUNCTION	DESCRIPTION
J4-1	+Battery	These connections connect battery power to the controller. The second +Battery connection can be used to power external devices of up to 1A.
J4-2	+Battery	
J4-3	-Battery	These connections provide a ground return line from the controller. The second -Battery connection can be tp provide ground for external devices of up to 1A.
J4-4	-Battery	
J4-5	Switched Input A	Switched inputs are configurable to detect battery voltage, ground, closed, or open. See Switched Inputs 25 for more information.
J4-6	Switched Input B	
J4-7	Switched Input C	
J4-8	Switched Output A	Each switched output provides +Battery voltage when active and can supply up to 1A of current. Switched Output A is locked to Fuel Relay Switched Output B is configurable. Switched Output C is locked to Crank Relay.
J4-9	Switched Output C	
J4-10	Switched Output B	
J4-11	Sensor Ground	Provides ground for 2-wire sensors.
J4-12	Sensor Input A	High resistance sensor (0 - 7,500Ω)
J4-13	Sensor Input B	Low resistance sensor (0 - 750Ω)
J4-14	Sensor Input C	Low resistance sensor (0 - 750Ω)

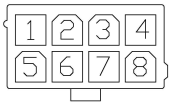


Looking at rear of controller

2.2 Advanced I/O Harness

The Advanced I/O Harness is only required if the number of inputs and outputs on the Main I/O Starter Harness are not sufficient to meet the requirements of your application.

TERMINAL	FUNCTION	DESCRIPTION
J3-1	Switched Input D	Switched inputs are configurable to detect battery voltage, ground, closed, or open. See Switched Inputs 25 for more information.
J3-2	Switched Input E	
J3-3	Switched Output D	Each switched output provides +Battery voltage when active and can supply up to 1A of current. They can be configurable to functions listed in Switched Outputs 29.
J3-4	Switched Output E	
J3-5	Switched Output F	
J3-6	No Connection	This terminal is currently not used.
J3-7	Sensor Ground	Provides ground for 2-wire sensors.
J3-8	Sensor Input D (Universal Sensor Input)	Can be configured using the PC Configurator to sense low resistance, high resistance, 0 - 5V, or 4 - 20mA. The 4-20mA options requires harness DWG1496.



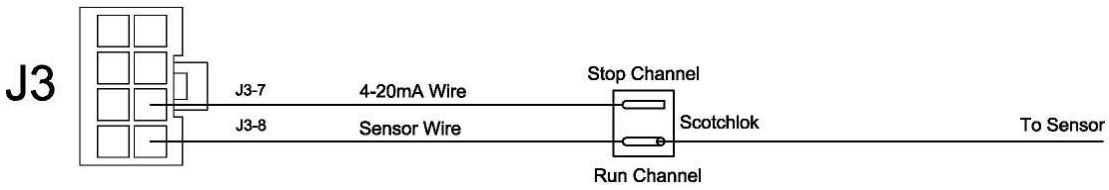
Looking at rear of controoller

Universal Sensor Input (Port D)

The Universal Sensor Input has the ability to sense low resistance, high resistance, 0 - 5V and 4 - 20mA sensors. In order to configure this input you must use the PC Configurator. See for more information.

To use the sensor as 4 - 20mA it requires wiring harness DWG1496. The following directions describe how to install the harness:

1. Place the crimp side of the 4 - 20mA wire into connector position J3-7.
2. Place Sensor Input D wire into the 'Run' channel of the Scotchlok connector.
3. Place the other side of the 4 - 20mA wire into the 'Stop' channel of the Scotchlok connector.
4. Drive the U-Contact down and latch the top cover.

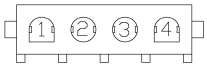


2.3 3-Phase AC Volts Harness

The 3-Phase AC Volts Harness is used for AC metering of the generator and mains voltages. A second harness is required if mains sensing is desired (AMF).

TERMINAL	FUNCTION	DESCRIPTION
J5-1	Generator Phase A	The controller can be configured in AC Monitoring 38 to accommodate various voltage configurations. See below for more information.
J5-2	Generator Phase B	
J5-3	Generator Phase C	
J5-4	Generator Neutral	

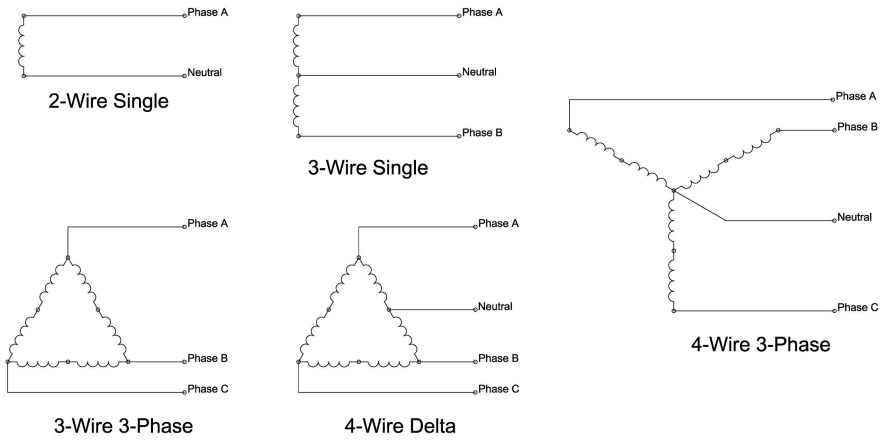
TERMINAL	FUNCTION	DESCRIPTION
J7-1	Mains Phase A	AMF versions only. The controller can be configured in AC Monitoring 38 to accommodate various voltage configurations. See below for more information.
J7-2	Mains Phase B	
J7-3	Mains Phase C	
J7-4	Mains Neutral	



Looking at rear of controller

Voltage Configurations

The controller can be configured in the settings for a variety of different voltages and setups. The diagrams below indicate the configurations and the necessary wiring connections for each one.



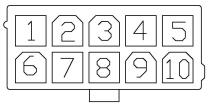
NOTE: If using a 2-Wire Single configuration you must use Phase A terminal. If using 3-Wire Single configuration you must use Phase A and B terminals.

2.4 Magnetic Pickup / J1939 Interface Harness

The Magnetic Pickup / J1939 Interface Harness is only required if you are using an electronic engine or acquiring your speed signal from a magnetic pickup sensor.

TERMINAL	FUNCTION	DESCRIPTION
J6-4	CAN Bus High	CAN Bus (J1939) is used for electronic engines that have an ECM.
J6-5	CAN Bus Low	
J6-6	CAN Bus Shield	
J6-7	Speed Input A	The speed sensing terminals are not sensitive to polarity. Magnetic pickups, tachometers, or a flywheel alternator can be used to provide signal. These inputs are not required if AC voltage is being used. See Speed Sensing and Battery 37 for more information.
J6-8	Speed Input B	

NOTE: Terminals J6-1, J6-2, J6-3, J6-9 and J6-10 are unused. These are left open for future expansion.

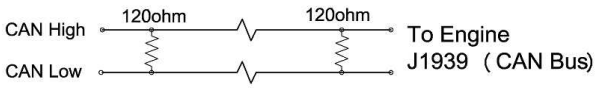


Looking at rear of controller

CAN Bus (J1939) Wiring Considerations

CAN Bus (J1939) is for use with electronic engines. There are some special precautions that need to be taken when wiring to the electronic control module (ECM).

- If controller is not the last device on the bus, connect to the existing bus and ensure that there are 120Ω terminating resistors at each end of the bus.
- If controller is the last device on the bus, you must install a 120Ω terminating resistor across the CAN High and CAN Low lines as shown in the figure below.
- If running the cable over a long distance, use Beldan 7895A cable or equivalent cable.



For the ECM to function, it must first receive power for a short time before cranking to allow it to boot. It is common practice to use the fuel relay to turn the ECM on and off. There are two ways to configure this:

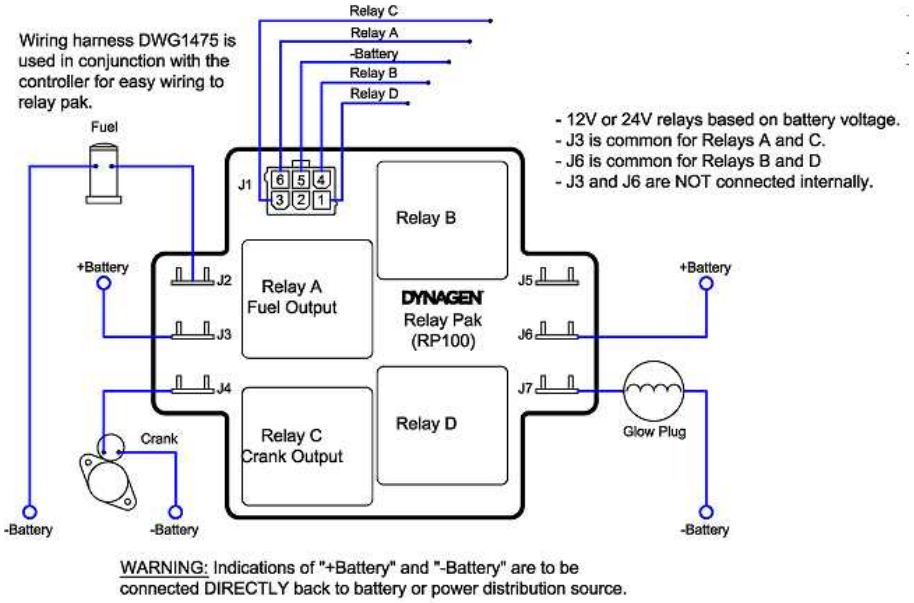
- The fuel relay is on during 'Preheat'. Increasing the 'Preheat' time in the Engine Logic 23 menu will allow longer time for the ECM to power up before cranking.
- Turning on the 'Auto Power ECM' setting in the J1939 menu enables the fuel relay to be on when controller is in Auto mode. This way the ECM will be always be on except wen in OFF mode.

2.5 Relay Pak (RP100)

The Relay Pak (RP100) can be used to control DC devices. Be sure to select relays based on your system voltage (12 or 24V). Listed below are the wiring connections and their functions.

