EMS447 and EMS448 Monitoring Systems
Installation and Operation Instructions
<u>Generic</u> for All Versions. S449 Board Included

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.**

EMS448

EMS447

c ⓤⓁ

ⓤⓁ ® *Listed for Cl. I, Div. 2, Grps. A, B, C & D hazardous areas on EMS447 (all transistor outputs) and EMS448 (board only).*

⚠ **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.*

Description

NOTE: The following applies to all EMS447 and EMS448 models. However, program changes to the micro-processor chip may affect operating procedures. See Section "2" of these Instructions for details on your specific program or the sequence of operations provided with custom programmed units.

The EMS447 and EMS448 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.

Program #01 Features

An on-board hourmeter keeps a log of equipment running hours and alerts 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.
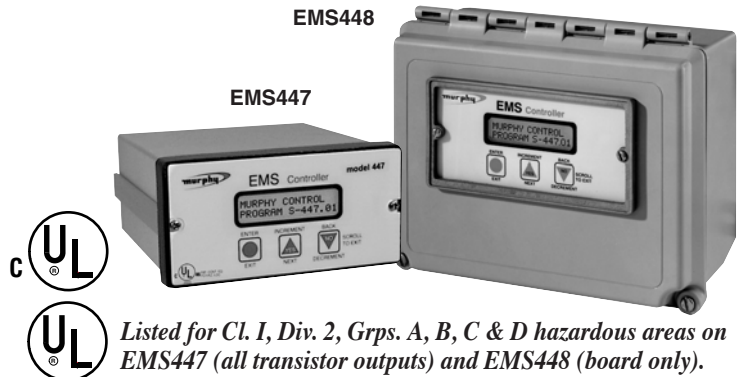
Sensor Inputs (See page 2 for details)

Electric Gage Senders: Accepts Murphy or equivalent resistance type senders. *NOTE: Configurations available for 4-20 mA or 0-5 VDC inputs.*

Digital Inputs: Accepts three opto-isolated bi-polar inputs (positive or negative), typically wired to external shutdown switches. One additional input can be ordered and traded for one transistor output.

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

Communications

Both models, EMS447 and EMS448, include an RS485 serial port. By using the RS485 port and the necessary software you can monitor the status of your equipment from a remote location. A communications software package and a RS485 to RS232 converter are needed to interface with a PC (IBM® compatible computer). Set your communications package to 9600 baud, N-8-1. Terminal emulation mode must be ANSI, and there must be a line in the CONFIG. SYS FILE to define system device as ANSI.

S449 Relay Output Boards

These relay output boards are used for additional relay contact capability. They require a ribbon cable with solder type, D-subminiature connectors such as our optional EMS25CAR2 assembly, (see Basic Models and listings, below).

Basic Models

EMS447: 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:

EMS25TB: *Plug-in terminal block assembly.*
EMS25RM: *Rail mount DIN type terminal block.*
EMS25CAR2: *Ribbon cable with 2 male D-sub connectors.*
EMS25TBCAR2: *Ribbon cable with 1 male and 1 female D-sub connector.*
EMS25CAS: *Male connector and color coded cable 9 ft. (2.74 m) std. length.*
EMS25MS: *Solder type male connector (D-Subminiature).*
S449-2: *Dry Relay board for EMS447 models.*
S449-4: *Transistor Digital and Dry Relay board for EMS447 models.*

EMS448: Comes in a NEMA 4X type enclosure. Wiring is connected directly to the S449-3 relay board terminal block located within the enclosure. Relay board for additional relay contact capability is available.

S449-1: *Dry Relay board for EMS448 models only.*

EMS447, EMS448 and S449 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).

Communications: RS485 port, standard.

EMS447 Enclosure: Aluminum case 1/4 DIN type.

EMS448 Enclosure: Polyester fiberglass NEMA 4X type.

EMS447 and EMS448 Sensor Inputs:

Digital: *3* 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 MP3298 magnetic sensor.*

EMS447 Outputs:

3† Transistor digital: *125 mA sinking.*

3 Relay: *SPST 3A @ 30 VDC N.O. connected to Battery +.*

EMS448 (S449-3) **and S449-4** (EMS447) **Outputs:**

2 Transistor digital: *125 mA sinking.*

4† Dry Relay: *2 SPST, 5A @ 30 VDC, 250 VAC, 1/10 hp @ 120 VAC; 2 DPDT, 2A @ 220 VDC,250 VAC††.*

S449-1 (EMS448) **and S449-2** (EMS447) **Outputs:**

6† Dry Relay: *4 SPST, 5A @ 30 VDC, 250 VAC, 1/10 hp @ 120 VAC; 2 DPDT, 2A @ 220 VDC, 250 VAC††.*

EMS447 Weight: 2-1/4 lb (1 kg).

