

EMS467 Monitoring System

Installation and Operations Manual



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Section 40

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Warranty - A limited warranty on materials and workmanship is given with this FW Murphy product. A copy of the warranty may be viewed or printed by going to <http://www.fwmurphy.com/warranty>



Please read the following information before installing.

BEFORE BEGINNING INSTALLATION OF THIS MURPHY PRODUCT:

- Read and follow all installation instructions.
- Please contact FW MURPHY immediately if you have any questions.
- Disconnect all electrical power to the machine.
- Make sure the machine cannot operate during installation.
- Follow all safety warnings of the machine manufacturer.
- A visual inspection of this product for damage is recommended before installing
- It is your responsibility to have a qualified technician install the unit and make sure installation confirms with local codes.

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Product Description

The EMS467 Electronic Monitoring Systems/Controllers are micro-processor based for monitoring and control of equipment functions. The basic EMS system is programmed for a typical industrial engine power unit. Custom programming is available to adapt the EMS to a wide variety of engine and equipment requirements.

Basic programs provide auto-start/manual start and first-out shutdown for engine functions such as pressure, temperature, level and overspeed. Necessary time delays for start up lockout are included. Operating data is displayed on a 32 character back lit alphanumeric liquid crystal display.

The EMS operating parameters are configured through a simple three-button interface. Access to the system memory is controlled by entry codes. A password-protected program uses built-in memory to display the alarm/shutdown history, including a display of the last ten shutdowns, when and why they occurred and displays all of the engine operating conditions at time of last shutdown.

Input/Output Types and Specifications

Electric Gage Senders - Accepts Murphy or equivalent resistance type senders.

■ **NOTE:** Configurations available for 4-20 mA or 0-5 VDC inputs.

Digital Inputs (DI) - Number of devices: 8

Device types: discrete input, optically isolated, normally open (N/O) or normally closed (N/C), bi-polar (active high positive voltage/active low negative voltage), non-incendive.

Analog Inputs (AI) - Number of devices: 8 (7-field selectable, 1-dedicated for battery voltage)

Device types: analog input, accepts 4/20mA, 0-5 VDC, or Murphy (or equivalent) resistance type senders (two-wire type senders is recommended). 10 bit hardware.

Frequency Pickup - Number of devices: 1

Device types: magnetic pickup (MPU), 5 to 120 Vrms, 30 to 10k Hz. - Optically Isolated

Digital Outputs (DO) - Number of devices: 7

Device types: discrete output, normally open (N/O) or normally closed (N/C) 200mA sinking (DC-). Outputs 4 and 5 have flashback diodes and include software interrupts for high speed throttling. (i.e. Murphy AT03069)

Analog Outputs (AO) - Number of devices: 1

Device types: analog output, 0.5-4.2 VDC, 8 bit hardware

Communications

The EMS 467 includes an RS485 serial port. By using the RS485 port and the necessary software, the ability to monitor the status of the equipment from a remote location is possible.

Port 1 (SERIAL, DB25 female connector)

Interface: RS485

Protocol: Modbus RTU (master or slave), Proprietary (binary)

Connection: There are three (3) terminal connectors for RS485. Typical identification as A, B, SHD. See terminal board connection drawings for specific numbering.

Port 2 (SERIAL, DB9 male connector)

Interface: 5 wire RS232, DTE connection

Protocol: Modbus RTU RS232 (master or slave), Proprietary (binary), flash programming

Connection: DB9M, null-modem cable.

Modbus RTU Slave Address Configuration: The operator may assign a unique Modbus address to each controller (slave) unit that may be in the system. This allows the master controller to differentiate between the modules. Typically, this configuration is set to (1) by the factory. Refer to the sequence of operations to determine how to adjust the communication addresses.

Port 3 (CAN0 and CAN1, DB9 female connector)

Interface: Two (2) independent CAN 2.0B ports

Protocol/Services: J1939, Proprietary (binary)

Connection: There are three (3) screw terminal connectors for each CAN connection. These are identified as CAN H, CAN L, and SHD. See terminal board connection drawing or cable pin out designation for specific numbering.

S449 Relay Output Boards

Relay output boards are used for dry contact capabilities for non-hazardous applications. These output boards require the use of the EMS25TBCAR2 cable assembly.

S449-1: Seven (7) Dry Relay Outputs board for EMS467 models.

S449-3: Five (5) Dry Relay Outputs and two (2) Transistor Outputs board for EMS467 models.

Basic Models

EMS467: Designed with an extruded aluminum enclosure suitable for panel installation. Two (2) separate models are available for your specific application. The EMS467 standard case provided for high debris areas. The EMS467 vented case is provided for more protected areas and higher temperature locations for increased ventilation.

EMS25TB: Plug-in terminal block assembly.

EMS25RM: Rail mount DIN type terminal block, DB25F (female) connector

EMS25CAR2: Ribbon cable (2') with 2 male D-sub connectors. Used with EMS25RM.

EMS25TBCAR2: Ribbon cable (2') with 1 male and 1 female D-sub connector. Used with S449 output Boards.

EMSTBIF: Rail mount DIN type terminal block, DB25M (male) connector.