TERMINAL	FUNCTION	DESCRIPTION
J1-2 J1-5	-Battery	This connection provides a ground return line from the RP100 to the controller.
J1-6 J1-4 J1-3 J1-1	Relay A (Coil) Relay B (Coil) Relay C (Coil) Relay D (Coil)	Activated by applying 12 / 24V to the terminal. These are intended to be connection to switched outputs on the controller.
J2 J5 J4 J7	Relay A (Contact) Relay B (Contact) Relay C (Contact) Relay D (Contact)	Connect to high current auxiliary devices. Wire gauge is dependent upon current requirements. **Pilot Duty Rating: 5.83A per relay** **Resistive Rating: 10A per relay (40A Momentary)**
J3	A/C Common (Contact)	Relays A and C share a common contact point. Connect this terminal to +Battery or -Battery. Wire gauge is dependent upon amperage requirements.
J6	B/D Common (Contact)	Relays B and D share a common contact point. Connect this terminal to +Battery or -Battery. Wire gauge is dependent upon amperage requirements.

The following is a sample wiring diagram using the RP100. Keep in mind that the wires from connector J1 are connected to the controllers switched outputs and ground.

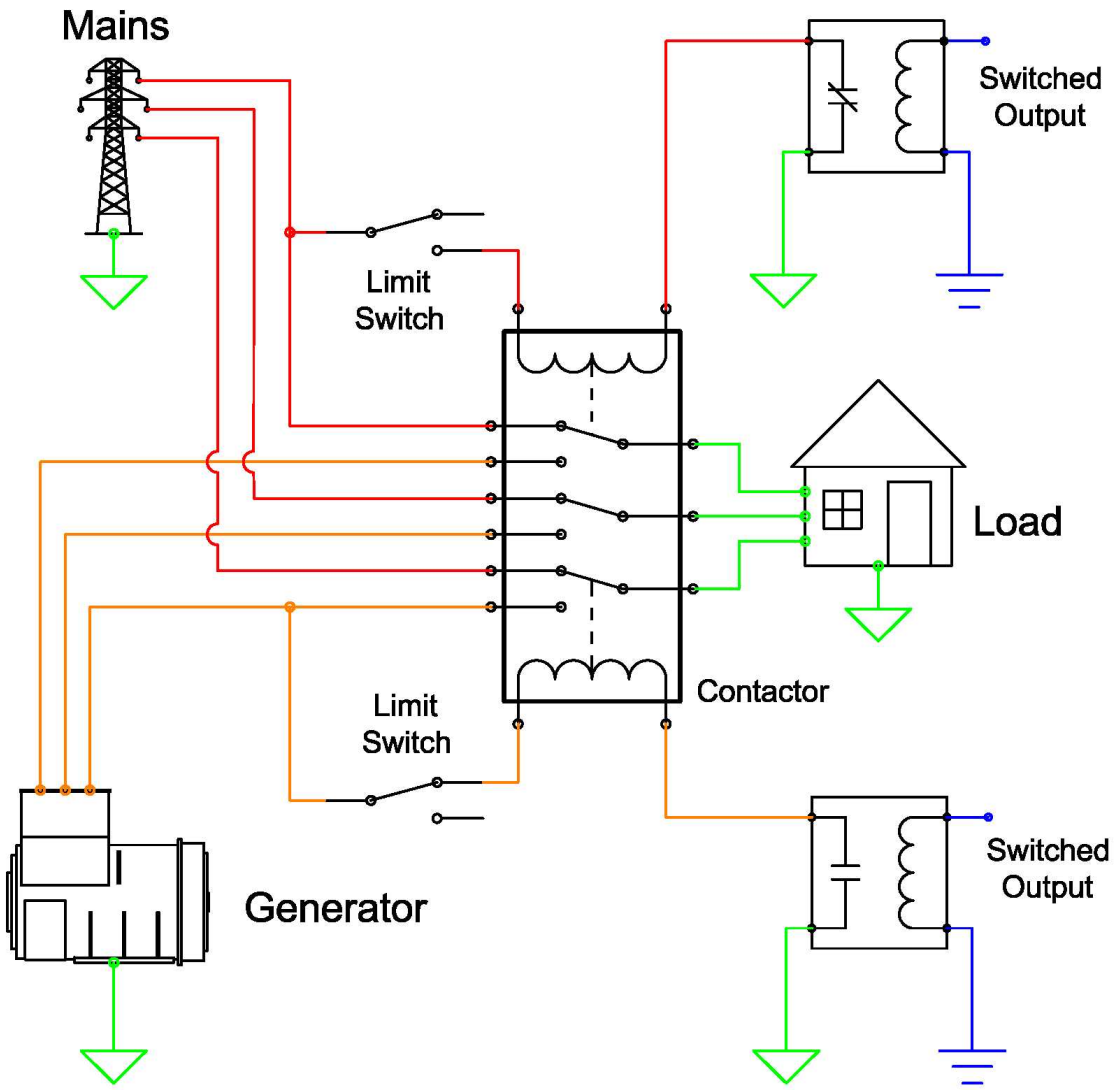


2.6 AMF / ATS Wiring

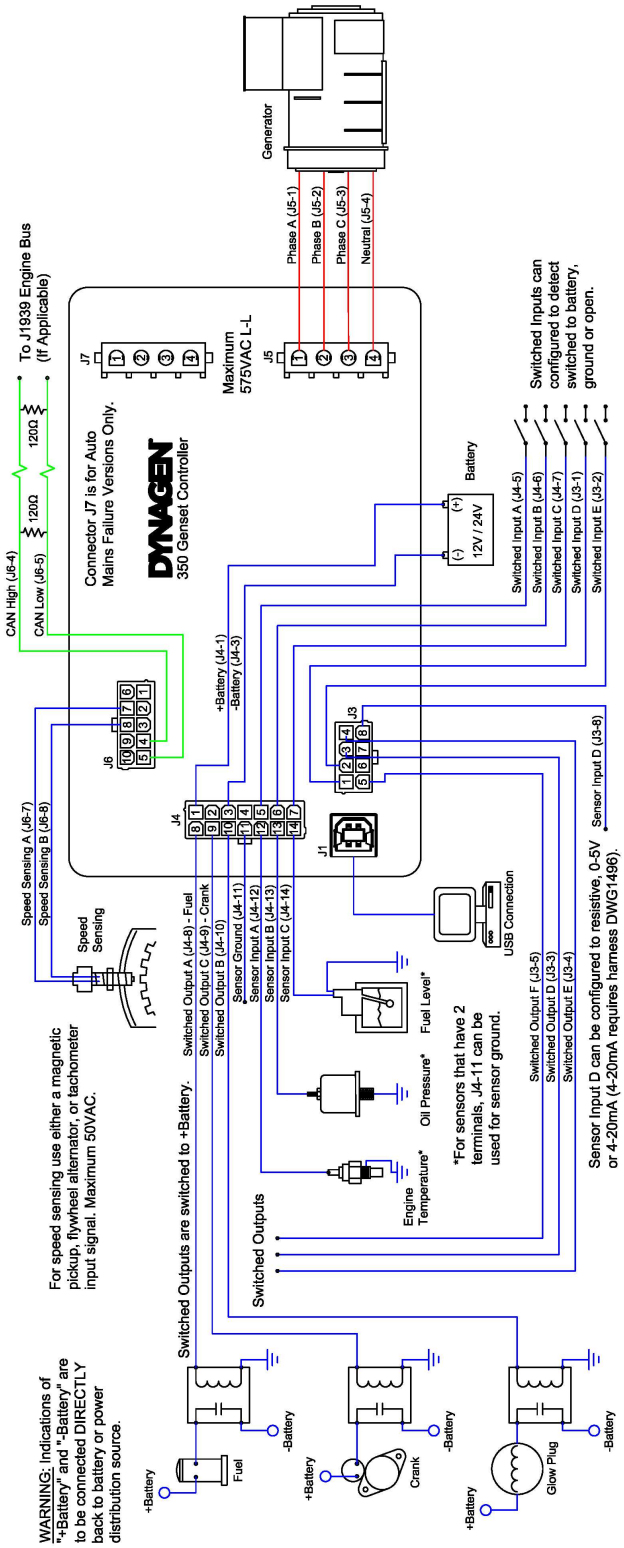
When wiring to a transfer switch there are two main items to take into account:

- Wire the transfer switch so that it defaults to the mains position if the controller fails by using a normally closed relay to the Mains coil.
- Use limit switches (if applicable) to disengage the AC voltage to the coil when the switch is in that position. This prevents the coil from burning out.

The following is an example wiring diagram for a transfer switch. Keep in mind that there are some items omitted (fuses, connections to controller, etc.) and that not all configurations will be the same.



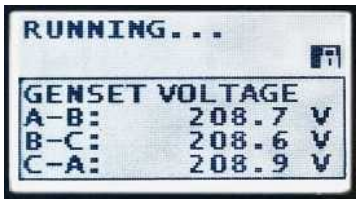
2.7 Typical Wiring Diagram



3 Using The Controller

The controller is equipped with an LCD screen (A), the navigation buttons (B), LED lamps (C) and the functional buttons (D). These components provide the means to interact with the controller.

LCD Screen (A)



The LCD Screen is the main source for providing information to an operator. From the LCD screen you can view and navigate the status, engine parameters, settings, and time.

Warnings and failures will appear on the LCD Screen and will be logged into the Events History of the controller.

Navigation Buttons (B)

The Navigation Buttons are used to move throughout the menu system, change settings and view parameters on the LCD screen.

SYMBOL	FUNCTION	DESCRIPTION
	Up	Used for moving around in the menu, changing a settings value, or changing the currently displayed parameter page.
	Enter	Used for entering the menu system, accepting settings, or locking the LCD screen when viewing parameters.
	Down	Used for moving around in the menu, changing a settings value, or changing the currently displayed parameter page.

LED Indicators (C)

The LED indicators are used to display the current status of the system. Different versions of the TOUGH series controllers have different LED combinations therefore some symbols may not appear on your controller. The following table shows the meanings of each symbol and LED color.

