EMS547 Engine Monitoring System
Installation and Operation Instructions
<u>Generic</u> for All Versions.

MURPHY

Please read the following instructions before installing. 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 conforms with local codes.

GENERAL INFORMATION

WARNING

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

CAUTION: *Certain danger to human and to equipment such as applied in a mobile or marine application may occur if some equipment is stopped without pre-warning. It is therefore, recommended that monitored functions be limited to alarm only or to alarm before shutdown in such applications.*

ARC WELDING PRECAUTIONS:
Before arc welding on equipment controlled by the EMS547, disconnect external battery power from the EMS547 and unplug the 25-pin ribbon cable connection from the back of the case. After welding is completed, reconnect the 25-pin ribbon cable and the external battery power.

Description

NOTE: The following applies to all EMS547 models. However, program changes to the micro-processor chip may affect operating procedures. See your specific program or the sequence of operations provided with custom programmed units.

The Murphy EMS547 is micro-processor based for monitoring and control of equipment functions. Basic EMS547 system is programmed for a typical industrial engine power unit. Custom programming is available to adapt the EMS547 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 EMS547 operating parameters are configured through a three-button interface. Access to 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.

EMS Controller

MURPHY CONTROL
PROGRAM S-547.01

Listings Pending for Cl. I, Div. 2, Grps. C & D areas.

An on-board hourmeter keeps a log of equipment running hours and service reminders alert you when to change oil, filters and perform other routine service.

Ramp Oil Pressure monitoring protects equipment at both high rated speed and low idle speed. For instance, based on engine manufacturer's requirement, shutdown could occur at 30 lb. (207 kPa) pressure at 1800 RPM or at 5 lb. (34 kPa) at 600 RPM or any shutdown point in between.

Sensor Inputs (See page 2 for details)
Electric Gage Senders: Accepts Murphy or equivalent resistance type senders (the use of two-wire type senders is strongly recommended).
NOTE: Configurations available for 4-20 mA or 0-5 VDC inputs.

Digital Inputs: Accepts four opto-isolated bi-polar inputs (positive or negative), typically wired to external shutdown switches.

Frequency Input: The optically-isolated speed sensing input senses a speed signal from a magnetic pickup.

Communications
The EMS547 has two RS485, and two RS232 communication ports. By using these ports and the necessary software, you can monitor and control your equipment from a remote location. The EMS547 can be programmed to call out or be called, using either cellular or standard land line type modems. Modbus RTU, or terminal emulation with limited control commands can be made available in the software.

Basic Models
The EMS547 comes in an extruded aluminum enclosure suitable for panel mounting. Wiring is via optional wiring harness. Relay boards are available for additional relay contact capability, see listings below:

EMS25RM: *Rail mount DIN type terminal block.*
EMS25CAR2: *Ribbon cable with 2 male D-sub connectors (for use with S449 circuit bards).*
EMS25TBCAR2: *Ribbon cable with 1 male and 1 female D-sub connectors (for use with EMS25RM).*
EMS25MS: *Solder type male connector (D-Subminiature).*
S449-1: *Dry Relay board.*
S449-3: *Transistor Digital and Dry Relay (needed when engine throttling is used).*

EMS547 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).

Display: Alphanumeric display, back lit; consists of 2-lines each with 16 characters (32 character total).

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

Communications: (2) RS485, (2) RS232 ports, standard.

EMS547 Enclosure: Aluminum case 1/4 DIN type.

EMS547 Sensor Inputs:

Digital: *4 optically-isolated* *inputs, (positive voltage or ground) such as from Murphy SWICHGAGE® instruments.*

Analog: *Up to 8 inputs–accepts a variety of resistive sending units, such as from Murphy electric gage senders.*

NOTE: When resistive sending units are used, one input will be designated for battery voltage sensing. The use of 2-wire type senders is strongly recommended. Special order analog inputs available (4-20 mA or 0-5 VDC).