EMSTB9: Rail mount DIN type terminal block, DB9M (male) connector.

EMSCAR5606: Data cable (6') with 1 male and 1 female D-sub connector. Used with EMSTBIF.

EMSCAR1206: Data cable (6') with 1 male and 1 female D-sub connector. Used with EMSTB9.

USER INTERFACE (PORT #1)

The DB25 connector contains analog and digital I/O. The following is a description of the PIN connections.

PIN	Hardware Assg.	Program PIN Assignment	PIN	Hardware Assg.	Program PIN Assignment
1	Analog 4	Configurable: Sender/Digital, 4-20mA, 0-5 VDC	14	Analog 6	Configurable: Sender/Digital, 4-20mA, 0-5 VDC
2	Analog 0	Configurable: Sender/Digital, 4-20mA, 0-5 VDC*	15	Analog 5	Configurable: Sender/Digital, 4-20mA, 0-5 VDC
3	Analog 7	Configurable: Sender/Digital, 4-20mA, 0-5 VDC	16	Analog 3	Configurable: Sender/Digital, 4-20mA, 0-5 VDC*
4	Analog 1	Configurable: Sender/Digital, 4-20mA, 0-5 VDC*	17	Analog 2	Configurable: Sender/Digital, 4-20mA, 0-5 VDC
5	Input 1	Digital Only (DC+ or DC-)	18	Input 3	Digital Only (DC+ or DC-)
6	Input 2	Digital Only (DC+ or DC-)	19	Input 4	Digital Only (DC+ or DC-)
7	Output 1	Transistor 200 mA sinking	20	Output 4	Transistor 200 mA sinking
8	Battery +	DC + (positive)	21	Output 5	Transistor 200 mA sinking
9	Battery +	DC + (positive)	22	Output 6	Transistor 200 mA sinking
10	Output 2	Transistor 200 mA sinking	23	Output 7	Transistor 200 mA sinking
11	Battery -	DC - (negative)	24	RS485 -	RS485 -
12	Output 3	Transistor 200 mA sinking	25	RS485 +	RS485 +
13	Freq. Input	Frequency Input			

CAN / USER INTERFACE (PORT #2)

The DB9 connector contains CAN communications, analog and digital I/O. The following is a description of the PIN connections.

PIN	Hardware Assg.	Program PIN Assignment	PIN	Hardware Assg.	Program PIN Assignment
1	CAN 0H	CAN 0 High +	6	Input 5	Digital Only (DC+ or DC-)
2	CAN 0L	CAN 0 Low -	7	Input 6	Digital Only (DC+ or DC-)
3	CAN 1H	CAN 1 High +	8	Input 7	Digital Only (DC+ or DC-)
4	CAN 1L	CAN 1 Low -	9	Input 8	Digital Only (DC+ or DC-)
5	Analog Out 1	Analog Out 1 (0.5 - 4.2 VDC)			

RS232 (PORT #3)

The DB9 connector contains RS232 communications. The following is a description of the PIN connections.

PIN	Hardware Assg.	Program PIN Assignment	PIN	Hardware Assg.	Program PIN Assignment
1	DCD*	Data Carrier Detect (Install LK14, Remove LK13)	6	N/C	No Connection
2	RD	Received Data	7	RTS	Request To Send
3	TD	Transmitted Data	8	CTS*	Clear To Send (Install LK13, Remove LK14)
4	DTR	Data Terminal Ready (Tied to PIN 7)	9	N/C	No Connection
5	GND	Signal Ground			

* LK13 or LK14 must be installed. Only one jumper may be connected.

Installation

The EMS467 Monitoring System is U.L. approved in hazardous locations, Class 1, Division 2, Groups A, B, C and D. Read and follow all Warning notices.

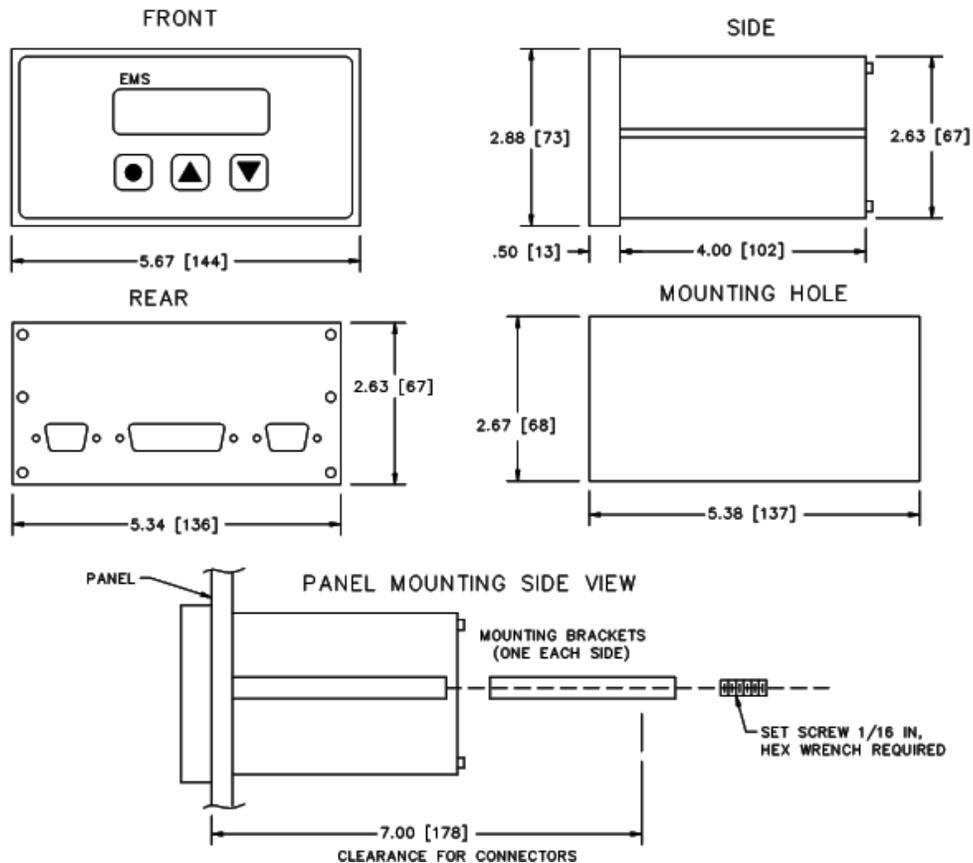
A. WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2,