EMS448 Weight: 3-1/2 lb (1.5 kg).

EMS447 Dimensions: 9-1/4 x 8-1/4 x 5-1/4 in. (235 x 210 x 133 mm).

EMS448 Dimensions: 12-1/4 x 7-1/4 x 5-3/4 in. (311 x 184 x 146 mm).

*   One additional digital input can be ordered and traded for one transistor output.
** Isolates EMS circuitry from the input circuitry to avoid electrical noise/damage.
†   One additional output can be ordered and traded for one digital input.
†† One DPDT pole has common connected to Battery+. N.O. available fused/unfused.

## EMS447 and EMS448 MOUNTING

EMS447 Model

The EMS447 should be mounted in a location that is accessible to the operator. EMS447 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]).
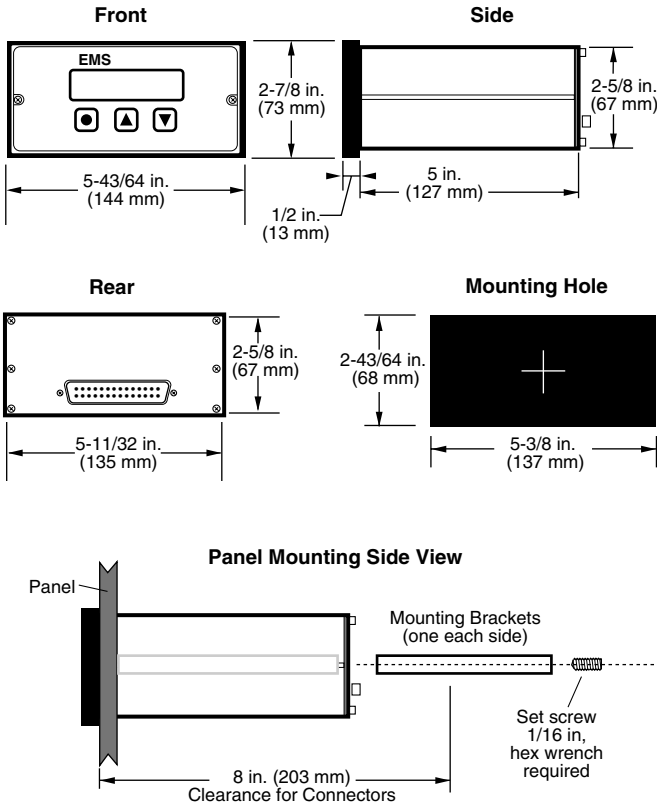
EMS448 Model

The EMS448 models have 4 mounting feet, (shipped loose–assemble the feet using the screws provided). The customer must provide a hole in the enclosure for the incoming wiring (see suggested location for wiring hole, below). Use of conduit or a strain relief bushing and Meyer's hub for sealing is recommended.
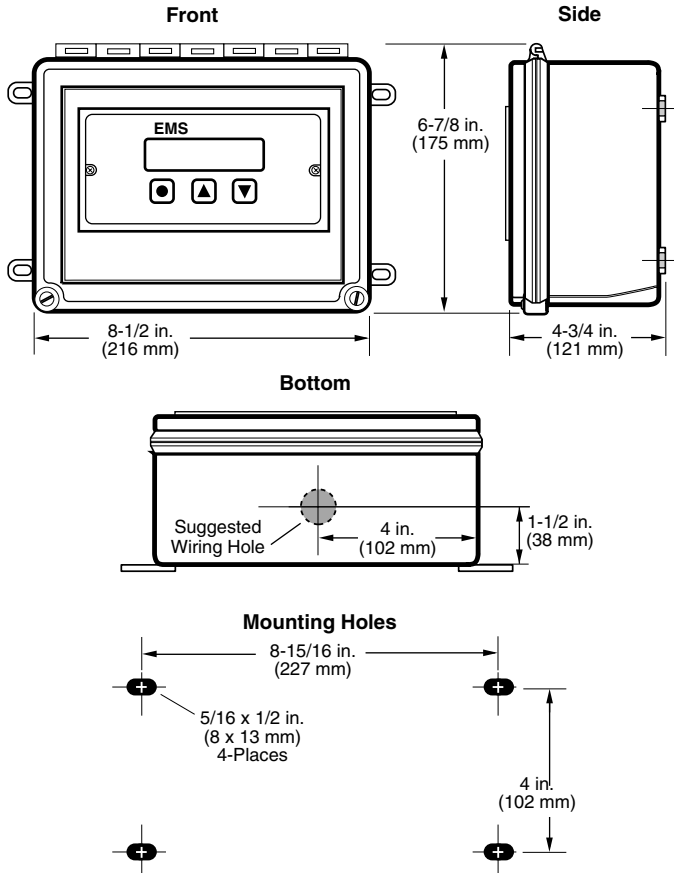
WARNING: DISCONNECT ALL ELECTRICAL POWER BEFORE BEGINNING INSTALLATION AND STOP ALL MACHINERY BEFORE PERFORMING THE HOOK UP. FOLLOW ALL INSTRUCTIONS.