SYMBOL	FUNCTION	LED STATUS	DESCRIPTION
	Generator Status	Solid Green	Engine Running
		Solid Amber	Warning
		Solid Red	Failure
	Mains Status	Solid Green	Mains Available
		Solid Red	Mains Unavailable
	Load	Symbol Only	Symbol Only
	Switch Position	Solid Green	Switch Active

Functional Buttons (D)

The following table describes the function of the Functional Buttons. Keep in mind that some buttons may have multiple purposes depending on the status of the controller.

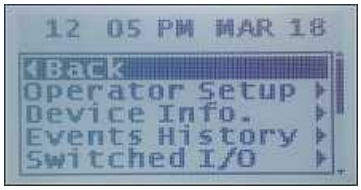
SYMBOL	FUNCTION	DESCRIPTION
	Off	Used for turning off the engine or exiting out of AUTO mode. All automatic methods of starting the engine are disabled.
	Auto	Places the controller in AUTO mode which allows it to start or stop based on conditions (Exerciser, Low Battery Recharge, Failure, Remote Start, Loss of Mains).
	Run	Starts the engine manually and will continue to run until the off button is pressed, emergency stop input is activated, or a failure occurs.

3.1 Using the Menu System

Switching Between Menus

Press the ENTER button to navigate into the configuration menu of the controller. If the controller is in AUTO or RUNNING mode you must first enter OFF mode by pressing the OFF button.

NOTE: Entering the OFF mode while the generator is running will shut it down.

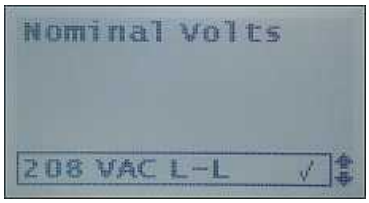


Use the UP and DOWN buttons located next to the LCD screen to scroll through menus. The current position on the screen is indicated by the **HIGHLIGHTED TEXT**. A scroll bar may be displayed on the right hand side of the screen. This indicates the current position in the menu and pressing the UP or DOWN buttons will reveal more options.

To move into the currently highlighted menu item you must press ENTER. If you wish to move to a previous menu, scroll up and select 'Back' by pressing the ENTER button.

Changing a Setting

To change a setting on the controller you must first navigate to it. Once you have the setting you wish to change highlighted, press enter to view the options menu for that setting.

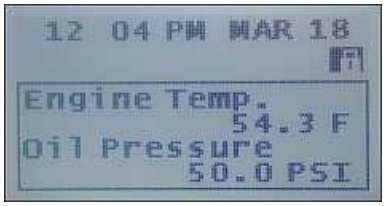


There are generally 2 types of settings. One is a list setting that you must scroll up and down to select the option that you want. The other type is a numerical setting. To change this setting you must use the up and down buttons to scroll to the value you want. To change the value quickly, press and hold the directional arrow.

Once you have changed your setting to the desired value, you must press the enter button to accept the change. Upon pressing enter a check mark will appear, press enter again to return to the previous menu.

Viewing Engine Parameters

While the controller is in AUTO or RUNNING mode you can view the current status of the engine (fuel level, engine temperature, etc). By default the controller will automatically scroll through the parameters for you to view.



To manually change the parameters you are viewing, scroll to it using the UP and DOWN buttons. You can lock the screen from scrolling by pressing the ENTER button. Upon being locked a small icon of a lock will appear in the top right corner. You can still manually scroll through the parameters while the screen is locked.

3.2 Warnings, Failures and Events History

Warnings and Failures

Warnings and failures occur when certain parameters (fuel level, oil pressure, etc.) are outside of specified limits. These settings can be set using the front panel or the PC Configurator. All warnings and failures are recorded in the Events History section of the menu.

Events History

Every time an event of significance occurs, the time and date as well as a description of the event is placed as an entry in the Events History. Examples of events are: 'Successful Start', 'Over Speed Warning' or 'Low Oil Failure.'

To view the Events History :

1. Place the controller in OFF mode.
2. Press enter to bring up the Main Menu and then select Events History.
3. Press the up or down buttons to browse through the events.
4. Press enter to exit out of the Events History.

From this menu you can scroll up to 150 events using the up and down arrows. Keep in mind the events are recorded in order so Event 1 is the most recent event and Event 150 is the oldest event.

NOTE: If a new event is recorded and there are already 150 events in the history, the oldest recorded event will be deleted.

Device Information

You can find out information about the controller by navigating to the 'Device Info.' menu. From inside this menu you can see the following information.

FUNCTION	DESCRIPTION
About Controller	Gives the hardware version, software version and serial number.
Maintenance	Gives the amount of time remaining before maintenance is required. If '----' is displayed maintenance is disabled. A negative number indicates the amount of time since maintenance timer expired.

3.3 Starting, Stopping and Controller Modes

Controller States

The following table contains the states the controller can be in and their descriptions.. Each mode has a different purpose and changes the way the controller interacts with the engine logic, inputs, outputs and sensors.

STATE	DESCRIPTION
Off	While in OFF state, the user can change settings through the menu system. Automatic starting is disabled.
Auto	While in AUTO state, automatic starting is armed and certain engine parameters are monitored.
Running	While in RUNNING state, the controller waits to be stopped and monitors engine parameters.
Failure	The controller shuts down the engine and reason for failure is displayed on screen.

Start and Stopping Methods

The controller can be started and stopped in a variety of different methods. The following section briefly outlines these methods:

NOTE: The LCD backlight will turn off during the first 2 seconds of cranking to limit voltage dip during cranking.

Manual Start and Stop

Manual starting and stopping of the generator can be done through the front panel buttons. Pressing the RUN button will start the engine and pressing the OFF button will stop the engine.

NOTE: Cool down time is bypassed when engine is started manually.

Start / Stop Input

Starting and stopping can be completed through use of switched input 'Start / Stop.' If you do not have the AMF version of the controller, this input can be used as a 'Remote Start' contact for connecting to pre-existing Automatic Transfer Switch infrastructure or other switch.

Switched input 'Start / Stop' also has a feature that allows it to be used as a momentary input. See Start / Stop (Momentary Function) 28 for more information.

Momentary Inputs

Switched inputs 'Momentary Start' and 'Momentary Stop' can be used for starting and stopping of the engine. Unlike other inputs, they only have to be activated for a short period of time to perform their function.

Battery Recharge Start

The controller has the ability to monitor the battery voltage and start the engine to charge the battery based on voltage level settings. See Speed Sensing and Battery 37 for more information.

Exerciser Start

The controller can start the engine at predetermined intervals to allow the engine to be exercised. See Exerciser and Maintenace 41 for more information.

Auxiliary Sensors

The controller can be configured to cause the engine to start and stop based on sensor levels. See Auxiliary Sensors 33 for more information.

Example: A generator is required to start in order to heat a building when the ambient temperature drops below a certain point. The controller can be configured to monitor the temperature, start the generator and run until it reaches a certain temperature.

Auto Mains Failure

Te AMF version of the controller, it can be configured to automatically start the engine if a loss of mains power is detected. It can can also be used to control Automatic Transfer Switch functions to allow fully automated power restoration. See AMF / ATS 39 for more information.

3.3.1 Emergency Stop and Failures

Emergency Stop

A switched input can be configured to 'Emergency Stop.' When this input becomes active the controller will immediately turn off the Fuel Relay and turn on the Energize-to-Stop output (if applicable).

WARNING: It is mandatory to wire your Emergency Stop button or switch in a way that it physically disconnects the fuel solenoid in conjunction with feeding the emergency stop input on the controller.

Failures

Failures occur on the controller when a parameter that is being monitored goes outside its desired range. The controller will immediately turn off the Fuel Relay and turn on the Energize-to-Stop output (if applicable). It will also display the cause of the failure and record it into the Events History.

If you notice that the engine is shutting down immediately after start up, verify that the 'Bypass Time' in the Sensors 31 menu is set to a high enough value to allow the readings to settle to their normal ranges.

4 Configuration

Changing the following settings can alter the way the engine is started and stopped and how the controller reads inputs, control outputs, and interprets and act on sensor data. When configuring settings be sure to thoroughly read their descriptions to understand how they will affect the controller.

The following list is a breakdown of the settings menu structure inside the controller.

- Operator Setup
  - a. Lamp Test
  - b. Display
    - i. LCD Reverse
    - ii. LCD Contrast
    - iii. Page Scroll
    - iv. Message Pop-Up
    - v. LCD Backlight
  - c. Date/Time
    - i. Date Change
    - ii. Time Change
    - iii. Daylight Saving
  - d. Units
    - i. Temp. Unit
    - ii. Pressure Unit
  - e. Run from OFF
    - i. Run from OFF
- Device Info.
  - a. About Controller
  - b. Maintenance
- Events History
- Switched I/O
  - a. Switched IN
    - i. X Function
    - ii. X Active Modes
    - iii. X Trigger
  - b. Switched OUT
    - i. X Function
- Sensors
  - a. Battery
    - i. Batt Recharge
    - ii. Recharge Setup
    - iii. Setpoints
    - iv. Crank Low Batt
  - b. Engine Speed
    - i. Signal Source
    - ii. Speed Settings
    - iii. Setpoints
  - c. Engine Temp.
    - i. Signal Source
    - ii. Sensor Type
    - iii. Trim Offset
    - iv. Setpoints
  - a. Oil Pressure
    - i. Signal Source
    - ii. Sensor Type
    - iii. Trim Offset
    - iv. Setpoints
  - b. Fuel Level
    - i. Signal Source
    - ii. Sensor Type
    - iii. Trim Offset
    - iv. Setpoints
  - c. Aux Sensor 1
    - i. Signal Source
    - ii. Mode Select
    - iii. Trim Offset
    - iv. Mode Settings
    - v. Setpoints
  - d. Aux Sensor 2
    - i. Signal Source
    - ii. Mode Select
    - iii. Trim Offset
    - iv. Mode Settings
    - v. Setpoints
- Timers
  - a. Engine Logic
    - i. Delay To Start
    - ii. Preheat Time
    - iii. Crank Time
    - iv. Midheat Time
    - v. Crank Rest Time
    - vi. Crank Attempts
    - vii. Fuel Crank Rest
    - viii. RPM Disconnect
    - ix. Postheat Time
    - x. Warm-up Time
    - xi. Cooldown Delay
    - xii. ETS On Duration
  - b. Exerciser
    - i. Enable
    - ii. Delays
    - iii. Schedule
  - c. Maintenance
    - i. Reset Counter
    - ii. Enable Counter
    - iii. Count Interval
  - d. Trigger Delays
    - i. Config Inputs
- AC Monitor
  - a. Genset Voltage
    - i. Voltage Source
    - ii. Scaling Factor
    - iii. Nominal Volts
    - iv. Volt Sel Inputs
    - v. V Setpoints
    - vi. H Setpoints
  - b. Mains Voltage
    - i. Mains Source
    - ii. Scaling Factor
    - iii. Nominal Volts
    - iv. AMF/ATS Mode
    - v. AC Stable Time
    - vi. V Setpoints
  - c. ATS Outputs
    - i. Genset Drive
    - ii. Genset Trigger
    - iii. Genset ATS Dly
    - iv. Mains Drive
    - v. Mains Trigger
    - vi. Mains ATS Dly
    - vii. Mains Open
- Communications
  - a. J1939 Bus
    - i. ECM Model
    - ii. Loss of ECM
    - iii. DTC Display
    - iv. Active DTC Log
    - v. Read Stored DTC
    - vi. Auto Power ECM
    - vii. ECM Power Delay
    - viii. Cummins Idle
    - ix. SPN Conversion
    - x. EMS2B Freq Sel
    - xi. EMS2B Acc Pedal
- 2. Other Config
  - a. Passcode
    - i. Bypass
    - ii. Timeout
    - iii. Number