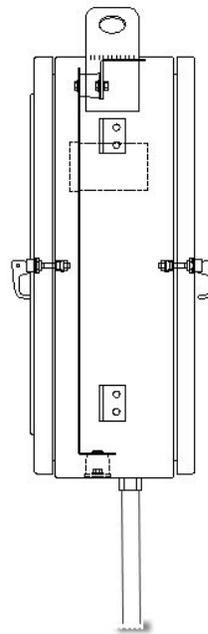
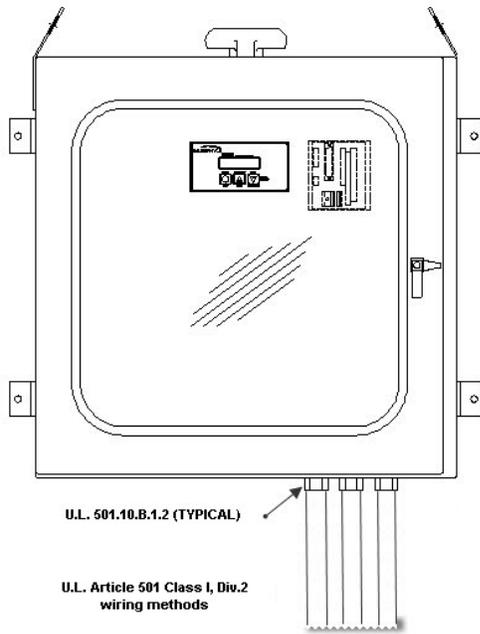
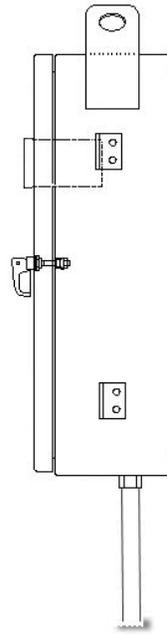
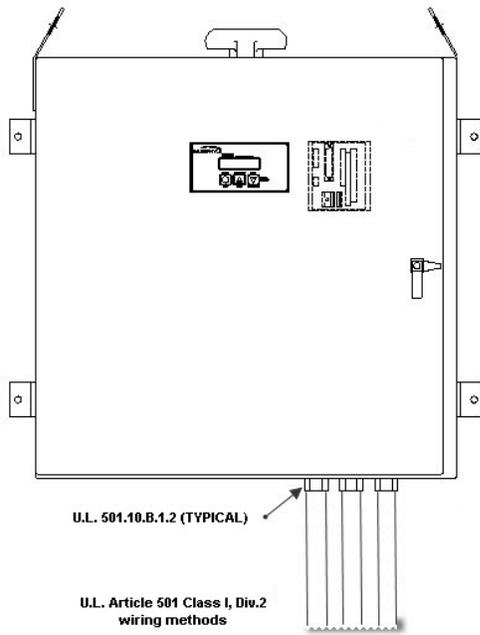
B. WARNING - EXPLOSION HAZARD - WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES, and

C. WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NONHAZARDOUS.

EMS467 Mounting

The EMS467 should be mounted in a location that is accessible to the operator. EMS467 requires a rectangular mounting hole, (see mounting hole below) and sufficient rear clearance for wiring connections. Install the unit in an enclosed location within operating temperatures (-4 to 149°F [-20 to 65°C]).





