EMIT Total Solution

Installation Manual
Annunciator v100
Generic/Non-ECU Engine

August 2016

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CONVENTIONS USED

Within an instructional section:

Bold text refers to required tools.

Underlined text refers to EMIT item numbers, kit components, or assembly components.

Italicized text refers to items or parts already existing on the engine, compressor, or panel.

	Important notes or warnings

	Tips, examples, and suggested practices

WIRING WARNING

- Do not install or change wiring on the system unless area is known to be non-hazardous.
- Always have power disconnected and fuel shut off when altering panel wiring.
- Always use properly rated fuses on all panel systems.

ETS SYSTEM OVERVIEW

The Emit Total Solution, or ETS, system consists of a display (EIM) and one or more connected modules. This document covers the installation of the annunciator module. Other modules, such as the governor or AFRC, can be used with a single EIM display. The installation of other modules are covered in other documents.

This document will cover the physical installation and wiring of the EIM and annunciator module, and the basic setup procedure of the annunciator.

EMIT INTERFACE MODULE (EIM) INSTALLATION

MOUNTING THE EIM

The EIM enclosure is designed to be weatherproof, but care should be taken when mounting the controller to minimize the impacts of the environment. The following guidelines should be followed when selecting a mounting location:

- Do not mount the controller in locations where excessive vibration, heat, and/or moisture exist (refer to EIM specifications).
- Avoid mounting the controller within eight (8) feet of high energy electrical sources such as ignition coils, spark plug wires, or "G" leads.
- Do not mount with the front screen facing direct sunlight as the UV will degrade the touch screen material.
- Do not mount with the front screen of the controller facing ignition systems or ignition components. RF noise from these components may interfere with the operation of the controller.
- Do not mount either internally or externally on a "tattle tale" panel.

PANEL MOUNT

If mounting directly in the panel:

- Cut the panel and drill using the dimensions shown in Figure 1.
- Using the gasket and four (4) 10-32 nylon locking nuts, secure the EIM to the cutout location.

⚠	If the controller face is not mounted in a weatherproof enclosure, use of the EIM Panel Mount Gasket (14007) is required to maintain warranty coverage. This item is included in the EIM Panel Mount Kit (14200).

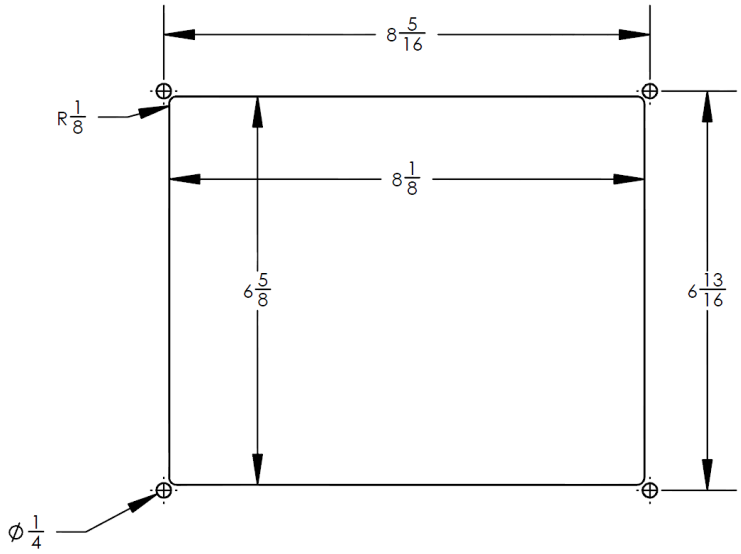


Figure 1. Cutout Dimensions for Panel Mounting

MOUNTING OUTSIDE OF THE PANEL

If mounting outside of the panel:

- Using the mounting enclosure found in the EIM Mount Outdoor Kit (14202), locate a space on either side of the panel that is appropriate taking into consideration operation and access of the panel and other components around the panel.
- Drill out the four (4) mounting bolt locations using a 5/16” drill bit for the mounting bracket on the side of the panel using the dimensions in Figure 2.
- Mount the bracket to the side of the panel using the included 1/4”-20 hardware.
- After wiring for the EIM and any other module that will be enclosed in the EIM base is competed, secure the EIM to the EIM base in the mounting bracket using the four (4) captured screws in the faceplate of the EIM.

⚠	Do not drill holes in the EIM enclosure or the warranty will be voided.