Operator Setup

The Operator Setup options are settings that can be changed by the end-user of the controller. These settings are not passcode protected and do not change the way the controller interacts with the engine.

SETTING	SETTING	DESCRIPTION
Lamp Test	---	Tests the LED's by flashing them red and green to verify they are functioning properly.
Display	LCD Reverse	Reverses the black and white of the LCD screen.
	LCD Contrast	Adjusts the contrast of the LCD.
	Page Scroll	Amount of time before parameter page scrolls.
	Message Pop-up	Rate at which status messages display.
	LCD Backlight	Amount of time before the LCD backlight turns off.
Date / Time	Date Change	Changes the day, month and year.
	Time Change	Changes the second, minute and hour.
	Daylight Saving	Determines if daylight savings time is enabled or disabled. North America only.
Units	Temperature Units	Select between Celsius and Fahrenheit.
	Pressure Units	Select between PSI and kPa.
Run from OFF	---	Determines if controller can be manually started while in OFF mode.

Other Configurations

SETTING	SETTING	DESCRIPTION
Passcode	Bypass	Enables or disables the use of the passcode.
	Timeout	Amount of time after the passcode is entered to remain unlocked. Once timeout limit is reached due to inactivity the passcode must be entered again.
	Number	The desired passcode digits.

4.1 Engine Logic

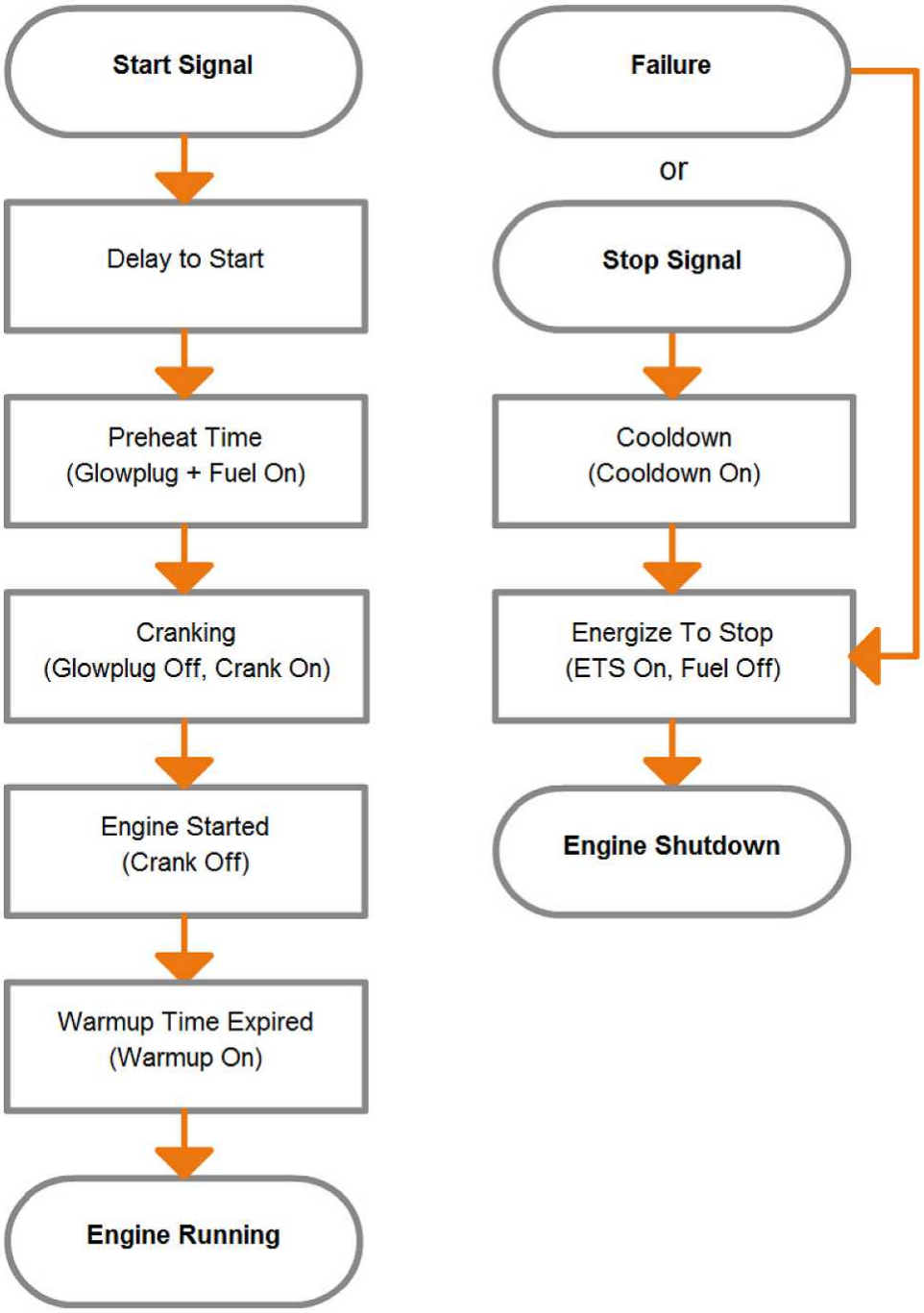
The Engine Logic settings determine how the controller starts and stops the generator. It gives the user the functionality to add delays and timers to the sequences. Listed below some of the items are switched outputs that are affected by Engine Logic functions. These must be configured in the Switched Outputs 29 menu in order to function.

NOTE: To disable a delay or timer set it to 0 seconds.

FUNCTION	DESCRIPTION
Delay To Start	Amount of time to delay before starting the engine after the controller receives a start signal.
Preheat (Glowplug Output)	The glow plug output will turn on for this amount of time before cranking occurs. During this time the fuel output is also turned on.
Crank Time (Crank Output)	Amount of time the engine will crank before resting.
Mid Heat Time (Glowplug Output)	Keeps glow plug output turned on while cranking but not during crank rest. Output will turn off upon cranking failure, crank success or mid heat time expiration.
Crank Rest Time	Duration to rest before the next crank attempt.
Crank Attempts	Number of attempts the engine will try to crank before going into a overcrank failure.
Fuel Crank Rest (Fuel Output)	Determines if the fuel output is on or off during crank rest.
RPM Disconnect (Crank Output)	The speed at which to disconnect the crank output because the engine has started successfully.
Post Heat Time (Glowplug Output)	Amount of time the glow plug output remains on after crank success and the engine is running.
Warm Up Time (Warmup Output)	Period of time after engine starts to warmup the engine. The Warmup output becomes active after the Warm Up Time expires.
Cool Down Delay (Cooldown Output)	Amount of time the cool down output is active after the controller receives a shutdown signal. A switched output can be configured to be active during 'Cool Down.' If the engine is shutdown by using the 'OFF' button, 'Cool Down' will be bypassed.
ETS On Duration (ETS Output)	Energize-To-Stop (ETS) will be turned on for a set amount of time after 'Cool Down' delay expires and before engine shut down. This is used to shutdown certain types of engines.

The flowchart on the following page depicts the way the controller uses some of the the engine logic settings to start and stop the engine.

The following flowchart shows a typical start up and shutdown sequences for a controller. Some items from the Engine Logic section have been omitted / included for illustration purposes and may not be used in your application.



4.2 Switched Inputs

The controller is equipped with inputs that respond to contact openings and closures. Each switched input has the following the options associated with it.

Trigger Modes

Trigger modes signify the conditions that will activate an input.

TRIGGER	DESCRIPTION
Close to +Battery	Input active when +Battery is applied.
Close to Ground	Input active when ground is applied.
Close to +Battery / Ground	Input active when +Battery or ground is applied.
Open	Input active when open (neither +Battery or ground is applied).

Active Modes

Actives modes are the modes in which an input is capable of being triggered.

ACTIVE	DESCRIPTION
Disable	Input is not active and cannot be triggered.
Global	Input active in every mode with the exception of menu system.
Not In Auto	Input active when controller is not in Auto mode.
Auto	Input active when controller is in Auto mode.
Running	Input active from start signal to engine shutdown.
Cranking	Input active from start signal to engine started.
After Cranking	Input active from engine started to engine shutdown.

NOTE: All switched inputs with the exception of the the Configurable Inputs 28 have actives modes that are fixed and cannot be changed.

Functions

The function of the input is how the controller responds to that input being triggered. Read the descriptions in the tables below for the meaning of each function.