Connecting the EMS467

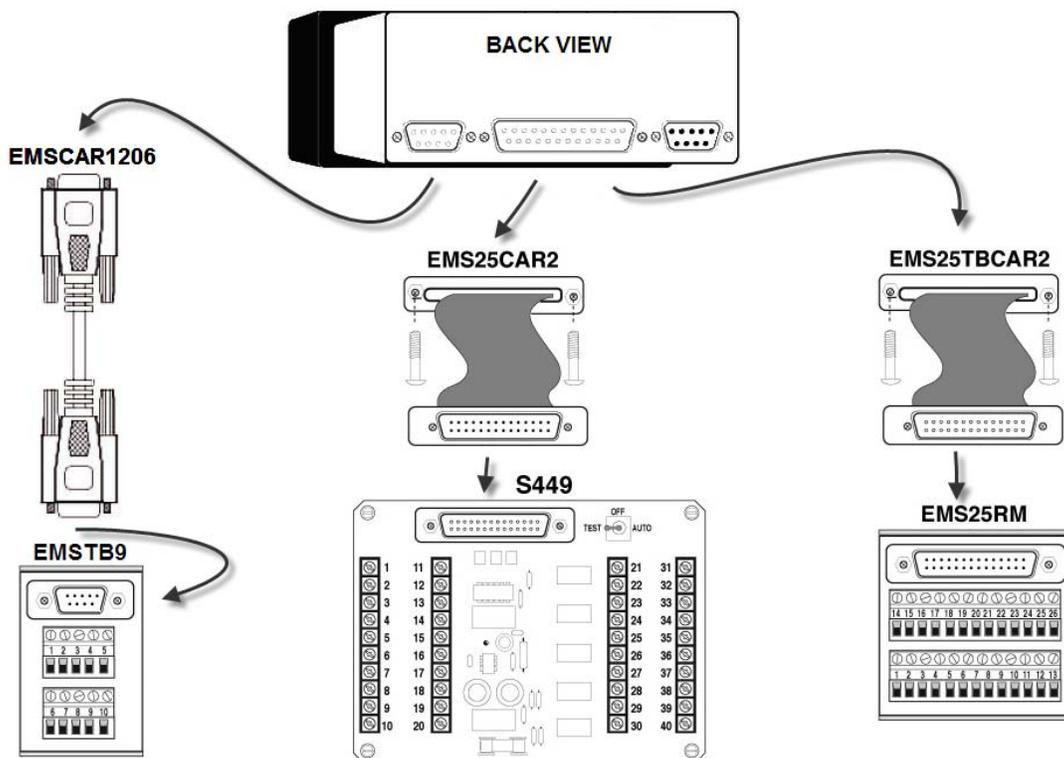
WARNING: DISCONNECT ALL ELECTRICAL POWER BEFORE BEGINNING INSTALLATION AND STOP ALL MACHINERY BEFORE PERFORMING THE HOOK UP. FOLLOW ALL INSTRUCTIONS.

EMS467 Models

Murphy offers optional connector assemblies for easy hook up to the EMS467 module (see options below). Terminal designations, PIN and color codes depend upon the EMS program used. Specific wiring information is supplied with each unit. Refer to these installation instructions or the sequence of operations for specific wiring instructions.

Attaching the EMS25TB to the EMS467 model:

1. Remove (2) hex standoffs that hold the DB plug into the housing
– *CAUTION: remove one at a time*– and replace with (2) 4-40 x 1/4" screws.
2. Remove (2) 6-32 x 1/4" screws that plug holes in back plate.
3. Push EMS25TB cable assembly onto DB connector.
4. Attach 6-32 x 1" screws through mounting plate/holes and tighten.



EMS467 Operations

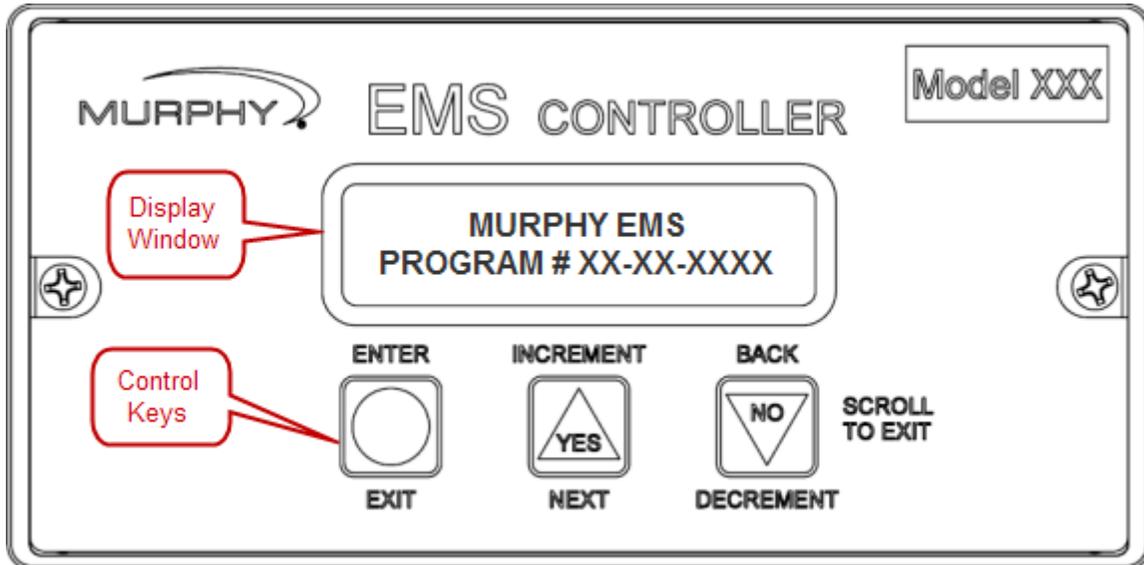
Operating the Interface

By using the three membrane buttons and the liquid crystal display, make set-point changes, acknowledge alarms, and scroll through the display. The graphic below shows the display and buttons.