EMS447 Models

Murphy offers optional connector assemblies for easy hook up to the EMS447 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 "Section 2" separate document, of these installation instructions, or the detailed sequence of operations provided with custom programmed unit).

Attaching the EMS25TB to the EMS447 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 terminal block onto DB connector.

4. Place spacers between terminal block and back plate.

5. Attach 6-32 x 1" screws into EMS25TB through spacer and into plate and tighten.
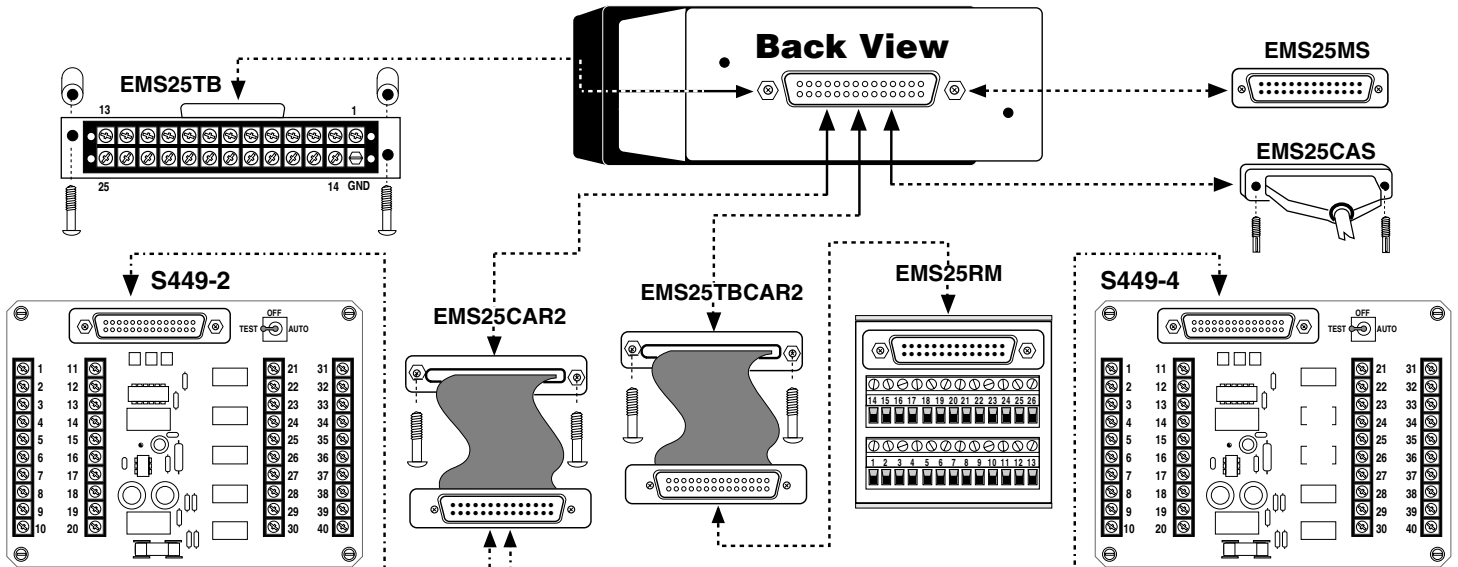
EMS448 Models

Customer must provide conduit hole and make connections directly to the terminals located within the enclosure. Terminal designations, PIN and color codes depend upon the EMS448 program. Specific wiring information is supplied with each unit (refer to "Section 2" of these instructions, separate document, or the detailed sequence of operations provided with custom programmed unit). Optional S449-1 relay output board can be used instead of S449-3 (standard with EMS448 models).