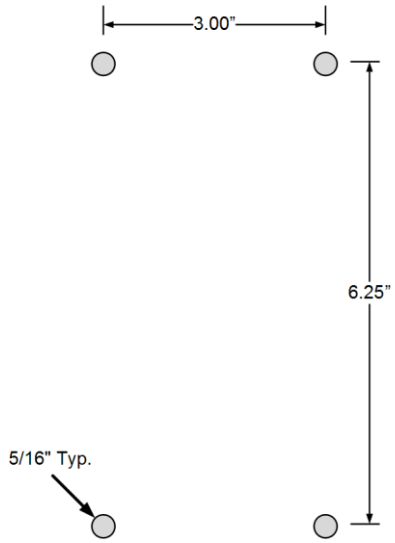


Figure 2. Outdoor Mount Drill Pattern

Figure 3. EIM Outdoor Mount Kit (14202)

ANNUNCIATOR INSTALLATION

MOUNTING THE ANNUNCIATOR MODULE

The annunciator module must be mounted within a panel or other suitable enclosure. Identify an appropriate location within the panel for accommodating the space required for the annunciator module. Also consider the routing of wiring required for various sensors when choosing a location. Ideally, the thermocouple wires will be routed physically separate from other wiring to reduce noise pickup on thermocouple readings. Additionally, some installations my require non-incendiary digital input connections to be routed in separate channels.

The annunciator is mounted in a panel using the Module Panel Mount Kit (14205).

- Remove the three screws and the end cap on one side of the module using a **No. 0 Phillips screw driver**.
- Slide the two DIN rail mounting clips onto the reverse side of the module with the larger tab side of the clip oriented towards the top.
- Reinstall the end cap using the original three screws and a **No. 0 Phillips screw driver**.
- Snap the DIN rail mounting clips installed on the module onto DIN rail.
- Install the included DIN rail stops on each end of the module.

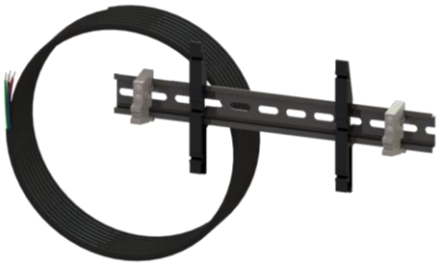


Figure 4. Module Panel Mount Kit (14205)

MOUNTING THE PANEL SWITCHES

See “Annunciator Panel Switches” below.

WIRING GUIDELINES

Standard wiring harnesses are constructed with FEP insulation and a FEP jacket rated at 200ºC. This product has excellent resistance to oils, aliphatic hydrocarbons, heat, weather, acids, alkalis as well as oxidation. This product also has superior abrasion and flame resistance. Harnesses are also available with an armored jacket. The wiring connections to the ETS modules are connected to removable plugs via screw terminals. Each plug is labeled with the appropriate pin numbers and corresponding wire colors to ease installation. The following are important guidelines for wiring the ETS modules to the engine:

- Do not install the system with power applied.
- If not enclosed in conduit, the wiring harness should be securely attached to the supporting structure using tie wraps, p-clamps, or mounting brackets.
- Long, unsupported wire runs should be avoided.
- Keep all wiring away from hot or moving parts and all ignition wires.
- All wiring splice connections should be soldered and protected with heat shrink tubing, with the exception of thermocouples.

- Thermocouple wires should be spliced only when necessary, and if possible only using the metal(s) present in the thermocouple wire to prevent a new metal junction.
- Properly connect all wires before energizing the power connections.
- Care should be taken when making connections to the terminal blocks to allow for excess wire for the front cover to be folded back up and secured in place. This prevents strain on the connections.
- Shielding wire must be grounded to the available lugs inside the back of the enclosure or to shielding terminals.
- All electrical components must share a common ground.

NON-SENSOR ANNUNCIATOR WIRING

POWER AND COMMUNICATIONS

Annunciator terminal block 1 (Pins 1-6) are used for the main power and communications for the module.

Attach BATT+/- (Pins 4/5) to the power source. Be sure to fuse the power connection with a 5A fuse. The system can be used with 12V or 24V power systems.

The CAN connections (Pins 1-3) are used by the annunciator to communicate with the EIM and other modules, if present. The CAN wiring is daisy-chained between all modules in the system. If using only the annunciator and EIM, then simply run the CAN Communication Harness from the annunciator to the EIM CAN terminals. If using more modules, connect the modules in a single chain as shown in the example below. The modules on the chain can be in any order.