- The **ENTER (EXIT)** button is used to confirm a set-point, Get into and out of a display and to Acknowledge alarms.

- ▲ The **YES (INCREMENT)** button is used to Scroll up the display, to Select messages, and Increase values.

- ▼ The **NO (DECREMENT)** button is used to Scroll down the display, to Select messages, and Decrease values.

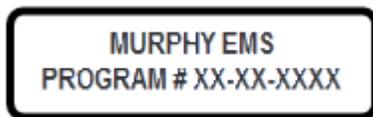


The 32-character, two line, liquid crystal display shows monitored information such as Engine Oil, Engine Temperature, R.P.M. etc., plus on-board information such as Engine Hours and Battery Voltage. When a shutdown or a service reminder comes due, the display will show this information, immediately.

Scrolling Main Displays

During normal operation, the EMS allows the user to scroll through a number of informative displays. The user can manually scroll through monitored information by pressing the ▲ (Yes) or the ▼ (No) buttons, or if program version allows it, the user may set up the EMS for automatic scrolling selection. When a shutdown occurs or a service reminder comes due, the EMS will display the corresponding information regardless of the scrolling mode. When first powered up, the EMS will delay for 1 minute before starting to scroll. When the scrolling mode is changed, the EMS will not start its scrolling immediately. A 10 second delay must time out before scrolling begins.

To set the Automatic scroll mode press the ▼ (No) button until title page appears (screen below):



Now, press the ● (Enter) and the ▲ (Yes) buttons simultaneously. To set the Automatic scroll mode to off, press ● (Enter) and ▼ (No) buttons at the same time. The Automatic scroll off enables the user to manually scroll through the displays. Your entry choices will be shown.

IMPORTANT: Main displays will vary with each microprocessor program available. Refer to the Main displays listing included with your EMS system.

First Time Set-Up

CAUTION: MAKE SURE ALL S-NUMBERS HAVE BEEN ADJUSTED OR VERIFIED TO YOUR APPLICATION BEFORE PLACING THE UNIT INTO OPERATION.

The **S-numbers and P-numbers** (Set point numbers) allow the user to customize your EMS unit. Access to the S-numbers and P-numbers is password-protected.

The **S-Numbers** include operational variables such as Crank/Rest, Warmup/ Cooldown Times, Alarm and Shutdown points. The user will also be able to configure the EMS mode of operation (Automatic or Manual) if applicable.

The **P-numbers** are used for service acknowledgment and shutdown history.

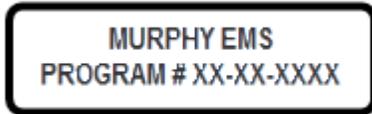
A complete list including S-numbers and P-numbers, their description and access codes is included with each EMS unit.

The EMS Operating Parameters and field settings are configured through the three-button key pad and the display window.

How to Access the S-Numbers

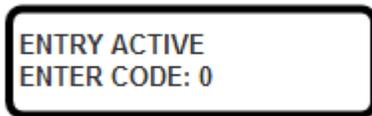
Also refer to the “Quick-reference” sheet supplied with this installation.

1. Turn the power ON, but DO NOT ALLOW EQUIPMENT TO OPERATE.
2. Press the ▼ button until the title page appears:



MURPHY EMS
PROGRAM # XX-XX-XXXX

3. Press the ● button until the entry code screen appears:



ENTRY ACTIVE
ENTER CODE: 0

4. Press the ▲ or ▼ buttons until appropriate entry code is displayed. (See separate document which shows the entry/access codes for your unit.)
5. Press the ● button once, the S-numbers main menu will be displayed. The display window will show the S-1 screen, for example:



RUN HRS *****
S1 R1 SEL

6. Once in the S-numbers, go to a specific function by pressing the ▲ or ▼ buttons then pressing the ● button to enter the specific function. Now increase, toggle, or decrease the setpoint.

All Setpoints use the above described procedure. Once finished adjusting the desired S-numbers, exit the set-up mode by pressing and holding the ▼ button until the exit screen is displayed:

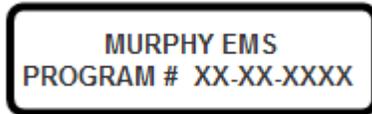


RUN HRS *****
S0 CIRCLE = EXIT

Now press the ● button to set the EMS back into normal operation and scrolling mode (automatic or manual as applicable). If the user fails to exit the S-numbers menu, the EMS will exit after a 5 minute delay

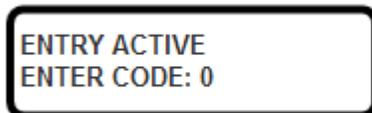
How to Access the P-Numbers

1. Turn the power ON, but DO NOT ALLOW EQUIPMENT TO OPERATE.
2. Press the ▼ button until the title page appears:



MURPHY EMS
PROGRAM # XX-XX-XXXX

3. Press the ● button until the entry code screen appears:



ENTRY ACTIVE
ENTER CODE: 0

4. Press the ▼ or ▲ buttons until appropriate entry code is displayed. (See separate document which shows the entry/access codes for your unit.)
5. Press the ● button once, the P-numbers main menu will be displayed. The display window will show the P-1 screen, for example:



RUN HRS *****
P1 R1 SEL

6. Once in the P-numbers, go to a specific function by pressing the ▲ or ▼ buttons then pressing the ● button to enter the specific function. Now increase, toggle, or decrease that setpoint.