FUNCTION	ACTIVE MODE	DESCRIPTION
Disable	N/A	Disables the input regardless of condition.
Start / Stop	Auto / Running	Starts engine when activated and stops engine when de-activated. Special 'momentary' mode can also be used, see Start / Stop (Momentary Function) 28 for more information.
Emergency Stop	Global	Shuts down the engine immediately. Required to be wired to cut fuel to the engine. See Emergency Stop and Failures 20 for more information.
Idle Mode	Running	All failures associated with under voltage, under frequency and under speed are ignored.
Volt Select 1 Volt Select 2	OFF / Auto	Used for selecting different voltage configurations. See Voltage Select 27 for more information.
Charger Fault	Global	Displays a warning that there is a charger fault.
Momentary Start	Auto	Starts the engine when momentarily activated.
Momentary Stop	Running	Stops the engine when momentarily activated.
Configurable Warning 1 Configurable Warning 2	Configurable	Displays a warning with custom user text. See Configurable Inputs 28 for more information.
Configurable Failure 1 Configurable Failure 2	Configurable	Enters a failure mode and displays custom user text. See Configurable Inputs 28 for more information.
Air Pressure Failure	Cranking	Enters a failure mode and displays that there is a low air pressure failure.
Hydraulic Pressure Failure	Cranking	Enters a failure mode and displays that there is a low hydraulic pressure failure.
Low Oil Pres Warn	Running	Displays a warning that there is low oil pressure.
Coolant Level Failure	Global	Enters a failure mode and displays that there is a low coolant failure.
High Fuel Warning	Global	Displays a warning that the fuel level is too high.
Lamp Test	Global	Performs a 'Lamp Test' for the LED's.
Fuel In Basin	Global	Displays a warning that there is fuel in the basin.
Battle Mode	Running	Ignores all warnings and failures while running.

AMF / ATS Inputs

The following inputs are only available in the TG350AMF version of the controller. See AMF / ATS 39 for more information on how these inputs function.

FUNCTION	ACTIVE MODE	DESCRIPTION
Generator Position	Global	Indicates the current position of the user operated transfer switch. See AMF / ATS 39 for more information.
Mains Position		
Transfer to Generator	Running	Causes the ATS to change to the generator position when in Manual ATS mode. See AMF / ATS 39 for more information.
Transfer to Mains	Auto / Running	Causes the ATS to change to the mains position when in Manual ATS mode. See AMF / ATS 39 for more information.
Test Mains Failure	Auto	Simulates loss of mains to test AMF features.

4.2.1 Voltage Select

The controller can be configured to display different AC voltages depending on the status of the 'Volt Select' switched inputs. In order for this feature to function properly, the 'Genset Voltage Source' setting must be set to 'Auto Selection' and the 'Voltage Select Inputs' settings found in AC Monitoring 38 must be configured. The following table demonstrates the relationship between the switched inputs and the monitored voltage source.

NOTE: Changing the voltage select inputs while the generator is running will have no effect. They must be changed prior to starting up.

VOLT SELECT 1	VOLT SELECT 2	VOLTAGE SOURCE
Inactive	Inactive	3-Wire Single Phase
Inactive	Active	4-Wire 3-Phase
Active	Inactive	4-Wire 3-Phase
Active	Active	4-Wire Delta

This application is generally used with rental generators that have the ability to use a CAM switch to change the voltage configuration.

4.2.2 Configurable Inputs

The configurable inputs are used to create custom warnings and failures that are viewed on screen and in the Event History. To change this text, the PC Configurator must be used. If you select these inputs without changing the custom text using the PC Configurator, the text will default to 'Config Warn 1', 'Config Fail 1', etc.

There are also timer features associated with the configurable inputs called 'Trigger Delays' that can be found in the Timers Setting menu. The timers add a delay to the amount of time it takes before that warning, failure, and switched output (if required) becomes active.

NOTE: If the switched input becomes inactive before the trigger delay time expires, the warning or failure will not occur.

Configurable Input Example:

The user wants the controller to display 'High Water Warn' and turn on a pump 45 seconds after a level sensor connected to a switched input becomes active.

1. Using the PC Configurator, set a switched input to 'Config Warn 1' and custom text to 'High Water Warn.' Wire the level sensor switch to the switched input.
2. Set 'Input Warn 1' under the 'Trigger Delay' menu to 45 seconds.
3. Set a switched output to 'Config Warn 1' and wire that output to a slave relay controlling a pump.

4.2.3 Start / Stop (Momentary Function)

When a switched input is configured to 'Start / Stop' the trigger modes have different meanings than other inputs. The following table describes the trigger mode functionality.

TRIGGER	DESCRIPTION
Close to +Battery	Input active when +Battery is applied.
Close to Ground	Input active when ground is applied.
Close to +Battery / Ground	Input active when +Battery or ground is applied for 3-5 seconds.
Open	Input active when neither +Battery or ground is applied for 3-5 seconds.

The reason for changing these trigger mode is to allow the user to wire a single push button to be used for both starting and stopping the engine. Holding the button for too long will cause the engine to shutdown immediately after starting and vice versa.

4.3 Switched Outputs

The controller is equipped with switched outputs that can be configured to activate under certain conditions. When activated, the switched outputs are switched to battery voltage. The following is a description of each switched outputs function and the condition that triggers it.

FUNCTION	ACTIVE MODE	DESCRIPTION
Disable	---	Disables the output regardless of condition.
Fuel Relay	Auto / Running	Turns on to provide fuel to the engine. This is fixed to switched output A.
Crank Relay	Cranking	Turns on to crank the engine. This is fixed to switched output C.
Not In Auto	Off	Turns on when the controller is not in 'Auto.'
System Ready	Auto	Turns on when in 'Auto' mode and no warnings or failures are present.
Backlight	Global	Turns on when the LCD backlight is on.
Failure	Global	Turns on when any failure occurs.
Maintenance	Global	Turns on when the maintenance clock reaches zero.
Voltage Regulator	Running	Turns on when controller is not in idle mode.
Warm-Up	Running	Turns on after the 'Warmup Up' time has expired as defined in Engine Logic 23.
Energy to Stop	Running	Turns on during 'ETS On Duration' as defined in Engine Logic.
Glow Plug	Preheat / Midheat / Postheat	Turns on during 'Preheat, Midheat, and Postheat' times as defined in Engine Logic 23.
Cool Down	Running	Turns on during 'Cool Down Delay' as defined in Engine Logic 23.
Aux Sensors 1 and 2	Running	Turns on as defined in Auxiliary Sensors 33.
Overcrank	Failure	Turns on when engine fails to start after the amount of cranks attempts as defined in Engine Logic.
Engine Running	Running	Turns on from the beginning of cranking, through engine running until shutdown.
Exercising	Running	Turns on when the controller is performing the exerciser function. See Exerciser and Maintenace 41 for more information.

Switched Outputs continued on next page...

FUNCTION	ACTIVE MODE	DESCRIPTION
Recharging	Running	Turns on when the controller is performing a battery recharge. See Speed Sensing and Battery 37 for more information.
Configurable Warnings and Failures	Configurable	Turns on when corresponding switched input becomes active. See Configurable Inputs 28 for more information.
Pull Coil	Running	See Pull and Hold Coil 30 for more information.

The following outputs turn on during the event in which they describe. Example: 'High Temp Warn' output only comes on if there is a warning due to high engine temperature.

OTHER OUTPUTS			
High Fuel Warn	Low Oil Pres Warn	Low Fuel Fail	AC Hz Warning
Low Temp Warn	Under RPM Fail	Low Fuel Warn	Under Volt Warn
High Temp Fail	Under RPM Warn	Battery Warn	Over Volt Warn
High Temp Warn	Over RPM Fail	Battery Fail	AC Hz Failure
Low Oil Pres Fail	Over RPM Warn	Coolant Lv Fail	Fuel In Basin

AMF / ATS Outputs

FUNCTION	ACTIVE MODE	DESCRIPTION
Generator Coil	Global	Turns on to move the transfer switch into the generator position. See AMF / ATS 39 for more information.
Mains Coil	Global	Turns on to move the transfer switch into the utility position. See AMF / ATS 39 for more information..

4.3.1 Pull and Hold Coil

On some engine systems the fuel pump has two solenoids. The reason for this is that the initial power on of the fuel solenoid requires substantial current (Pull Coil), but only needs a small amount of current to hold it in place (Hold Coil).

1. Pull coil is energized when fuel is first turned on.
2. Hold coil is energized after pull coil has fully activated.
3. Pull coil is de-energized while Hold coil remains on while the engine is running.

Configuring a switched output to Pull Coil automatically configures the engine logic necessary for a Pull Coil system.

4.4 Sensors

The controller is equipped with 4 analog sensor inputs for reading information such as oil pressure and engine temperature. The following table lists the different types of sensors that can be monitored.

PARAMETER	NOTES
Engine Temperature	Failures can only occur on high temperature. Warnings occur on both low and high temperature.
Oil Pressure	Warnings and failures can only occur on low oil pressure.
Fuel Level	Warnings and failures can only occur on low fuel level.
Auxiliary Sensor 1	Must have a Custom Sensor Tables 36 created using the PC Configurator. See Auxiliary Sensors 33 section for more information on functionality.
Auxiliary Sensor 2	

Preloaded Sensor Tables

The following table is the default sensors that are preloaded onto the controller and do not require a custom sensor table.

SENSOR NAME	TYPE	RESISTANCE RANGE	UNIT RANGE
DAT DAH (Datcon 02022-00)	Temperature	4220 - 54Ω	32 - 325°F
VDO 250F (VDO 323-420)	Temperature	1578 - 38Ω	32 - 325°F
DAT 100P/R240 (Stewart 289B-F)	Oil Pressure	240 - 33Ω	0 - 100PSI
VDO 150P/R180 (VDO 360-004)	Oil Pressure	10 - 180Ω	0 - 150PSI
DAT R/33-240	Fuel Level	240 - 33Ω	0 - 100%
VDO R/0-180	Fuel Level	10 - 180Ω	0 - 100%

NOTE: The temperature sensors shown here are for use with high resistance ports (0 - 7,500Ω). Using a low resistance port will limit the lower temperature readings.