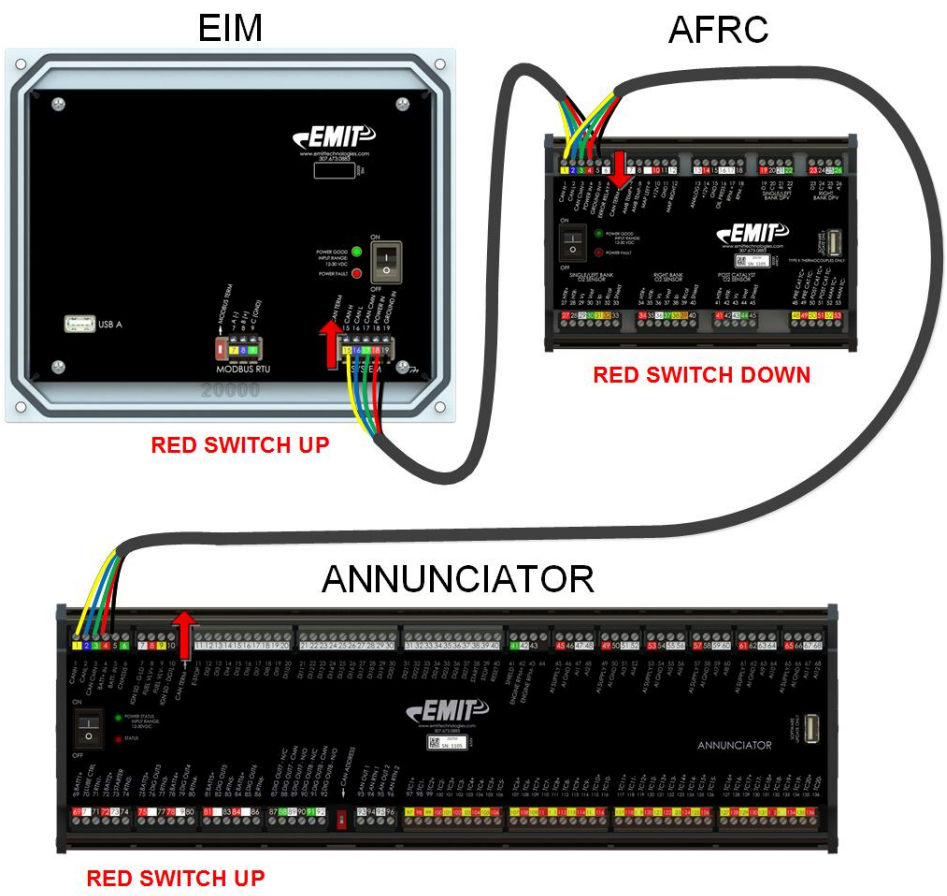


Figure 5. CAN wiring example with EIM and two modules

The two modules at the end of the CAN network, i.e. with only one set of wires in the connector, should have the red CAN switch terminated (switched up). Any modules in the center of the network should have the switch down.

MAIN SHUTDOWN WIRING

The main shutdown wiring terminal block is pins 7-10. The annunciator should be wired to shut off the ignition, and if present, a fuel valve when the system is stopped. The pins used will be dependent on the fuel valve and ignition type.

	If using a non-EMIT ECU, such as a Caterpillar ADEM or a Waukesha ESM, refer to the annunciator schematic provided for wiring to the ECU, and skip this section

Ignition Types

- Ignitions with a digital shutdown (including EMIT ignition): Wire the shutdown lead to DC SHDN (Pin 10). This pin is grounded when the engine should be OFF.
- Ignitions with a g-lead (magnetos and other systems with AC power on shutdown lead): Wire the shutdown load to MAG/CD SHDN (Pin 7). This pin is also grounded when the engine should be OFF, but the input is rated differently.

Fuel valve types

- DC-Powered fuel valves (always on): Wire the power of the valve to the panel power block or battery, and the ground of the valve to DC FUEL (Pin 9). This pin is grounded when the engine should be ON, which will power the fuel valve. When the engine should be off, the ground on pin 9 is removed and the valve will be unpowered.
- CD-Powered fuel valve: For CD-powered fuel valves, the valve is manually latched open, and a brief voltage from the g-lead closes the valve. For this type of valve, wire the power to MAG/CD FUEL (Pin 8) and the other end to ground. During a shutdown, the g-lead on pin 7 will be briefly routed to pin 8 to latch shut the valve. Afterwards, the g-lead will be grounded. Note that this type of valve can only be used if the ignition type can power it.
- Momentary DC fuel valves (latch closed): Wire a digital output to a control relay, then connect the normally open contact to power on one side and the fuel valve coil on the other, with the other fuel valve wire to ground. Select the output chosen on the “Shutdown Pins” setup page.

PRE/POST LUBE WIRING (IF USED)

If using a Pre/Post lube system, wire LUBE CTRL (Pin 70) to the positive side of the lube pump, or a relay to run the lube pump. Run the other side of the lube pump or relay to ground. Run a wire from BATT1+ (Pin 69) to a fused power source. The annunciator will route power from Pin 69 to Pin 70 when the lube output should be active.

STARTER WIRING

The STARTER output (Pin 73) is powered when the annunciator is starting the engine. Wire pin 73 to one side of a relay with the other side connected to ground. The contact side of the relay should be wired to properly actuate the starter solenoid. Wire Pin 72 to a fused power source.

	If using autostart, the annunciator will run the starter during the start process. If not using autostart, it can still be useful to wire the starter solenoid from the annunciator. In such a case, the annunciator will run the starter when the START button is held, but only when the annunciator is in a RUN state, which adds a factor of safety.