Frequency: *1 optically-isolated* *input for speed reference, such as Murphy's MP3298 magnetic sensor (2-30 VAC rms, 60 Hz – 9 kHz).*

EMS547 Outputs:
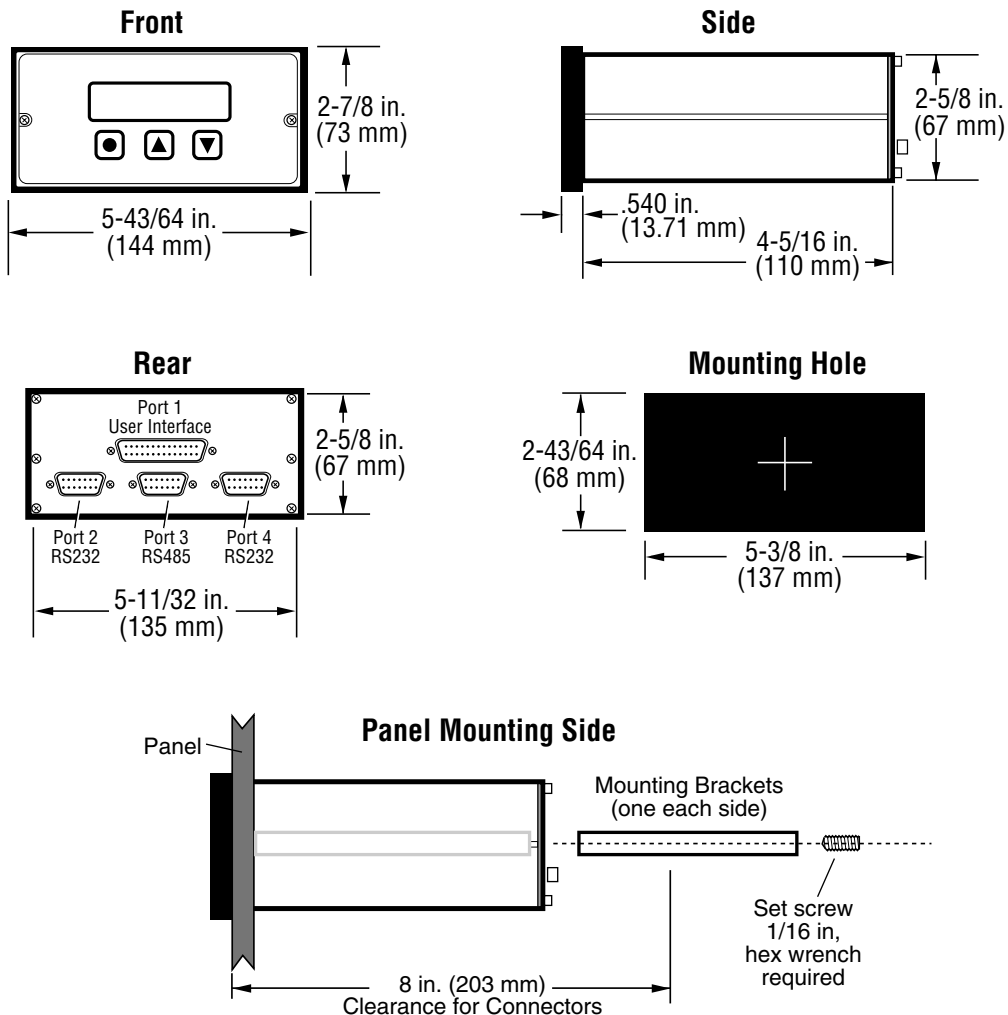
7 Transistor digital: *125 mA sinking.*

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

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

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

EMS547 DIMENSIONS

The EMS547 should be mounted in a location that is accessible to the operator. EMS547 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]).

Front
2-7/8 in. (73 mm)
5-43/64 in. (144 mm)

Side
2-5/8 in. (67 mm)
.540 in. (13.71 mm)
4-5/16 in. (110 mm)

Rear
Port 1 User Interface
Port 2 RS232   Port 3 RS485   Port 4 RS232
2-5/8 in. (67 mm)
5-11/32 in. (135 mm)

Mounting Hole
2-43/64 in. (68 mm)
5-3/8 in. (137 mm)

Panel Mounting Side
Panel
Mounting Brackets (one each side)
Set screw 1/16 in, hex wrench required
8 in. (203 mm) Clearance for Connectors