Sensor Settings

When configuring each sensor, the following settings must be set in order for the sensor to function properly. If the signal source is set to 'Disabled', it is not required to adjust the other settings.

SETTING	DESCRIPTION
Signal Source	Choose one of the ports available. Verify it is compatible with the sensor by checking the harness data in Installation 7.
Sensor Type	Choose one of the available defined sensors. See Custom Sensor Tables 36 if your sensor is not listed.
Trim Offset	Use this setting to add or subtract units from the reading of the sensor in the case that there are errors in the readings.
Fault Set Points	Configures the points at which the controller will detect a warning or failure based on the sensor reading. The **Bypass** time is the number of seconds to ignore warnings and failures for that sensor after the engine has started.

Trim Offset

This feature is used to calibrate your sensor in the case there are discrepancies between the reading and the actual value. When setting the Trim Offset for temperature or oil pressure, remember that the units are in Fahrenheit and PSI.

Example: The controller is reading an engine temperature of 210.4°F when in fact we know the engine temperature is 200°F. Setting the Trim Offset to -10.4°F would correct the error.

Sensor as a Switch

The sensor inputs have a feature that allow them to functions as switched inputs. When selecting a 'Sensor Type,' selecting one of the following options will make it function in switch mode.

- CLOSE = Warning
- OPEN = Warning
- CLOSE = Failure
- OPEN = Failure

NOTE: CLOSE is equivalent to a short to ground and OPEN is equivalent to no connection.

4.4.1 Auxiliary Sensors

The following section relates to the functionality of Auxiliary Sensors 1 and 2. These sensors have advanced functions and customization.

SETTING	DESCRIPTION
Signal Source	Determines the port the sensor is connected to.
Mode Select	Determines how the controller will act depending on the reading of the sensor. See below for more information.
Trim Offset	Use this setting to add or subtract units from the reading of the sensor in the case that there are errors in the readings.
Mode Settings	Settings that relate to the specific mode. See below.
Setpoints	Configures the points at which the controller will detect a warning or failure based on the sensor reading.

Mode Select Options

Mode Select determines how the controller will interpret and act upon the Aux Sensor data. The controller can monitor for faults, turn on outputs, or start the engine. Refer to the 'Scenarios' section on the next page for further information on how these settings function.

SETTING	DESCRIPTION
Fault Monitor	Monitors for warnings and failures.
Output on Low	If readings drops below Start Level, turn on switched output.
Output on High	If readings rises above Start Level, turn on switched output.
Start on Low	If readings drops below Start Level, auto start the engine.
Start on High	If readings rises above Start Level, auto start the engine.

WARNING: When using a mode other than 'Fault Monitor' , the controller will not detect warnings and failures for this sensor.

Mode Settings

Mode Settings are used to change the way the selected Aux Sensor mode functions. Active Time, Start Level, and Stop Level do not apply to the 'Fault Monitor' mode.

SETTINGS	DESCRIPTION
Bypass Time	The number of seconds to ignore warnings and failures for that sensor after the engine has started.
Active Time	The amount of time to turn on the output or engine. See the 'Scenarios' below for more information.
Start Level	The level at which the auxiliary switched output or generator turns on.
Stop Level	The level at which the auxiliary switched output or generator turns off.

Scenarios

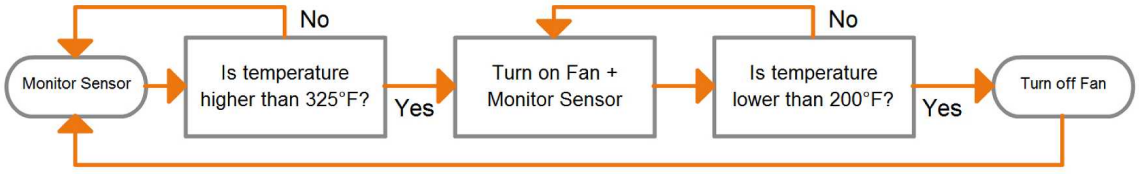
The Aux Sensor settings can be configured in such a way that it can provide different 'Scenarios' based on what the Stop Level and Active time are set to. Refer to the table below to choose the scenario best suited for your application.

STOP LEVEL	ACTIVE TIME	DESCRIPTION
Disabled	Disabled	Once the Start Level is reached, the output or engine will turn on indefinitely.
Disabled	Enabled	Once the Start Level is reached, the output or engine will turn on until Active time expires.
Enabled	Disabled	Once the Start Level is reached, the output or engine will turn on until the Stop Level is reached.
Enabled	Enabled	Once the Start Level is reached, the output or engine will turn on until the Stop Level is reached or Active Time expires.

NOTE: Once the output or engine turns off, the controller will continue to monitor the levels and will **restart** the output or engine if the Stop Level still has not been met.

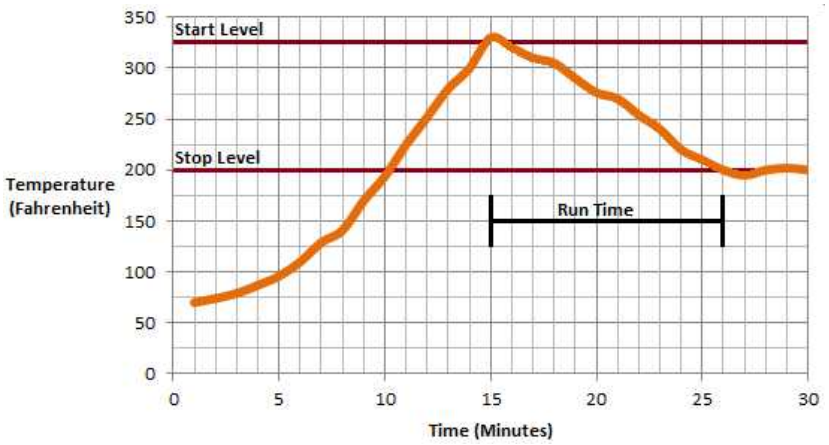
Auxiliary Analog Example

The following section outlines an example of setting up the controller to work with a fan that turns on (Switched Output B) at an engine temperature of 325°F to cool down the engine. The fan won't turn off until the engine temperature falls below 200°F. The following flowchart depicts the simplified logic sequence of the controller.



The settings and graph below gives a general idea of how to configure the controller and how it functions. As you can see the output turns on at 325°F and stays on until it drops below 200°F. The 'Run Time' shown here is the amount of time the fan was on.

SETTING	VALUE	REASON
Switched Output B	Aux Sensor 1	This output will be connected to the slave relay controlling the fan.
Aux Signal Source	Port D	This is the port the engine temperature sensor will be connected to.
Mode Select	Output on High	The output is to turn on at a high engine temperature.
Active Time	Disabled	The output is to stay on as long as the Stop Level has not been reached.
Start Level	325°F	The temperature at which to turn the fan on.
Stop Level	200°F	The temperature at which to turn the fan off.



4.4.2 Custom Sensor Tables

Using the , you are able to create a custom sensor table for a sensor that is not supported by the controller. From inside the sensor table utility the following settings must be set in order to create your table.

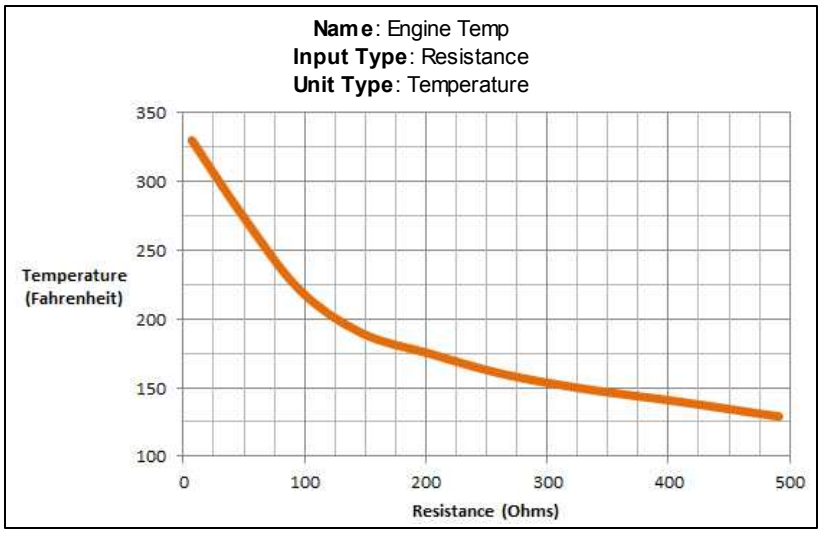
PARAMETER	DESCRIPTION
Name	Usually the manufacturer and part number of the sensor.
Input Type	Choose resistance, voltage or current based on the sensor type.
Unit Type	Choose temperature, pressure, voltage, current or percentage based on the sensor. This defines what unit of measurement will be displayed on the front panel when monitoring the sensor.
Table Values	These values are what creates the sensor table and allows the controller to display and monitor the sensor. The more values that are entered the more accurate the readings will be.

NOTE: For detailed information about using the sensor table utility please refer to the PC Configurator Manual.

Example Custom Sensor Table

Below is an example sensor table for engine temperature sensor DATCON 02025-00.

TEMP.	VALUE
129°F	491Ω
140.1°F	406Ω
149.2°F	330Ω
160°F	263Ω
175°F	202Ω
189.7°F	147Ω
221°F	96Ω
275°F	49Ω
330°F	7Ω



4.4.3 Speed Sensing and Battery

Speed Sensing

The controller monitors the revolutions per minute (RPM) of the engine. It uses the speed data to determine when the engine has started and if it is running at the correct speed. The following table outlines the settings associated with speed sensing:

SETTING	DESCRIPTION
Signal Source	Choose between J1939, Magnetic Pickup, or Genset Signal (AC Voltage) as a speed source.
Speed Settings	Sets the values for generator RPM, AC frequency and flywheel teeth.
Fault Set Points	Configures the points at which the controller will detect a warning or failure based on the speed reading.

NOTE: When using J1939 or Genset Signal as a signal source, connections to the speed sensing terminals are not required.