ANNUNCIATOR PANEL SWITCHES

The annunciator has three push-button panel switches- START, STOP, and RESET. There is also an emergency stop switch provided, but an existing E-Stop can also be used

Mounting

Drill a 22.3 mm (0.88”) hole for each of the three push button switches. Place each switch in the panel and thread the nut on the back to hold the switch in place.

Attach the provided switch nameplates below each switch. The nameplates require 4.625” x 2.5” of space.

Wiring

For the Start (Green) and Reset (Black) switches, wire terminal 14 to ground and 13 to the annunciator, with start wired to pin 38 and reset wired to pin 40. For the stop (Red) switch wire pin 11 to ground and pin 12 to the annunciator pin 39.

For the E-Stop, or an existing E-Stop if present, wire one side of the normally closed contact to ground and the other side to pin 11 on the annunciator module.

ANNUNCIATOR SENSOR WIRING

There are four types of sensors wired to the annunciator- digital inputs, analog inputs, thermocouples, and magnetic pickup. The wiring of each is described below.

	Since every input is configurable, create a list in advance of how you intend to number the inputs. This will make it easier to match the configuration to the wiring once the wiring is complete.

DIGITAL INPUTS

Digital inputs are inputs that are only closed to ground. These inputs can be “Normally Open”, which means that when the input closes to ground it is considered faulted, or “Normally Closed”, which means that the input should always be closed to ground, and when it is opened the input is considered faulted.

Any digital input can be software configured to be normally opened or normally closed.

Wire digital inputs to pins 12-37. Each pin is for a single digital input. Some sensors may require the other end to be connected to ground, or might require power, ground, and an output. Refer to the sensor’s documentation if you are not sure.

In some installations, the digital inputs will be considered non-incendiary and will need to be routed in separate channels from other wiring. Refer to the panel documentation if needed.

No-Flow Inputs

If using compressor block lubrication no-flow monitoring, connect the proximity switch (or switches) to ground on one side and a digital input on another. Any digital input can be used as a no-flow input, up to three total.

ANALOG INPUTS

Analog inputs are inputs that connect to sensors that read a range of values, most commonly pressure sensors. Each analog input can be software configured to be considered 4-20 mA, 0-5 V, or 1-5 V. The type of input depends on the sensor, and should be printed on the sensor body.

The AI SUPPLY pins are powered from an internal 12V supply. Be sure to check analog sensors to see the input voltage rating. If a sensor is not suitable for 12V power, such as a 5V powered sensor, be sure to power it from another supply.

Wire the analog input sensor outputs to pins labeled “AIx”, using the power and ground pins as needed.

For pressure transducers, the sensor can be installed on-skid and wired to the panel, or stainless tubing can be run to the panel and the pressure transducer can be panel installed. Use an appropriate thread sealant and tighten the pressure transducer connection to 15 ft-lbs.

THERMOCOUPLES

Thermocouples are wired to pins 97-136 on the annunciator, and can be Type K or Type J. The type is software programmable, so any type can be wired to any input. The default type is Type K.

	Type J thermocouples are normally used for lower temperatures than Type K

To prevent the pickup of noise, route thermocouple wires physically separated from other wiring. If drain wires are present in the thermocouple wire, route the drain wire to a suitable ground.

For ANSI-compliant thermocouple wiring, type K uses yellow for TC+ and red for TC-, and type J uses white for TC+ and red for TC-.

If using a block of thermocouples for engine cylinder temperatures, those should be the first set of thermocouples used. For example, if 8 cylinder temperatures are needed the inputs TC1-TC8 should be used.

If more than 20 thermocouples are needed, an EMIT annunciator expansion module is available

MAGNETIC PICKUP

If using a magnetic pickup, wire it to the MPU pins 42-43 on the annunciator module. If no EMIT governor or ignition is present in the system, the magnetic pickup is required if using autostart.

USING THE ANNUNCIATOR WITH OTHER ETS MODULES

The ETS modules will share some data with each other as needed. The best practices for sensor wiring when multiple modules are used is discussed in this section.

Magnetic Pickup

If an EMIT Governor or Ignition is present in the system, the magnetic pickup input on the annunciator does not need to be used. The engine speed will be shared from the Ignition or Governor to the Annunciator (and AFRC) and can be displayed and setup normally in the Annunciator section of the EIM. The governor always requires a physical direct MPU connection.