HOOKING UP THE EMS547

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

Murphy offers optional connector assemblies for easy hook up to the EMS547 module (see options below). Terminal designations, PIN and color codes depend upon the EMS547 program used. Specific wiring information is supplied with each unit. Detailed sequence of operations is provided with custom programmed units.
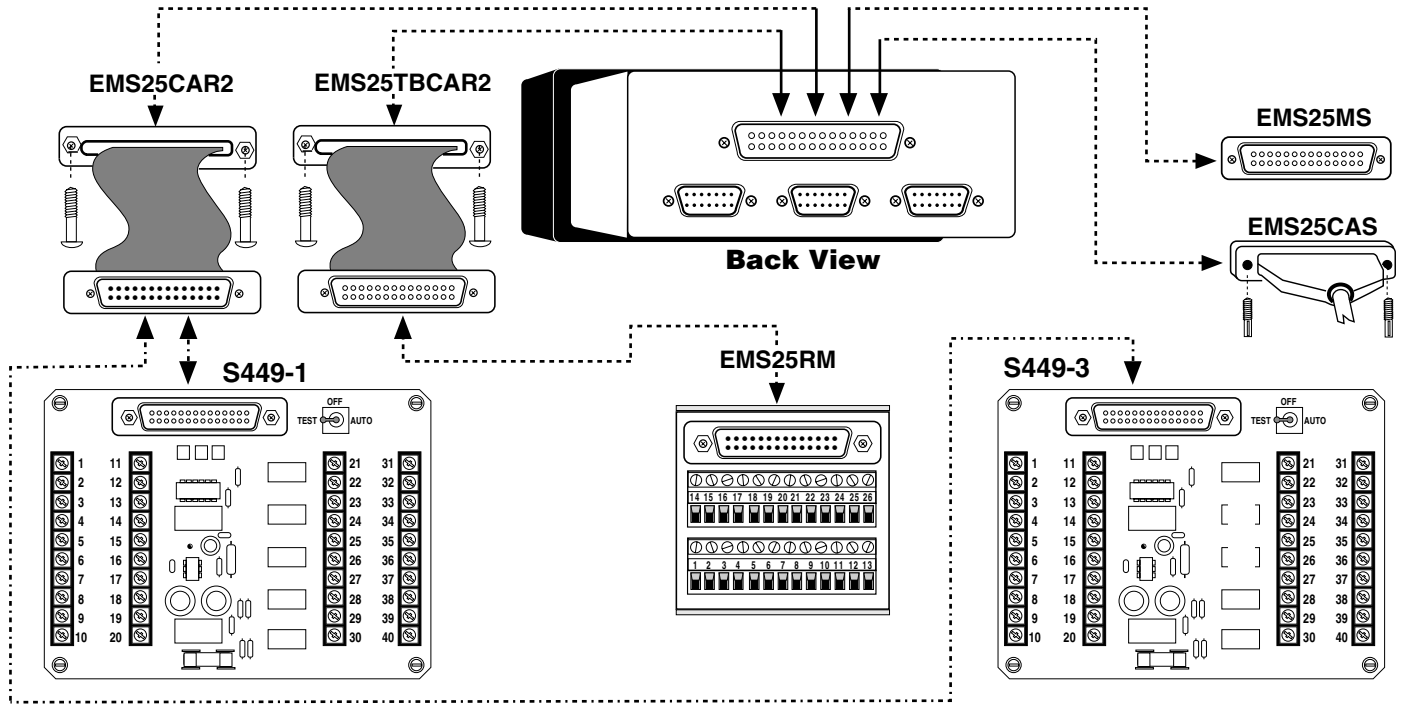
PORT CONNECTION DESCRIPTION

The EMS547 controller has four (4) DB connectors in the back (see schematic below). The following page includes a description of each of the four ports.
Unless otherwise specified the following may not be available in this application. Refer to specific program information provided with your EMS547 (if applicable).

EMS547 Back View
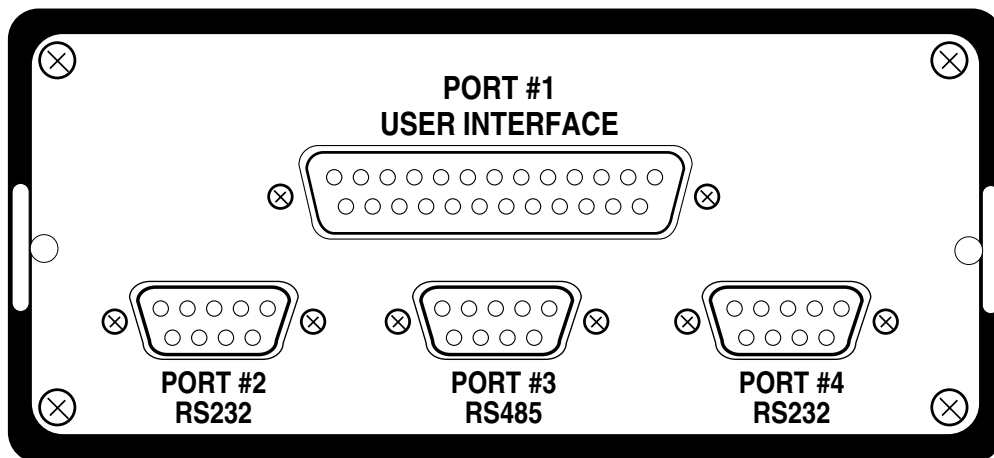
PORT CONNECTION DESCRIPTION