S449-3 Circuit board is standard with EMS448 units.
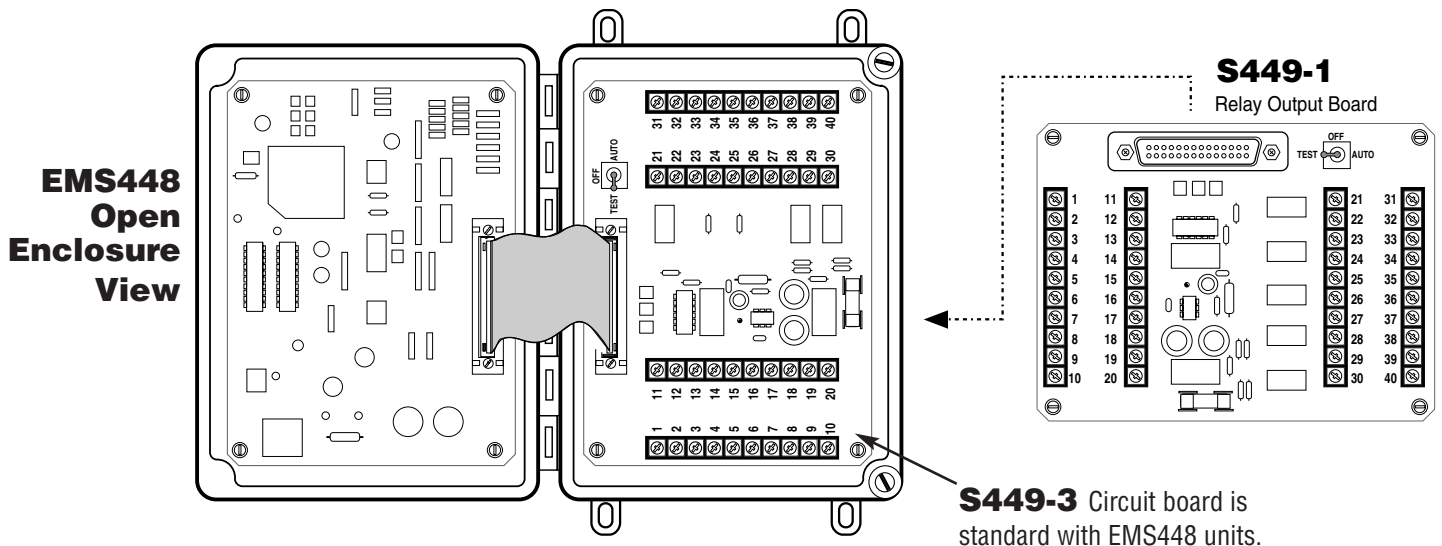
The following information is typical for operation of <u>ALL</u> EMS Series units. Specific requirements depend upon the microprocessor program.

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 <u>**ENTER**</u> (**EXIT**) button is used to <u>Confirm</u> a set-point, <u>Get</u> into and out of a display and to <u>Acknowledge</u> alarms.

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

▼ The <u>**NO**</u> (**DECREMENT**) button is used to <u>Scroll</u> down the display, to <u>Select</u> messages, and <u>Decrease</u> values.
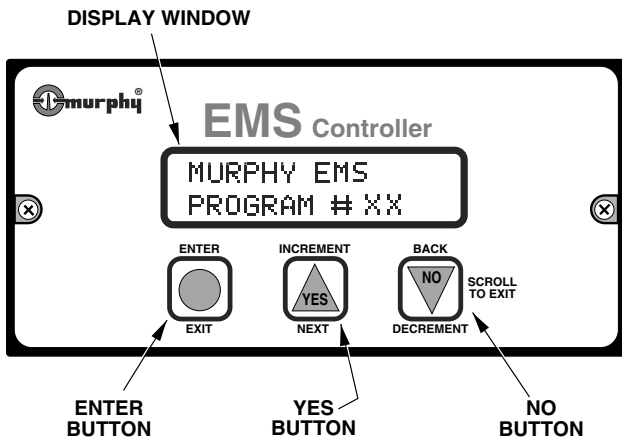
The 32-character, two line, liquid crystal display shows monitored information such as Engine Oil, Engine Temperature, R.P.M. etc., plus on-board information such as Engine Hours and Battery Voltage. When a shutdown or a service reminder comes due, the display will show this information, immediately.