Manifold Pressure

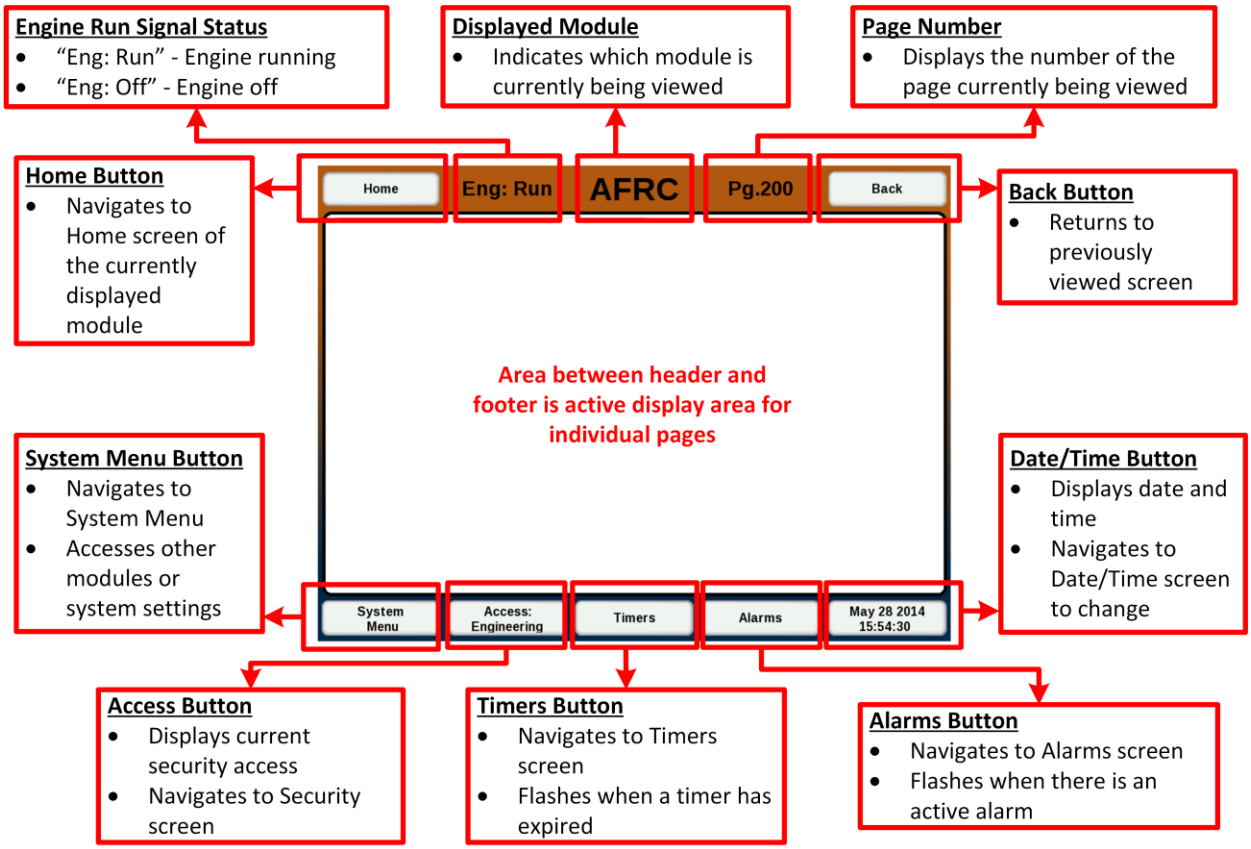
The engine manifold pressure can be connected to the AFRC, Governor, or Annunciator, and will be shared between all modules including Ignition. If present, wiring to the Governor is the preferred option, since the labeling and scaling will be known automatically.

Pressure sensors for speed control

If both an EMIT governor and annunciator are present, the pressure sensors should always be wired and setup on the annunciator. If using pressure-based speed control on the Governor, it will use the required sensor data from the annunciator by using the communication bus.

SYSTEM SETUP AND QUICK START

USER INTERFACE



USER INTERFACE ELEMENTS

Button	Example	Description
Button (Sensitive)	Open	• Light grey. Active and selectable.
Button (Insensitive)	Open	• Dark grey. Disabled and cannot be selected.
Combobox	Diff Pressure	• Light grey. Displays selected value. • Hold finger on button and slide to selection.
Toggle Button	Auto Vs. Manual	• Pressing the button changes the text of the button. The text of the button indicates the current status.
Enable Button	X Vs. X	• Dark grey indicates button is enabled or "on". • Light grey indicates button is disabled or "off".

EIM SETUP

SECURITY ACCESS

- Press the 'Access: Operator' button in the footer of the display
- Using the keypad on the screen, enter the Setup security password, then press the 'Submit' button
    - Passwords for the system are located on the cover of the EMIT USB drive included with the EIM
- The 'Access:' button will now display 'Access: Setup' after successfully entering the password

DATE AND TIME

- Press the button displaying the date and time in the lower right corner of the display
- Use the buttons and keypad to set the current date and time
    - Time is in 24-hour format
- Press the 'Submit' button when completed

ANNUNCIATOR INITIAL SETUP

COMMON INPUT CONCEPTS

In general individual inputs are configured to trigger an alarm action if not in the desired range. Inputs are set each set up to have an input class, which determines when the input is *armed*, and an input action which determines what happens if the input is faulted while armed.