User Interface (Port #1)

The DB25 connector contains the 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, 4-20 mA, 0-5 VDC.	14	Analog 6	Configurable: Sender/Digital -4-20 mA. - 0-5 VDC.
2	Analog 0	Configurable: Battery, Digital, 4-20 mA, 0-5 VDC*	15	Analog 5	Configurable: Sender/Digital -4-20 mA. - 0-5 VDC.
3	Analog 7	Configurable: Sender/Digital -4-20 mA, 0-5 VDC	16	Analog 3	Configurable: Sender/Digital -4-20 mA. - 0-5 VDC
4	Analog 1	Configurable: Sender/Digital, 4-20 mA, 0-5 VDC	17	Analog 2	Configurable: Sender/Digital -4-20 mA. - 0-5 VDC
5	Input 1	Digital Only (+ or–)	18	Input 3	Digital Only (+ or–)
6	Input 2	Digital Only (+ or–)	19	Input 4	Digital Only (+ or–)
7	Output 1	Transistor 125 mA sinking	20	Output 4	Transistor 125 mA sinking
8	Battery +	Battery Plus (+ve positive)	21	Output 5	Transistor 125 mA sinking
9	Battery +	Battery Plus (+ve positive)	22	Output 6	Transistor 125 mA sinking
10	Output 2	Transistor 125 mA sinking	23	Output 7	Transistor 125 mA sinking
11	Battery –	Battery Ground (-ve negative)	24	RS485 –	RS485 (–)
12	Output 3	Transistor 125 mA sinking	25	RS485 +	RS485 (+)
13	Freq. Input.	Frequency Input 2 VAC min.			

*Not available if any input is for sender. If Analog 0 is battery monitor, there must not be any connection to this terminal. Battery monitor function is internal.

RS232 (Port #2)

The DB9 connector is a 4-wire, RS232 port. The following is a description of the pin connections.

PIN	Description	PIN	Description
1	Not connected	6	Not connected
2	Receive	7	Request To Send/RS232 Output/Data Terminal Ready**
3	Transmit	8	Clear To Send/RS232 Input/Carrier Detect**
4	Not connected	9	Not connected
5	Signal ground		

**Depends on software–special non-standard cable may be required.

RS485 (Port #3)

The DB9 connector is a 2-wire, RS485 port. The following is a description of the pin connections.

PIN	Description	PIN	Description
1	Not connected	6	Not connected
2	Not connected	7	Not connected
3	Not connected	8	Not connected
4	RS485 +	9	Not connected
5	RS485 –		

RS232 (Port #4)

The DB9 connector is a 4-wire, RS232 port. The following is a description of the pin connections.

| PIN	Description	PIN	Description
1	Carrier Detect	6	Data Set Ready
2	Receive Data	7	Request To Send
3	Transmit Data	8	Clear To Send
4	Data Terminal Ready	9	Ring Indicator
5	Signal Ground		

⚠ *The following information is typical for operation of ALL EMS Series units. Specific requirements depend upon the microprocessor program.*

Operating the Interface

By using the three membrane buttons and the liquid crystal display, you can 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.