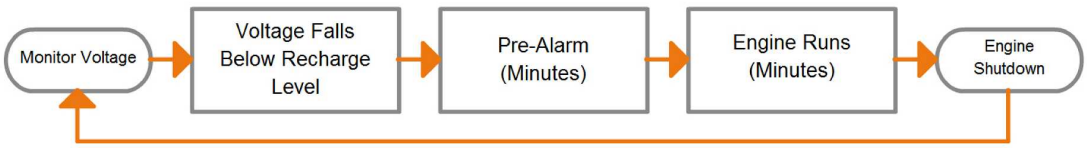
Battery Settings

The controller has the ability to monitor the battery voltage supplying the controller. While monitoring, the controller can go into a failure mode if the voltage gets too low or too high, as well as start the engine to recharge the battery.

SETTING	DESCRIPTION
Battery Recharge	Enables or disables the battery recharge function.
Recharge Setup	Determines the recharge voltage level, pre-alarm time, and run duration for the battery recharge feature.
Fault Set Points	Configures the points at which the controller will detect a warning or failure based on the battery voltage.
Cranking Battery	Screen displays 'Low Voltage During Cranking' warning if voltage falls below this level during cranking.

NOTE: When the generator is running, the battery voltage will equal the alternator charging voltage. The actual open-circuit battery voltage may be lower than displayed.

Battery Recharge Sequence



4.5 AC Monitoring

The controller is equipped with the ability to monitor and display generator voltage. For information on configuring the controller to monitor mains voltage, refer to AMF / ATS 39.

PARAMETER	DESCRIPTION
Voltage Source	The wiring configuration of the generator. Selecting 'Auto Selection' will use the Voltage Select 27 switched inputs for which wiring configuration is implemented and displayed.
Scaling Factor	Multiplier at which the voltage is read into the controller. See below for more information.
Nominal Voltage	Nominal voltage of the generator under normal operating conditions.
Voltage Select Inputs	Nominal voltages that can be selected by use of Voltage Select 27 input. Used with mobile gensets to select the voltage configuration to be displayed on screen.
Voltage Setpoints	Warning and failure set points for generator AC voltage.
Frequency Setpoints	Warning and failure set points for generator AC frequency.

AC Voltage Calibration

The Scaling Factor setting can be used to calibrate the AC voltage if there is discrepancies between the reading and the actual value. It can also be used if potential transformers are used to step down the voltage. This setting differs from the 'Trim Offset' in Sensors 31 in that it multiplies by the scaling ratio instead of adding / subtracting.

Example: The voltage source is a 3-Wire 3-Phase system with a nominal voltage of 208V. The controller is reading 206.3V but a calibrated multimeter gives 208.3V so the Scaling Factor must be set to compensate. There are two ways to do this.

1. Trial and Error - Keep adjusting the scaling factor until it gives you a correct reading.
2. Calculate - Use the following equation to determine the scaling factor:

   Scaling Factor = Multimeter Reading / Controller Reading
   Scaling Factor = 208.4V / 206.3V
   Scaling Factor = 1.010

NOTE: Scaling Factor applies to all phases in the system.

Step-Up / Down Transformers

The Scaling Factor setting can also be used to scale up or down readings if they are fed into a transformer before being read by the controller.

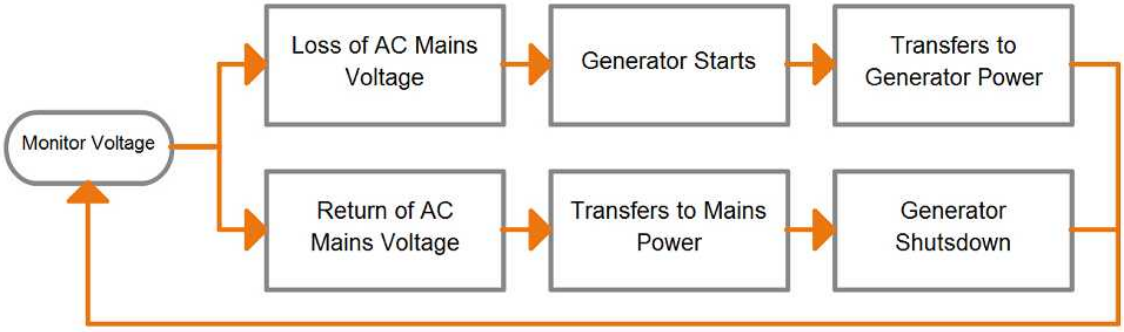
Example: Voltages about 575VAC are being monitored using the controller and there are 2:1 step down transformers between the generator and the controller. A sensing ratio of 2.00 is required to scale the voltage back up to the appropriate value.

4.5.1 AMF / ATS

The Auto Mains Failure (AMF) and Automatic Transfer Switch (ATS) features of the controller are very powerful. There are 3 different AMF / ATS modes.

TERM	DESCRIPTION
Disabled	All AMF / ATS functions are disabled and controller functions as a standalone genset controller.
AMF	Upon loss of mains the generator will automatically start but no transferring will take place.
AMF + ATS	Upon loss of mains the generator will automatically start and the ATS will automatically transfer to generator power. Manual ATS is a secondary function of AMF + ATS, see below for details.

The following drawing shows a basic diagram of how Auto Mains Failure and Automatic Transfer Switch work together.



Manual ATS

Manual ATS mode is a way to manually start the generator and change the ATS position. It can only be used when the AMF / ATS Mode is set to AMF + ATS.

To run the controller in Manual ATS you must first start the generator manually by pressing the RUN button. Once started you can use the switched inputs 'Transfer to Gen' and 'Transfer to Mains' to manually change the ATS position.

NOTE: During Manual ATS mode you can move back to the regular ATS functionality by pressing the AUTO button. Moving back to regular ATS functionality will disable the 'Transfer to...' inputs.

Mains Voltage

The Mains Voltage settings are used to configure the monitoring of mains voltage.

PARAMETER	DESCRIPTION
Mains Source	The wiring configuration of the mains.
Scaling Factor	Ratio at which the voltage is read into the controller. See AC Monitoring 38 for more information.
Nominal Voltage	Nominal voltage of the mains under normal conditions.
AMF / ATS Mode	Select between Disabled, AMF, AMF+ATS modes.
AC Stable Time	Amount of time the voltage levels have to be within or outside the limits of the 'Voltage Setpoints' before being considered stable / unstable.
Voltage Setpoints	Voltage level settings that determine whether the mains has dropped out or picked up.

ATS Outputs

The ATS Outputs must be configured if using the controller in conjunction with a transfer switch. Read the descriptions in the tables below for the meaning of each parameter.

PARAMETER	DESCRIPTION
Genset Drive	'Gen Coil' output is constantly on when transferring to generator.
Genset Trigger	'Gen Coil' output is connected to a normally open or closed relay.
Genset ATS Delay	Time to wait before transferring to generator after 'Gen Pickup' time.
Mains Drive	'Mains Coil' output is constantly on when transferring to mains.
Mains Trigger	'Mains Coil' output is connected to a normally open or closed relay.
Mains ATS Delay	Time to wait before transferring to mains after 'Mains Pickup' time.
Mains Open	Sets whether the transfer switch disconnects from mains upon loss of mains or genset ready.

Generator and Mains Position Switched Inputs

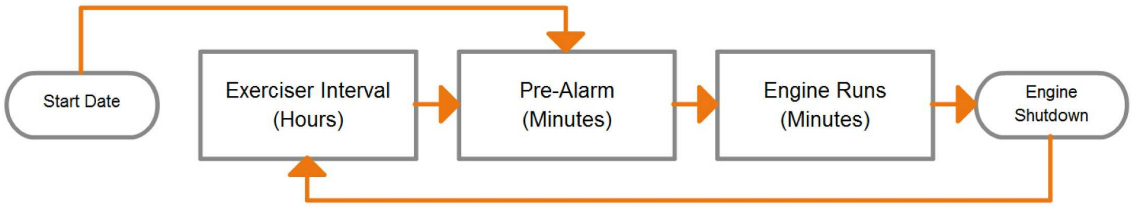
These inputs are only used when the AMF / ATS Mode is set to AMF. Their only function is for turning on and off the switch LED's on the controllers front panel. They must be wired to switches that indicate the position of a user operated switch controlling the load position.

4.6 Exerciser and Maintenance

Exerciser

The controller has a feature that allows it to automatically start and stop the engine periodically. In order for this feature to function properly, the controller must be in AUTO mode and have the following settings configured.

SETTING	SETTING	DESCRIPTION
Enable	---	Enables or disables the exerciser function.
Delays	Pre-Alarm	Amount of time switched output 'Exercising' is active before starting the engine.
	Run Time	Amount of time to run the engine.
Schedule	---	Sets the time and date for the first exercise of the engine and then the interval at which it will exercise after that.



Maintenance

The controller has the ability to count down the time between scheduled maintenance by a technician. Once maintenance is required, the controller will alert the operator by the LCD screen or a switched output (if enabled) wired to a lamp / horn / buzzer. The following table describes the settings associated with the maintenance function.

SETTING	DESCRIPTION
Enable Counter	Enables or disables the maintenance function.
Count Interval	Determines the number of hours between required maintenance. A switched output can be configured to turn on once the count interval expires.
Reset Counter	Once the maintenance count interval expires, use this setting to reset the time and turn off the switched output (if enabled).

To find out the amount of time until next maintenance, follow these menu steps:

Main Menu -> Device Info. -> Maintenance

If '----' is displayed maintenance is disabled. A negative number indicates the amount of time since maintenance timer expired.

4.7 CAN Bus (J1939)

The controller is able to communicate with electronic control modules (ECMs) on engines that follow the SAE J1939 specification. Examples of standard messages are oil pressure, engine temperature and engine speed. Some engines may have proprietary messages that will not function with the controller.

The following ECMs are confirmed to be supported by the controller.