The available input classes are:

- Class ESD: The input is always armed
- Class A: The input is always armed, except during testing mode
- Class B1: The input is armed after the "Class B1 Timer" expires, which begins counting down when the "Reset" button is pressed.
- Class B2: The input is armed after the "Class B2 Timer" expires, which begins counting down when the "Reset" button is pressed.
- Class C: The input is armed whenever it first becomes not faulted after the "Reset" button is pressed. There is also an optional global timer to arm all C contacts after that time (any unarmed C contacts would immediately arm and fault).

The available alarm actions are:

- Shutdown: Shut down the engine
- Warning: Illuminate the warning lamp while faulted
- No Action: The alarm has no action, but the input is still present in the system to view for gauges, etc.
- Disabled: The input is not used

Additionally, an extra warning can be added on up to 8 inputs regardless of their main alarm action. This extra warning will generate an alarm event on the alarm screen when the event happens. This can be used to log an event where a sensor is slightly out of range but not yet in the shutdown range.

ANNUNCIATOR SETUP WIZARD

The best way to set up the annunciator for the first time is to use the setup wizard, which will help step through all the required setup screens. To access the setup wizard:

1. Enter the *Setup* or *Engineering* password
2. Select the “Annunciator” module on the EIM home screen
3. Select “Annunciator Setup”
4. Select “Setup Wizard”

The setup wizard will ask some questions about the general system setup and go through setup steps as needed. The different types of inputs will require different parameters, as discussed below.

Digital Inputs

- Name: Choose or type in a name for the input
- Type: Choose normally open or normally closed, based on the sensor type
- Alarm action and class: Choose as needed based on the descriptions in the previous section

Analog Inputs

- Name: Choose or type in a name for the input
- Type: Choose 0-5V, 1-5V, or 4-20mA based on the sensor type
- Value at (low) and (high): Enter the full range of the sensor. This should be printed on the sensor itself or can be found in the sensor documentation.
- Units: Enter the unit of the sensor for when displaying the value

If an EMIT governor is on the system and pressure-based speed control is used, the suction/discharge sensors on the annunciator must use the units “PSI” or “KPA”.

- Alarm low and high: Enter the low and high alarm for the sensor. If either the low or high is not needed, it can be put at the limit or out of range of the sensor to keep it from ever faulting.
- Alarm action and class: Choose as needed based on the descriptions in the previous section. The class can be different for a low vs. high alarm if needed.
- Optional secondary warning: If an extra warning is desired, it can be added here.

Thermocouples

- Name: Choose or type in a name for the input
- Type: Choose Type K or Type J based on the thermocouple type
- Display range: Choose the low and high display range for the input. This only limits how the gauges and graphs will be drawn, and does not have any effect on actual system operation. For example, one might want to have jacket water temperature use a range of 100-200 degrees, but postcat temp have a range of 300 to 1300 degrees.
- Alarm low/ high: Choose the low and high alarms if required. An unneeded limit can be set to zero to be disabled.
- Alarm action and class: Choose as needed based on the descriptions in the previous section
- Optional secondary warning: If an extra warning is desired, it can be added here.