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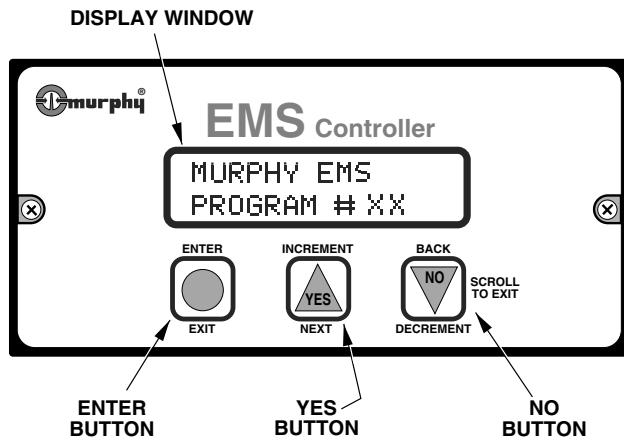
The 32-character, two line, liquid crystal display shows monitored information such as Engine Oil, Engine Temperature, R.P.M. etc., plus on-board information such as Engine Hours and Battery Voltage. When a shutdown or a service reminder comes due, the display will show this information, immediately.

Scrolling Main Displays

During normal operation, the EMS allows you to scroll through a number of informative displays. You can manually scroll through monitored information by pressing the ▲ (Yes) or the ▼ (No) buttons, or, if program version allows it, you 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):

```
MURPHY EMS
PROGRAM # XX
```

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 you 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 you 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, Warm-up/Cooldown Times, Alarm and Shutdown set points. You 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:
3. Press the ● button until the entry code screen appears:

```
MURPHY EMS
PROGRAM # XX
```

pressing the ▲ or ▼ buttons then pressing the ● button to enter the specific

```
ENTRY ACTIVE
ENTER CODE: 0
```

function. Now you can increase, toggle, or decrease the setpoint.

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

```
ENG SPD 0 RPM
S1 LINE1 SELECT
```

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

How to access the P-numbers

1. Turn the power ON, but **DO NOT ALLOW EQUIPMENT TO OPERATE**.
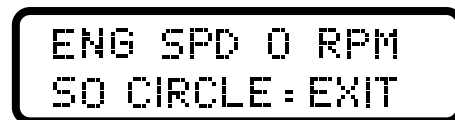
```
ENG SPD 0 RPM
S0 CIRCLE:EXIT
```

2. Press the ▼ button until the title page appears:
3. Press the ● button until the entry code screen appears:
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:

```
┌─────────────────────────┐
│ MURPHY EMS              │
│ PROGRAM # XX            │
└─────────────────────────┘
```

6. Now that you are in the P-numbers, you can go to a specific function by

```
┌─────────────────────────┐
│ ENTRY ACTIVE           │
│ ENTER CODE: 0          │
└─────────────────────────┘
```

pressing the ▲ or ▼ buttons then pressing the ● button to enter the specific function. Now you can increase, toggle, or decrease that setpoint.

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

```
┌─────────────────────────┐
│ ENG SPD 0 RPM          │
│ P1 LINE1 SELECT        │
└─────────────────────────┘
```

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

Acknowledging Service Reminders

```
┌─────────────────────────┐
│ ENG SPD 0 RPM          │
│ P0 CIRCLE = EXIT       │
└─────────────────────────┘
```

To acknowledge a service reminder, you must 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.

If you wish to change any service reminder interval, you may have to 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 do 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 tittle 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:

6. Press the ● button to access this specific sub-menu.

7. Press the ▲ or ▼ buttons until you see the following screen.

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

```
┌─────────────────────────┐
│ ENG SPD 0 RPM          │
│ S1 LINE1 SELECT        │
└─────────────────────────┘
```

Next to the "I" are the numbers 1-4 which represent the 4 standard digital inputs. When the letter "O" is displayed next to input numbers, that means the controller

I=Inputs   1 to 4   1 2 3 4

```
┌─────────────────────────┐
│ I 1-4 X000             │
│ ENTER SELECTION        │
└─────────────────────────┘
```

is **NOT SENSING** an input signal. The above example shows input 1 has tripped, for example vibration. Inputs 2, 3 and 4 are <u>not sensed</u>. 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 5 - 12:

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 the be turned <u>ON</u>. A "O" displayed means that the controller software is calling for the designated

I=Inputs   5 to 12   5 6 7 8   9 10 11 12

```
┌─────────────────────────┐
│ I 5-12 0000 0000       │
│ ENTER SELECTION        │
└─────────────────────────┘
```

Note: These are the analog inputs that may be used as digital inputs. Depending on the analog signal, an X or an O may be present.

output signals to be turned <u>OFF.</u>

O=Outputs   1 to 7   1 2 3 4   5 6 7

```
┌─────────────────────────┐
│ O 1-7 000X 000         │
│ ENTER SELECTION        │
└─────────────────────────┘
```

Refer to the "Pin Color Code and Terminal Designation Chart" (program specific document) or your application specific sequence of operations, 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.