Once finished adjusting or viewing the desired P-numbers, exit the set-up mode by holding the ▼ button until the Exit Screen is displayed:



RUN HRS *****
P0 CIRCLE = EXIT

Now press the ● button to set the EMS back into normal operation and scrolling mode (automatic or manual as applicable). If the user fails to exit the P-numbers menu, the EMS will exit after a 5 minute delay.

Acknowledging Service Reminders

To acknowledge a service reminder, first perform the required service to your equipment, then, clear the reminder message by accessing the P-numbers.

1. Press the ▼ button until the title page appears.
2. Press the ● button until the entry code screen appears.
3. Press the ▼ or ▲ buttons until appropriate entry code is displayed.
4. Press the ● button once, the P-numbers main menu will be displayed.
5. Next, using the ▼ or ▲ buttons, scroll to the P-number which represents the service performed. Press ● button to enter the function and toggle the NO to YES, using the ▲ button.

To change any service reminder interval, do so in the S-numbers (refer to “Section 2” of these installation instructions, separate document, or the detailed sequence of operations provided with custom programmed unit).

6. Now, exit to the main displays.

Inputs and Outputs Signal Checking

Before attempting to start your system, check which inputs and outputs are active and properly wired. The diagnostic information for confirming your EMS input/output setup can be found under the S-numbers menu or the Main Displays.

To access the input/output diagnostic information perform the following:

1. Turn the power ON, but **DO NOT ALLOW EQUIPMENT TO OPERATE**.
2. Press ▲ to see if I/O is in main displays. If not found here, press ▼ until title page appears.
3. Press ● until the entry code screen appears.
4. Press ▼ or ▲ until appropriate entry code for S-numbers is displayed. (See separate document which shows the entry/access codes for your unit.)
5. Press the ● button once, the S-numbers main menu will be displayed. The display window will show the S-1 screen, for example:



RUN HRS *****
S1 R1 SEL

6. Press the ● button to access this specific sub-menu.
7. Press the ▲ or ▼ buttons until the following screen appears.



I 1-8 X000 0000
ENTER SEL

The Letter “I”, shown in the upper most-left corner, determines that the screen displayed shows the EMS inputs.

Next to the “I” are numbers 1-8 which represent the 8 standard digital inputs.

When the letter “O” is displayed next to input numbers, which means the controller is NOT SENSING an input signal. The above example shows input 1 has tripped, for example vibration. Inputs 2, 3 and 4 are not sensed. By resetting the vibration switch, Input 1 will display “O”.

The next screen will show the balance of the inputs. The example below shows that the controller is NOT SENSING input signals 9 - 16:



Press the ▲ button to bring up the outputs display:



The above example shows Output number 4, designated with an “X”. This means that the controller software is calling for that output signal to be turned ON.