Scrolling Main Displays

During normal operation, the EMS allows you to scroll through a number of informative displays. You can <u>manually</u> 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 <u>automatic</u> scrolling selection. When a shutdown occurs or a service reminder comes due, the EMS will display the corresponding information regardless of the scrolling mode. <u>When first powered up, the EMS will delay for 1 minute before starting to scroll.</u> 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 <u>Automatic</u> scroll mode press the ▼ (No) button until title page appears (screen below):

```
MURPHY EMS
PROGRAM # XX
```

Now, press the ● (Enter) and the ▲ (Yes) buttons <u>simultaneously</u>. To set the <u>Automatic</u> scroll mode to <u>off</u>, press ● (Enter) and ▼ (No) buttons at the same time. The <u>Automatic</u> scroll <u>off</u> enables you to <u>Manually</u> 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 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 <u>**DO NOT ALLOW EQUIPMENT TO OPERATE**</u>.

2. Press the ▼ button until the title page appears:

```
MURPHY EMS
PROGRAM # XX
```

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:

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

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

<u>All Setpoints</u> 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
S0 CIRCLE:EXIT
```

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**.

2. Press the ▼ button until the title page appears:

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

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:

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

6. Now that you are in the P-numbers, you can go to a specific function by 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          │
│  P0 CIRCLE = EXIT       │
└─────────────────────────┘
```

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

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:

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

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

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

I=Inputs   1 to 4   1 2 3 4

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

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

Next to the "I" are the numbers 1-4 which represent the 3 standard digital inputs, and the additional input (depending on the program configuration).

When the letter "O" is displayed next to input numbers, that 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 5 - 12:

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

```
┌─────────────────────────┐
│  I5-12 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.

Press the ▲ button to bring up the outputs display:

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

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

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 ON. A "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.

EMS447 CIRCUIT BOARD

> **WARNING:** DISCONNECT ALL ELECTRICAL POWER AND STOP ALL MACHINERY BEFORE REMOVING THE EMS447 CIRCUIT BOARD FROM ITS CASE. IT IS YOUR RESPONSIBILITY TO HAVE A TRAINED PERSON OR A QUALIFIED TECHNICIAN REMOVE AND/OR TROUBLESHOOT THE EMS447 CIRCUIT BOARD.

Removing the Circuit Board

Should it becomes necessary to identify your circuit board configuration, remove the EMS447 circuit board from its case following these steps:

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

2. Undo the stand-offs (also on the back of the unit).

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

4. Gently, pull the circuit board and face plate together out of the EMS447 case.

Identifying Circuit Board Configuration

The following is important information for troubleshooting purposes. The EMS447 circuit board configuration designation is controlled by several factors: (see the call-outs on schematic below).

The Program Chip is labeled with your Program Number, Version, Date and Checksum.

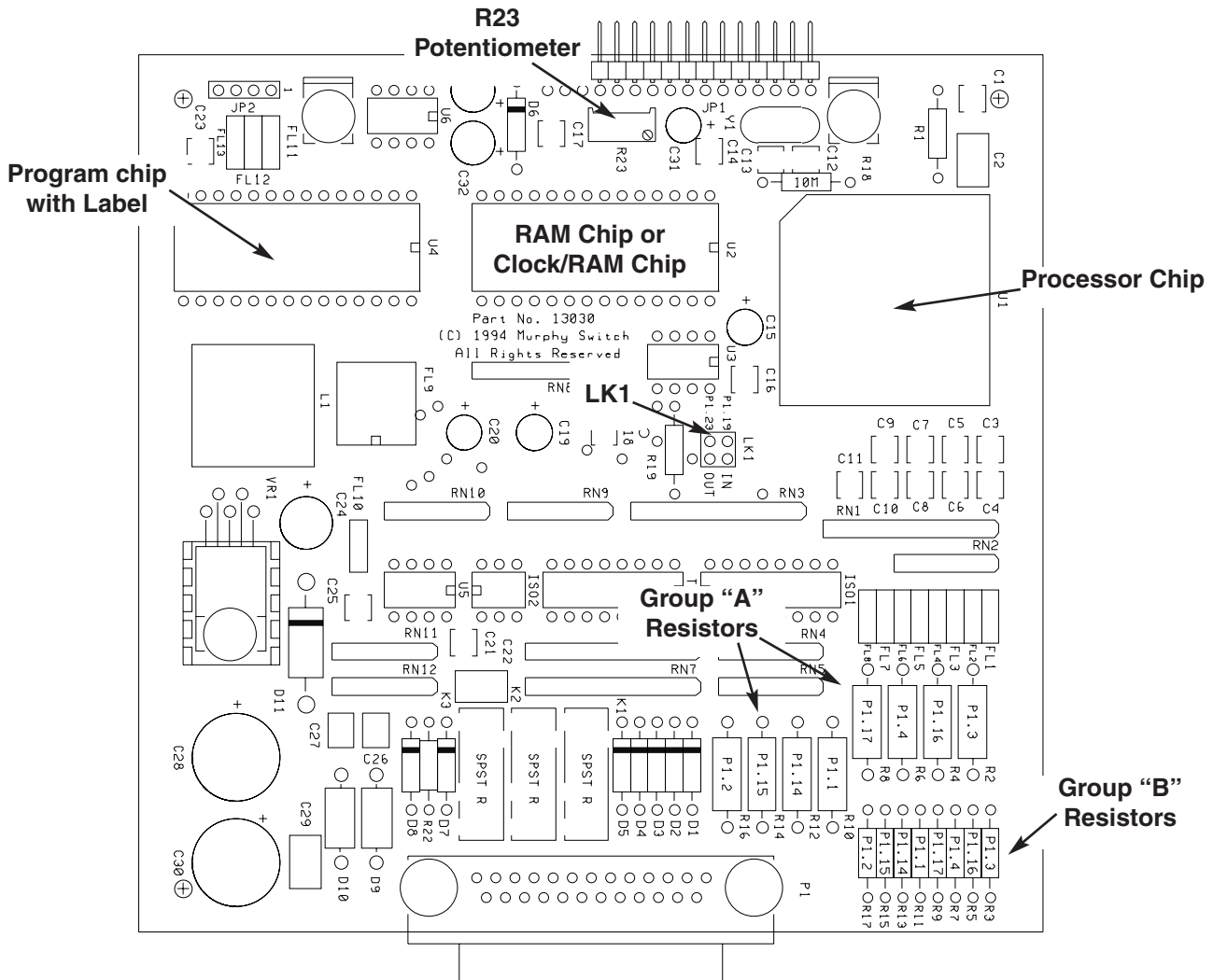The R23 potentiometer is for adjusting viewing angle and contrast.

LK1 determines your input/output configuration. When placed in the IN position, it enables a 4th digital input and disables the 7th digital output. When placed in OUT, it disables the 4th digital input and enables the 7th digital output (see specifications section, on page 2).

Resistors Configuration

Analog Channel #	Pin	Group A Resistor	Group B Resistor
0	2	R16	R17
1	4	R6	R7
2	17	R8	R9
3	16	R4	R5
4	1	R10	R11