EMS547 CIRCUIT BOARD

WARNING: DISCONNECT ALL ELECTRICAL POWER AND STOP ALL MACHINERY BEFORE REMOVING THE EMS547 CIRCUIT BOARD FROM ITS CASE. IT IS YOUR RESPONSIBILITY TO HAVE A TRAINED PERSON OR A QUALIFIED TECHNICIAN REMOVE AND/OR TROUBLESHOOT THE EMS547 CIRCUIT BOARD.

Removing the Circuit Board

Should it becomes necessary to identify your circuit board configuration or to make adjustments such as to configure analog inputs 0-7 (see LK3 info at right), remove the EMS547 circuit board from its case following the steps below:

1. Undo the connector and the screws (on the back of the case).

2. Undo the two Phillips (cross) type screws, on the face plate.

3. Gently, pull the circuit board and face plate together out of the EMS547 case. You may gently push on the D-sub connectors on the back of the EMS547 to get started.

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 bottom and middle pins, configures the analog input for either a resistive type sender or a **ground only** digital. Across the middle and top 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 EMS547, one to ground and one to the input. The EMS547 program used must support the way the analogs are configured.

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

View from the components side of the EMS547 circuit board

LK3 information see above.

4-20 mA SENDER

LK3

DB25 Connector
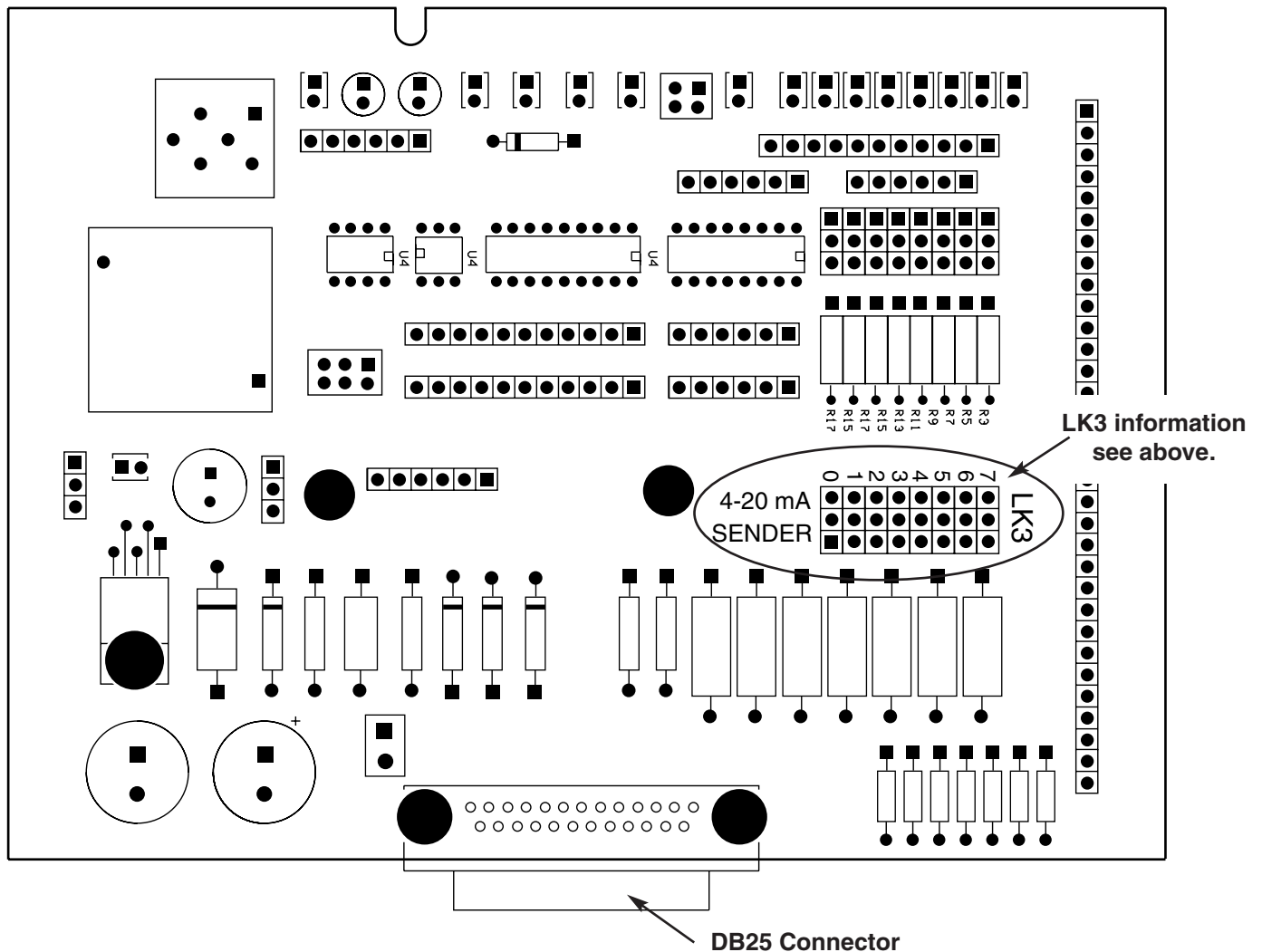
> **WARNING:** DISCONNECT ALL ELECTRICAL POWER AND STOP ALL MACHINERY BEFORE WORKING ON THE S449 RELAY BOARD. IT IS YOUR RESPONSIBILITY TO HAVE A TRAINED PERSON OR A QUALIFIED TECHNICIAN HANDLING AND/OR TROUBLE-SHOOT THE S449 RELAY BOARD.