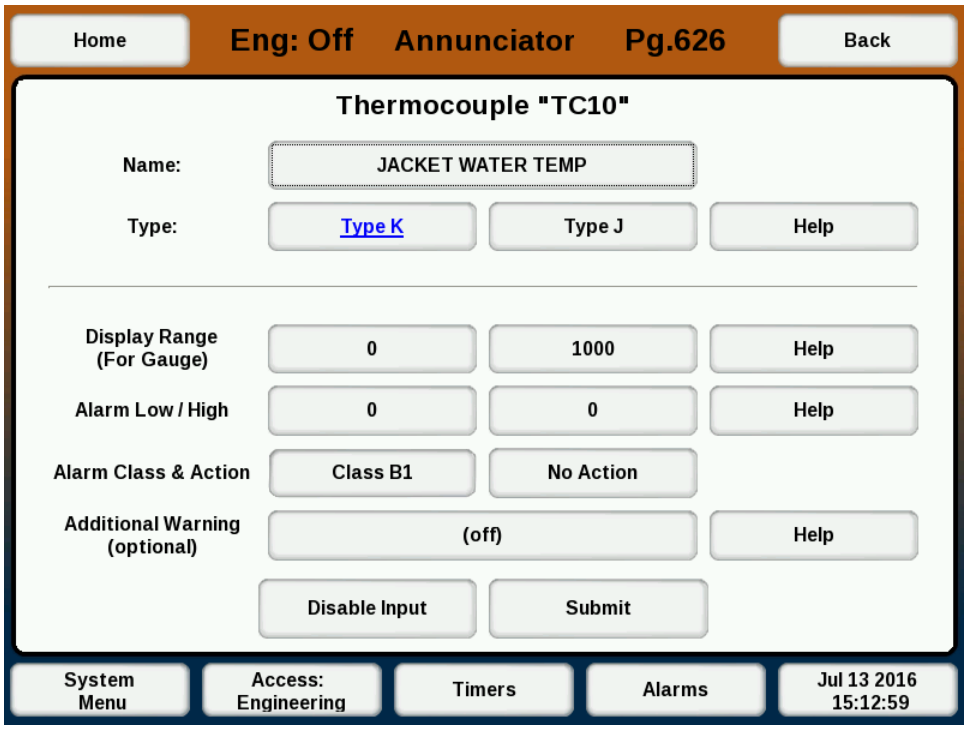


Figure 6. Input setup example- Thermocouple

Magnetic Pickup

- Number of flywheel teeth: Enter the number of teeth expected on the MPU.
- Low/high alarm values: Enter limits as required

Setup Wizard Review

At the end of the setup wizard, a page will be shown with a summary of the pending settings. If the settings look correct, select “Submit”.

OTHER ANNUNCIATOR SETUPS

After the initial setup wizard, the items in this section may or may not need to be setup, depending on what features you are using on the system.

HOME PAGE GAUGES

The home page shows up to five “sets” of gauges, each with six gauges. These gauges can be selected to show whatever group of inputs as desired. To change the home page gauges:

- Select “Annunciator Setup”
- Select “Display Setup”
- Select “Select Home Page Gauges”
- Select one of the 5 pages to pick the gauges for that page
    - Change between the different input types to see each group of inputs
    - Select an input to highlight it in blue and include it in the gauge set
    - Select a blue input again to deselect and remove it from the gauge set

- If no items are selected, the page will show “(Empty)” on the review screen, and will not be shown on the home screen. Note that most setups will not require all 5 pages of gauges.

NO FLOW MONITORING

To use the integrated no flow monitoring:

- Select “Annunciator Setup”
- Select “Inputs Setup”
- Select “No-Flow Monitoring”
- Up to three digital inputs can be used for no-flow (proximity switch) connection. Select one and set up the following
  - Which digital input to use
  - The maximum cycle time before faulting
  - The rated lubrication rate/speed (optional)
- Additionally, the alarm class and action at the top of the page is used to set the class and action for all no-flow inputs. Most typically this will be set to Class B1 / Shutdown. After the B1 timer expires, if a no-flow input does not detect a cycle within the maximum cycle time, the engine will shut down.
- If the rated lubrication rate and speed is entered, the annunciator will log the lubrication rate as a percent of rated speed. If over time this value is not close to 100%, it can lead to maintenance issues or wasted oil.

PRE / POST LUBE

If a pre/post lubrication system is used, it can be set up by the following:

- Select “Annunciator Setup”
- Select “Outputs Setup”
- Select “Pre/Post Lube”
- Enter the pre-lube and post-lube times. These are the amount of time the LUBE output will run before and after the engine operates.
- Optionally, an extra pre lube valid condition can be added that will cause LUBE to continue until that condition is met. For instance, the pre-lube might continue until compressor oil pressure is above some value.

SHUTDOWN PINS

If a CD (G lead) powered fuel valve is used, do the following:

- Select “Annunciator Setup”
- Select “Outputs Setup”
- Select “Shutdown Pins”
- Select the ignition and fuel valve type to see a wiring diagram
  - This does not actually change the operation, it only shows the diagram
- If using a CD (G lead) powered fuel valve, set the shutdown stage 2 timer to some value
  - This is the amount of time the G lead will be used to latch the fuel valve closed
  - A typical value is 3 seconds
- If not using a G lead powered fuel valve, the shutdown stage 2 timer can be set to zero

ECU INTEGRATION

This document mainly covers the case where all EMIT controls are used. If non-EMIT ECU is used, navigate to the following to select. Additionally, reading the appropriate section of the annunciator user manual is advised.

- Select “Annunciator Setup”
- Select “Outputs Setup”
- Select “Output Scheme”
- Select “Generic/ No ECU”
- Select “Submit”

B TIMER SETUP

In general the B1 timer is used for inputs that can be ignored for a period after startup, such as compressor pressure sensors. In general the B2 timer is much shorter and is used for inputs that should clear very quickly after starting the engine. By default the B1 timer starts at 3 minutes and the B2 timer starts at 30 seconds.

To change the B timer(s):

- Select “Annunciator Setup”
- Select “Timers Setup”
- Select “Class B/C Timer Lengths”
- Adjust the timer lengths as desired
- Select “Submit”

OTHER SETUPS

For other system configurations, refer to the annunciator user manual and on-screen help.