- Generic J1939
- John Deere JDEC
- Volvo EMS
- Cummins CM850
- Yanmar ECO
- Detroit Diesel
- Volvo EMS2B
- Izuzu 4H
- GM PSI E-Control

SETTING	DESCRIPTION
ECM Module	Choose the one of the available ECM modules from the list.
Loss of ECM	If no CAN messages are received for more than 6 seconds, the controller shuts down the generator.
DTC Display	Enables or disables active fault messages (DM1) monitoring. See Diagnostic Trouble Codes 44 for more information.
Active DTC Log	Enables or disables the storing of active faults (DM1). See Diagnostic Trouble Codes 44 for more information.
Read Stored DTC	Enables or disables the ability to request stored fault codes from the ECM (DM2). See Diagnostic Trouble Codes 44 for more information.
Auto Power ECM	When enabled, the fuel relay is enabled in Auto mode so that the ECM is already powered up and initialized before the user decides to start the generator.
ECM Power Delay	Used in conjunction with 'Auto Power ECM', on generator shutdown the controller waits the ECM Power Delay before turning on the fuel relay again. This is to prevent unwanted start ups due to the generator not being completely shut down.
Cummins Idle	When enabled, the controller tells the Cummins generator which speed to run at. GC1 is the newest protocol and GCP is for older engines. A switched input must be programmed to 'Idle Mode' for feature to function correctly.
SPN Conversion	Select the SPN conversion method. See 'DTC Conversion Methods' 47 for more information.
EMS2B Frequency Select	For Volvo EMS2B Engine Control Modules only.
EMS2B Accelerator Pedal	For Volvo EMS2B Engine Control Modules only.

WARNING: If using 'Cummins Idle Speed' and powering the ECM externally you may get the error message 'J1939 Erratic'. The ECM expects the speed update to be sent continuously and if it is not the ECM thinks there is a problem with the J1939 communications.

Parameters

The controller will work with any generator as long as it supports the standard messages listed in the SAE J1939 specification. Standard messages include oil pressure, engine temperature, and engine speed. Some engine control modules have proprietary messages that are intended for specialized devices and are not displayed by the controller.

The following is a list of parameters that can be accessed through use of the J1939 bus. In order to for each one to function properly, J1939 must be selected as the 'Signal Source' under each individual parameter.

1. Engine Speed
2. Engine Temperature
3. Oil Pressure
4. Oil Level
5. Fuel Level
6. Fuel In Basin

WARNING: There is a special case where parameters show N/A in place of the value. This means that the engine may still be starting up and controller has not yet accessed that information. If controller displays N/A during running and has not shut down on 'Loss of ECM', it means that the controller and ECM are communicating but not receiving those parameters.

Troubleshooting

The following section outlines some common issues seen when wiring and configuring the controller for J1939.

ISSUE	SOLUTION
Check for Communications	Set 'Engine Temperature' to J1939 and go into 'Auto' mode. Verify that the 'N/A' is not displayed for engine temperature.
Generator Not Starting	Check wiring to the ECM. Most have multiple power and ignition inputs that must be connected for it to operate properly.
Generator Restarts on Shutdown	Change 'ECM Power Delay' to a higher value.

The ECM should start and run the engine – even if there are no CAN communications with controller – when the controller turns on the fuel and crank outputs. If there are no communications between the ECM and controller, the controller will not stop the crank cycle when the engine is running as it is not receiving the engine speed.

4.7.1 Diagnostic Trouble Codes

The controller has a DTC feature that, when enabled, allows the controller to receive currently active DTCs (DM1) messages and display then on the screen as well as optionally store them to the Event History. The controller can also receive previously active (DM2) messages and display them on command. DM2 messages are intended for technician troubleshooting and are not stored to Event History.

J1939 Standards Supported (DM1)

1. Single package frame J1939-71
2. Multi-packages frame J1939-21
   a. BAM
   b. TP.DP

J1939 Standards Supported (DM2)

1. DM2 Single package frame J1939-71
2. Multi-package frame J1939-21
   a. BAM
   b. RTS/CTS
   c. TP.DP

DTC Display

This setting enables or disables active fault messages (DM1) monitoring. When the DTC DISPLAY feature is enabled the controller can receive active faults in the RUNNING, OFF and AUTO modes on the J1939 bus. Any new received active faults will trigger a message "NEW ACTIVE DTC" and the user can read the message on the controller front panel display. This new message will also be stored into the controller's event log if this feature was enabled.

Active Log DTC

The setting enables/disables the storing of active faults (DM1) in controller Event Log. The Event Log reserves 30 storage locations for DM1 messages.

Read Stored DTC

The setting enables/disables the ability to request stored fault codes from the ECM (DM2). When this setting is enabled the controller will allow manually triggered requests of stored faults from the ECM's memory (DM2).

4.7.2 DM1 Messages

When the engine's ECM detects a fault, it will send an Active Diagnostic Trouble Code, DM1, message. The DM1 message sent by the ECU will also contain information on the type of fault as well as the number of occurrences for the fault. If multiple DTCs are present, each will be transmitted over the J1939 network. When the DM1 messages are received by the controller controller there are 3 important pieces of information that are captured and displayed:

INFORMATION	DESCRIPTION
Failure Mode Indicator (FMI)	The type of failure. You must refer to the engine manufacturer's documentation to identify the meaning of the failure mode indicator number.
Occurrence Count (OC)	Identifies the number of times the failure has occurred.
Suspect Parameter Number (SPN)	The parameter number.

If one of these DTCs appears, please consult your engine manufacture for the definition of this fault. With some engine manufacturers, the text of the message can also vary slightly between engine types.

When active DTC messages are being received this will cause the controller display to lock and display the messages. If multiple active DTCs are received the controller will scroll and display each DTC message.

The user can also manually cycle through the DTC messages by activating either the UP or DOWN key after the screen has been locked. If the user stops at a specific DTC message the display screen will remain on that message for a period of 10 seconds before it begins scrolling again. Once the last DTC message is displayed, the display will begin scrolling though other controller parameters as normal. **The DTC messages are no longer available for viewing.**

DM1 Event Log

The controller Event History can store up to 30 DM1 messages (DM2 messages are not stored). Once the 30 limit has been reached the oldest message is removed from the log to be replaced by the incoming DM1

4.7.3 DM2 Messages

DM2 messages are previously active fault messages which are stored to permanent memory on the engine ECM. These stored messages can be retrieved by the host controller controller and displayed on the controller when a request is initiated by the user. The DM2 messages display the same type of information as the DM1 messages.

The controller can support a maximum of 32 messages. When previously active DTC messages are requested and received, the controller will display the stored messages on the controller front panel LCD screen. If multiple stored messages are received the user can either manually scroll through each stored message or the screen will scroll between each DTC stored message.

To Trigger a DM2 Request, simultaneously press the UP and DOWN keys for a period of 3 seconds in either the AUTO, OFF, or RUNNING modes. The UP and DOWN keys can also be pressed to remove the DM2 message screen.

If the controller is in the OFF or AUTO mode when the request is triggered, the ECM may not be powered on, so the controller will energize the fuel relay output and wait for the ECM to power on. The controller then sends out the DM2 request. In the event there is no response from the ECM, the controller will re-attempt an additional 3 times. It will then display 'Requesting Fail' and turn off the fuel output if there is no valid response on the fourth try. The default ECM address for DM2 request is 0 and the ECM address can only be changed by using the PC Configurator. The controller may also show 'Reading Abort' if communication is unsuccessful. If the request was successful, the controller will show 'Read DTC Success' and start to display the messages.

4.7.4 DTC Conversion Methods

This section is used to decode the information contained in the Modbus DTC (DM1 and DM2) registers if the ECM does not support the newest DTC conversion method. The DTC's for J1939 are specified in a specific format. Older J1939 specifications had three conversion methods and is impossible to tell them apart without contacting the engine manufacturer.

Newer J1939 specifications follow SPN method (Version 4) and can be determined by looking at the CM bit. It will be set to 1 for Version 4 and set to 0 for Versions 1, 2, and 3. If the CM bit is 0, use conversion methods listed below. Byte 1 to Byte 4 refers to the individual bytes in the controllers DTC Modbus registers..

DTC Conversion Method (Version) 1

BYTE	CONVERSION
Byte 1	8 most significant bits of 16 most significant bits of SPN
Byte 2	8 least significant bits of 16 most significant bits of SPN
Byte 3	3 most significant bits of byte contain the 3 least significant bits of SPN 5 least significant bits of byte contain the FMI
Byte 4	Most significant bit of byte contains CM 7 least significant bits of byte contains OC

DTC Conversion Method (Version) 2

BYTE	CONVERSION
Byte 1	8 least significant bits of 16 most significant bits of SPN
Byte 2	8 most significant bits of 16 most significant bits of SPN
Byte 3	3 most significant bits of byte contain the 3 least significant bits of SPN 5 least significant bits of byte contain the FMI
Byte 4	Most significant bit of byte contains CM 7 least significant bits of byte contains OC

DTC Conversion Method (Version) 3

BYTE	CONVERSION
Byte 1	8 least significant bits of SPN
Byte 2	8 second byte of SPN
Byte 3	3 most significant bits of byte contain the 3 most significant bits of SPN 5 least significant bits of byte contain the FMI
Byte 4	Most significant bit of byte contains CM 7 least significant bits of byte contains OC

DTC conversion method 3 is the same as DTC conversion Method 4 except that the CM bit is 1 so it is impossible to tell it apart from versions 1 and 2. Version 4 has the bit set to 0 which allows the user to know the conversion format without consulting the engine manufacturer.

5 Troubleshooting and Contact Information

Troubleshooting

If you are having issues with your controller, please refer to the solutions in the table below or contact your distributor for assistance. If the problem persists then contact DynaGen technical support.

NOTE: Always check the DynaGen website for the most up software, firmware and user manuals.

ISSUE	SOLUTION
Insert issue here.	Insert solution here.
Insert issue here.	Insert solution here.
Insert issue here.	Insert solution here.
Insert issue here.	Insert solution here.
Insert issue here.	Insert solution here.
Insert issue here.	Insert solution here.
Insert issue here.	Insert solution here.

Contact Information

Contacting DynaGen can be done by any of the methods below. Technical support is offered Monday - Friday, 8:00am - 4:00pm (EST).

TYPE	INFORMATION
Website	www.dynagen.ca/support
Email	support@dynagen.ca
Phone Number	(902) 406-0133
Twitter	@DynaGenTech
Address	3 Spectacle Lake Drive, Unit B105 Dartmouth, NS B3B1W8, Canada