Identifying Circuit Board Configuration

To identify the S449 relay board, if used, look for its 40 screw-type terminals (see the schematic below).

The S449 circuit board configuration designation is controlled by several factors: (see the call-outs on schematic below).

The S449 Relay Board used with the EMS547, jumpers LK1, LK2 and LK3 will be in the (8) position. If Test–Off–Auto switch is not to be used, jumper JP5 must be in the SHORT position and the Test–Off–Auto switch in OFF (if it is present). If Test–Off–Auto switch is used, jumper JP5 must be in OPEN.
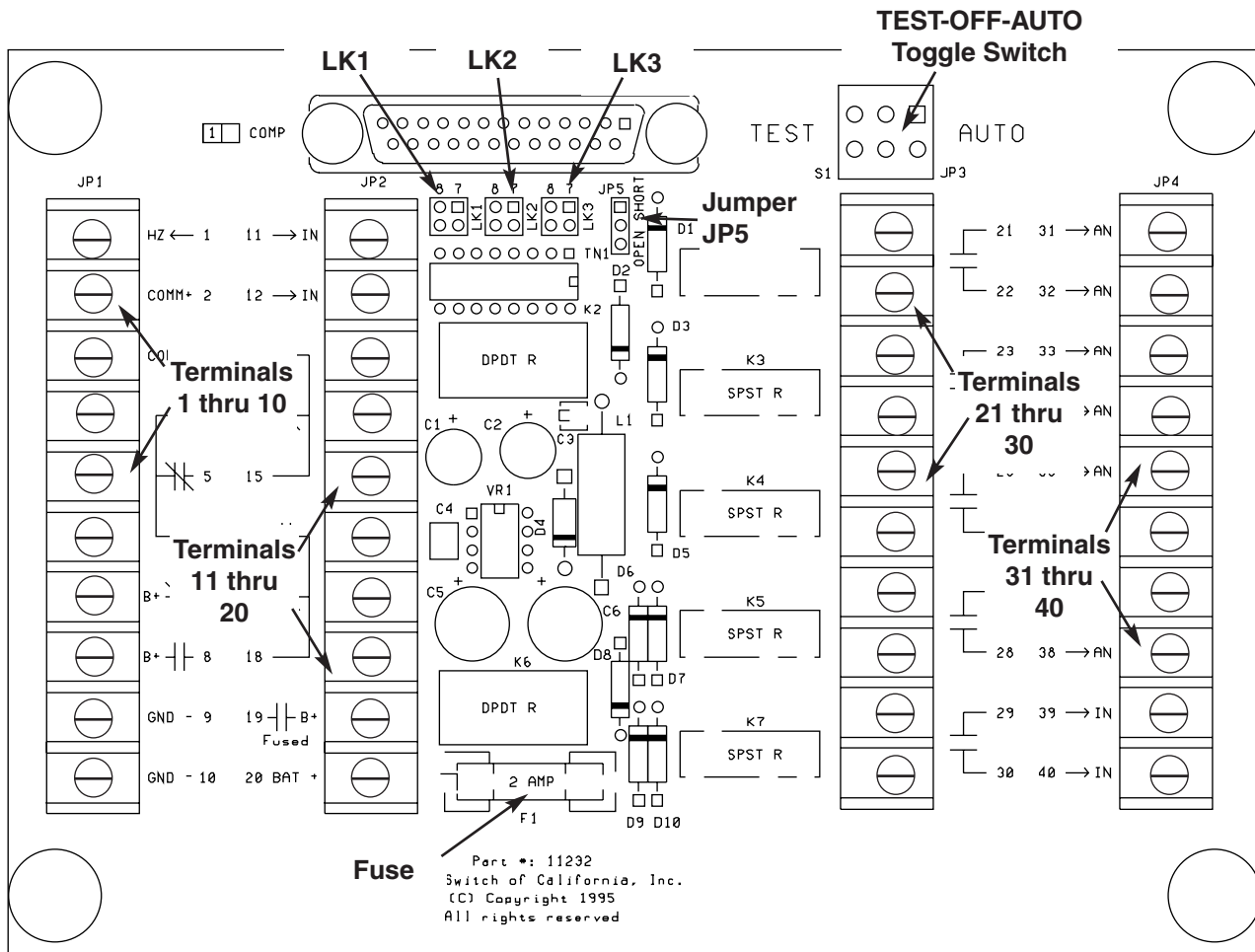
Warranty