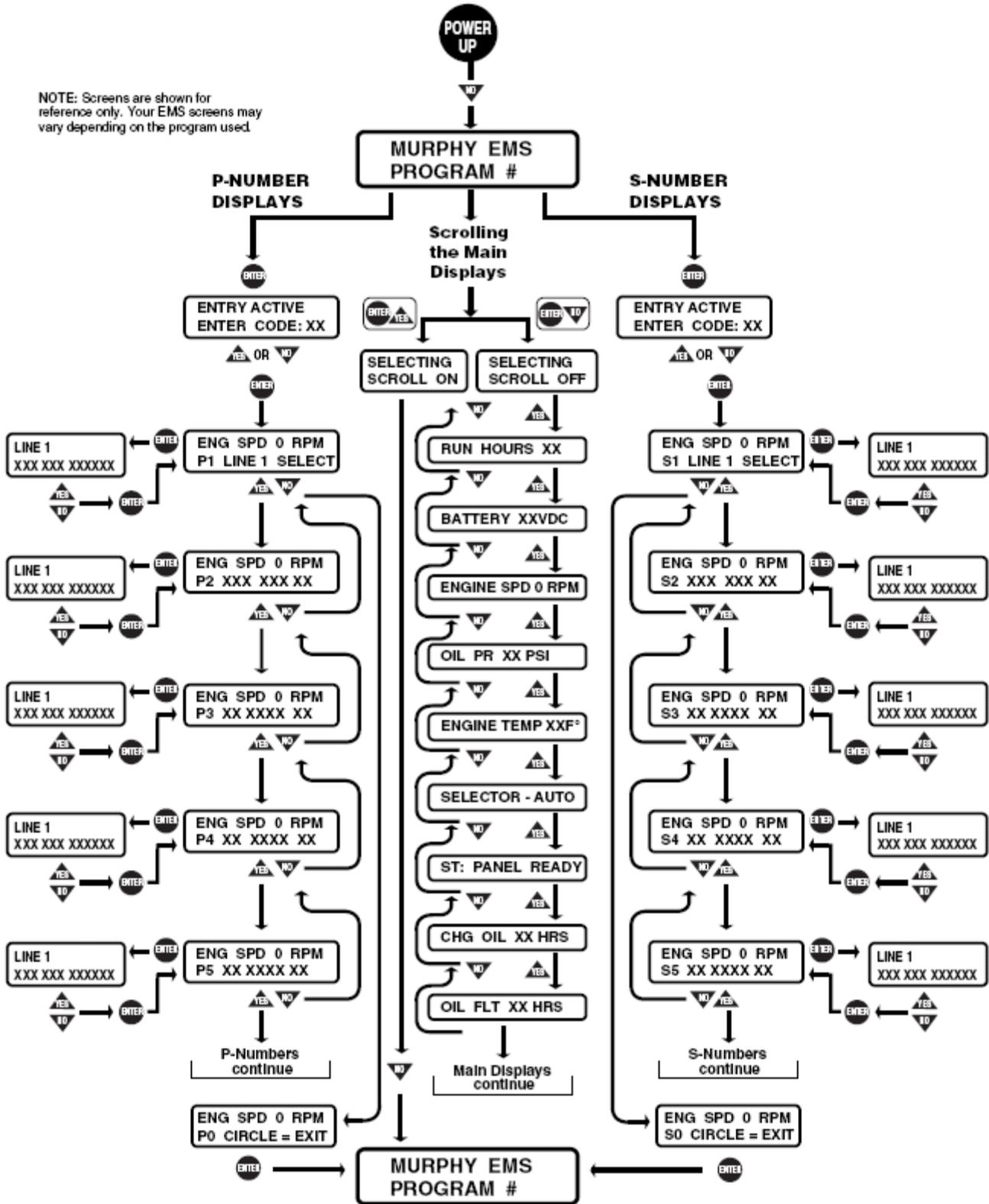
An “O” displayed means that the controller software is calling for the designated output signals to be turned OFF.

Refer to the “Pin Color Code and Terminal Designation Chart” (program specific document) and double check the wiring diagram(s) provided with your unit.

To exit S-numbers menu, press and hold the ▼ button until **S0 CIRCLE=EXIT** screen appears. Now exit to the main displays.

QUICK REFERENCE CHART

NOTE: Screens are shown for reference only. Your EMS screens may vary depending on the program used.



EMS467 Circuit Board

WARNING: DISCONNECT ALL ELECTRICAL POWER AND STOP ALL MACHINERY BEFORE OPENING THE EMS467 ENCLOSURE. IT IS YOUR RESPONSIBILITY TO HAVE A TRAINED PERSON OR A QUALIFIED TECHNICIAN HANDLE AND/OR TROUBLESHOOT THE EMS467 CIRCUIT BOARD.

Identifying the EMS467 Circuit Board Configuration

1. Follow the terminal block assembly instructions in this manual in reverse.
2. Remove the two (2) screws on the front face of the controller.
3. Push from the back side the DB25 connector. This will release the front from the case. From the front, hold the face, top and bottom, and pull circuit board from case.

The EMS467 circuit board configuration designation is controlled by several factors: (see the call-outs on schematic below)

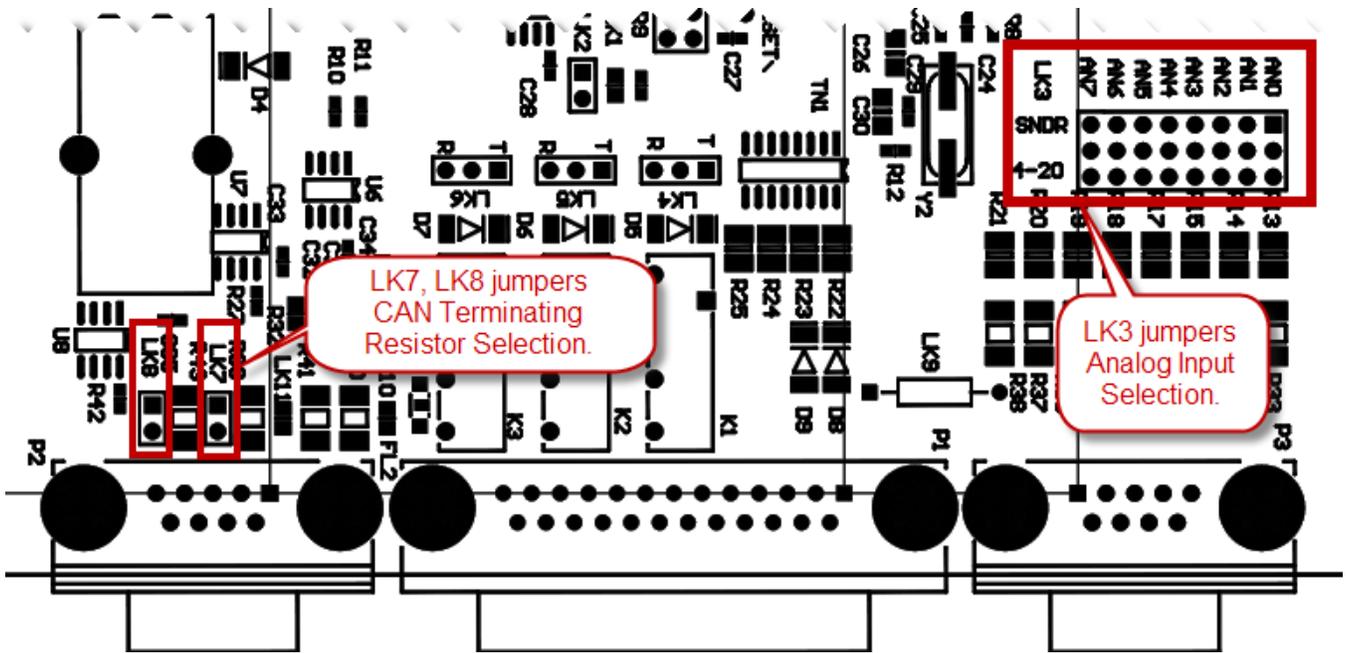
LK3 Information (configuring analog inputs 0-7)