BASIC ANNUNCIATOR UI OVERVIEW

ANNUNCIATOR HOME

The annunciator home screen shows the run status on the left and a set of gauges on the right.

Up to five sets of six gauges each can be shown on the annunciator home screen. If more than one set is filled in, a “Next” and “Prev” button will appear at the top of the gauge area to see the other gauges. Selecting a gauge will show the previous minute of runtime data as a graph, along with some input statistics from the datalog.

The run status will show if the annunciator is running, along with the status of various timers and outputs. Selecting the run status box will switch to the Input and Timer status screen.

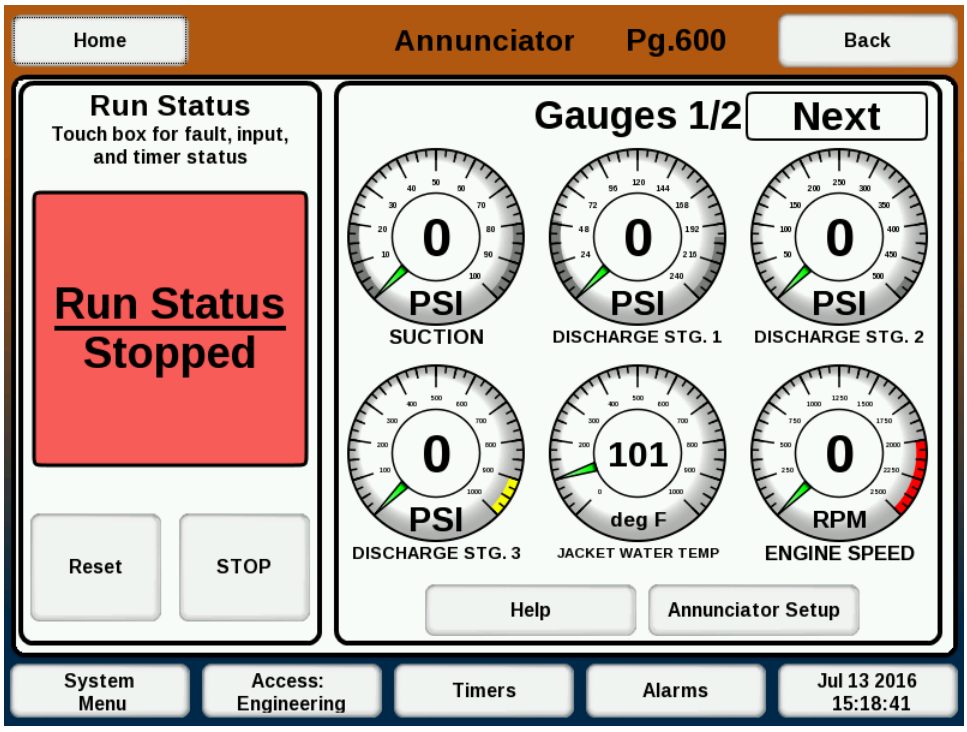


Figure 7. Annunciator Home Screen

INPUT AND TIMER STATUS SCREEN

The input and timer status screen will show the status of any faulted inputs on the left, and the status of any active timers on the right. It will also show the previous reason the annunciator was stopped.

The list of faulted inputs will be color-coded based on whether the input is armed, and the configured fault action of the input.

START/STOP/RESET OF ANNUNCIATOR

With the Annunciator in the “Stopped” state, pressing the panel RESET button, or pressing “Reset” on the Annunciator home screen will reset the annunciator. This will cause the annunciator to go to the “Run” state, or move to Pre-Lube or other startup states as needed.

If not in the stopped state, pressing RESET will restart the B timers.

Pressing the panel STOP button or selecting the “STOP” button on the annunciator home screen will always cause the annunciator to go to the “Stopped” state.

If autostart is used, then pressing the panel START button will begin the auto start process. This can be done if in the “Stopped” state or after pressing RESET, but all A contacts have to be clear for autostart to begin.

If autostart is not used then holding the START button will run the starter, if the annunciator is in a run state.

PANEL LIGHT TOWER

If using an EMIT panel, the light tower has the following functions:

- Red Light: Solid red when annunciator is stopped or faulted
- Yellow Light: Solid yellow if the engine is running with warnings, flashes yellow during autostart, and flashes yellow during last 5 seconds of B1 timer to warn the user it is about to expire
- Green Light: Solid green while annunciator is running (ignition / fuel enabled)
- Siren: Solid siren during autostart warn phase, quick beeps a few seconds before a auto-blowdown

Sheridan, Wyoming

772 Airfield Lane, P.O. Box 6785, Sheridan, WY 82801
Phone: 307-673-0883 | Fax: 307-673-0886

Fort Worth, Texas

6655 Corporation Parkway, Suite 160, P.O. Box 126263, Fort Worth, TX 76126
Phone: 817-546-7456 | Fax: 817-546-7459

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