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 www.fwmurphy.com/support/warranty.htm

In order to consistently bring you the highest quality, full featured products, we reserve the right to change our specifications and designs at any time.

Printed in U.S.A.

QUICK REFERENCE CHART

POWER UP

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

MURPHY EMS PROGRAM #

P-NUMBER DISPLAYS

S-NUMBER DISPLAYS

Scrolling the Main Displays

ENTER

ENTER

ENTRY ACTIVE ENTER CODE: XX

ENTRY ACTIVE ENTER CODE: XX

YES OR NO

YES OR NO

ENTER YES

ENTER NO

ENTER

ENTER

SELECTING SCROLL ON

SELECTING SCROLL OFF

NO   YES

RUN HOURS XX

NO   YES

BATTERY XXVDC

NO   YES

ENGINE SPD 0 RPM

NO   YES

OIL PR XX PSI

NO   YES

ENGINE TEMP XXF°

NO   YES

SELECTOR - AUTO

NO   YES

ST: PANEL READY

NO   YES

CHG OIL XX HRS

NO   YES

OIL FLT XX HRS

P-Number column

LINE 1 XXX XXX XXXXXX	ENTER	**ENG SPD 0 RPM P1 LINE 1 SELECT**
LINE 1 XXX XXX XXXXXX	ENTER	**ENG SPD 0 RPM P2 XXX XXX XX**
LINE 1 XXX XXX XXXXXX	ENTER	**ENG SPD 0 RPM P3 XX XXXX XX**
LINE 1 XXX XXX XXXXXX	ENTER	**ENG SPD 0 RPM P4 XX XXXX XX**
LINE 1 XXX XXX XXXXXX	ENTER	**ENG SPD 0 RPM P5 XX XXXX XX**

YES NO / YES NO (ENTER)

P-Numbers continue

S-Number column

ENG SPD 0 RPM S1 LINE 1 SELECT	ENTER	LINE 1 XXX XXX XXXXXX
ENG SPD 0 RPM S2 XXX XXX XX	ENTER	LINE 1 XXX XXX XXXXXX
ENG SPD 0 RPM S3 XX XXXX XX	ENTER	LINE 1 XXX XXX XXXXXX
ENG SPD 0 RPM S4 XX XXXX XX	ENTER	LINE 1 XXX XXX XXXXXX
ENG SPD 0 RPM S5 XX XXXX XX	ENTER	LINE 1 XXX XXX XXXXXX

NO YES / YES NO

S-Numbers continue

Main Displays continue

ENG SPD 0 RPM P0 CIRCLE = EXIT

ENG SPD 0 RPM S0 CIRCLE = EXIT

ENTER   ENTER

MURPHY EMS PROGRAM #