LK3 is used to configure analog inputs 0 through 7 for a particular program. The choices are: resistive* type sender / digital, 4-20 mA or 0-5 VDC. The following is based on orientating the board with the DB25 connector on the bottom. Putting the shunt across the top (SNDR) and center pins, configures the analog input for either a resistive type sender or a **ground only** digital. Across the bottom (4-20) and center pins configures the analog for a 4-20 mA. Leaving the shunt off configures the analog for a 0-5 VDC. To display battery VDC, or if the program uses a resistive type sender on any of the analogs, such as a Murphy ES2P analog 0 becomes not available and must have the shunt in the sender/digital position. Use only **two wire** senders and run both wires back to the EMS467, one to ground and one to the input. The EMS467 program used must support the way the analogs are configured.

*Analog 0 has choices: Battery Monitor/ digital/ 4-20 mA /0-5 VDC.

LK7, LK8 Information (configuring CAN communication Terminating resistors)

LK7 and/or LK8 are used to provide a 120Ω terminating resistor for the communication network. This jumper should **only** be installed if the EMS controller is the Master or the end-of-line device on the network.



Specifications

Input Voltage: 10 to 28 VDC.

Operating Temperature: -4 to 149°F (-20 to 65°C).

Storage Temperature: -4 to 149°F (-20 to 65°C).

Relative Humidity: 95%RH @ 140°F (60°C).

Weight: 2-1/4 lb (1 kg).

Dimensions: 9-1/4 x 8-1/4 x 5-1/4 in. (235 x 210 x 133 mm).

Enclosure: Aluminum case 1/4 DIN type.

User Interface: 3-button keypad, alphanumeric display, back lit; consists of 2 lines each with 16 characters (32 character total).

Communications: RS485 port, RS232 port, two CAN 2.0B ports, standard.

Realtime Clock

For UL Certification the device and circuits of the device shall be powered by the same isolated secondary DC power source with a 1 Amp maximum over-current protection device being provided by the end user.

Device shall be installed in a NEMA type enclosure that will provide acceptance for UL 501.10.8.2 (typical conduit entry) and UL Article 501, Class I, Division 2 wiring methods. Enclosure must be at least third party certified suitable to the authority having jurisdiction.

The UL Certification does not cover this device for functional testing for Engine and Generator Control and Protection or safety functions to UL 2200.

Signaling, annunciating, and indicating functions have not been evaluated to UL 2017 for function and reliability. These devices have not been evaluated by Underwriters Laboratories for use with any accessories.

If the unit is not accessible to the user the ambient temperature rating is 65 degrees C. examples: inside an enclosure, inside an engine compartment, inside an engine building.

If the unit is accessible to the user the ambient temperature rating is 40 degrees C. example: mounted through the front of an enclosure that is mounted in an outside environment

EMS467:

Digital Inputs: 8* optically-isolated** inputs.

Analog inputs: Up to 8 inputs– 7-field selectable, 1-dedicated battery voltage.

Frequency: 1 optically-isolated** input for speed reference.

Digital Outputs: 7† Transistor digital: 200 mA sinking.

Analog Output: 1 optically-isolated** 0.5-4.2 VDC into a 500 Ohm load

S449 Output boards:**S449-1:** (EMS447/467)

7 Dry Relays: 5 SPDT, 5A @ 30 VDC, 250 VAC, 1/10 hp @ 120 VAC;
2 DPDT, 2A @ 220 VDC, 250 VAC††.

S449-3: (EMS447/467)

2 Transistor digital: 125 mA sinking.

5 Dry Relays: 3 SPDT, 5A @ 30 VDC, 250 VAC, 1/10 hp @ 120 VAC;
2 DPDT, 2A @ 220 VDC, 250 VAC††.

** Isolates EMS circuitry from the input circuitry to avoid electrical noise/damage.

† Two of the transistor outputs have diodes. These two outputs must be used when using Murphy Throttle AT03069.

†† One DPDT pole has common connected to Battery+. N.O. available fused/unfused

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