5	15	R14	R15
6	14	R12	R13
7	3	R2	R3

Configuration	Group A Resistor	Group B Resistor
Sender	1.62K 1% 1/2 W	432 1% 1/4 W
4 to 20 mA	Remove	249 1% 1/2 W
0 to 5 VDC	Remove	Remove
Battery	51K 5% 1/4 W	10K 5% 1/4 W

WARNING: DISCONNECT ALL ELECTRICAL POWER AND STOP ALL MACHINERY BEFORE OPENING THE EMS448 ENCLOSURE. IT IS YOUR RESPONSIBILITY TO HAVE A TRAINED PERSON OR A QUALIFIED TECHNICIAN HANDLE AND/OR TROUBLESHOOT THE EMS448 CIRCUIT BOARD.

Identifying Circuit Board Configuration

Should it becomes necessary to identify your EMS448 circuit board configuration, undo the two latches/screws and open the EMS448 case. Within, you will find the EMS448 circuit board (EMS448 board does not include terminal blocks).

The EMS448 circuit board configuration designation is controlled by several factors: (see the call-outs on schematic below)

The Program Chip is labeled with your Program Number, Version, Date and Checksum.
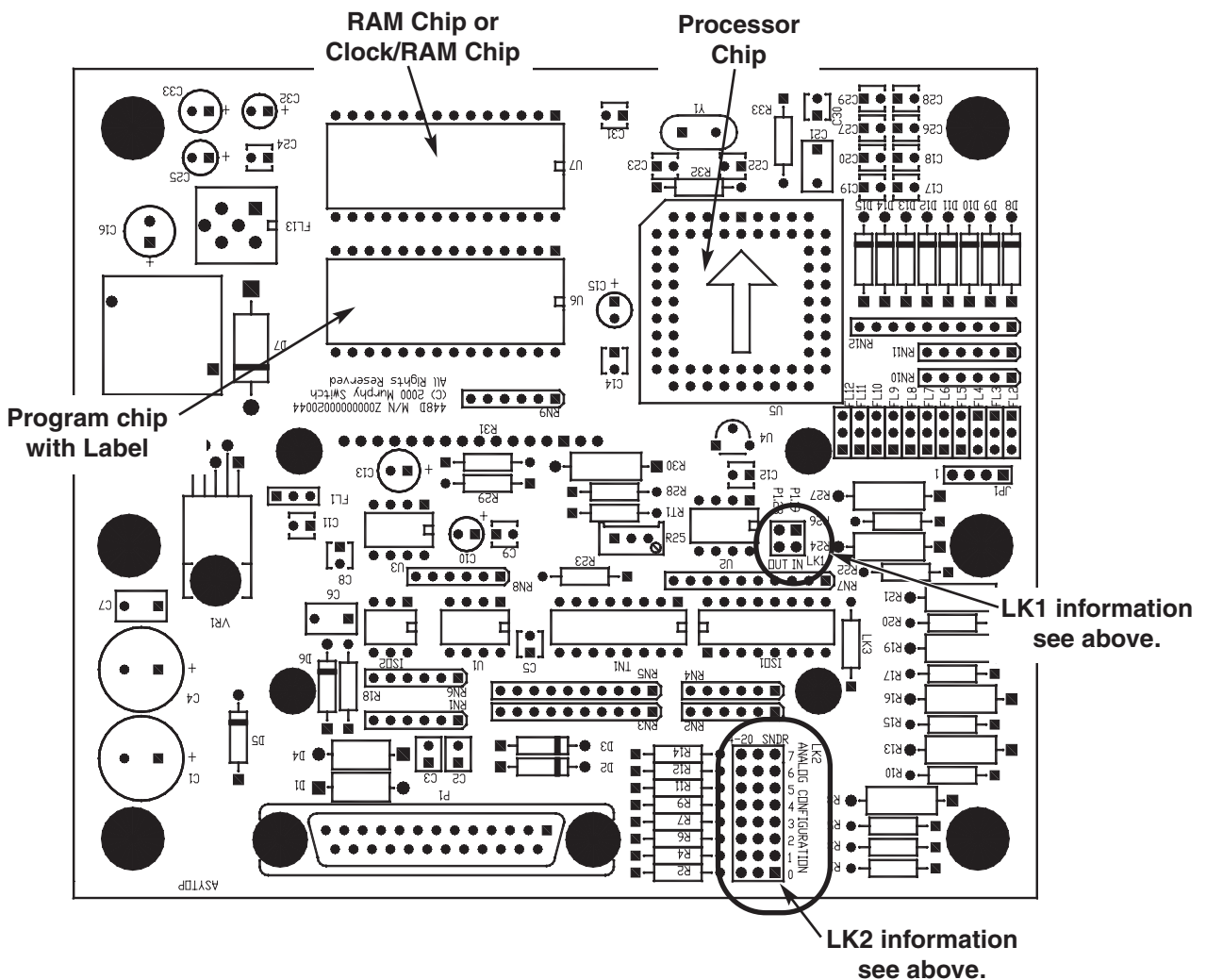
LK1 information (Input/Output configuration)

LK 1 determines your input/output configuration (see LK1 call-out below). When placed in the IN position, it enables a 4th digital input and disables the 7th digital output.

When placed in the OUT position, it disables the 4th digital input and enables the 7th digital output (see specifications section, on page 2).

LK2 information (configuring analog inputs 0-7)

LK2 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 EMS448, one to ground and one to the input. The EMS448 program used must support the way the analogs are configured.

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

RAM Chip or Clock/RAM Chip

Processor Chip

Program chip with Label

LK1 information see above.

LK2 information see above.

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

Should it becomes necessary to identify your S449 relay board configuration, undo the two latches/screws and open the EMS448 case (if applicable). To identify the S449 relay board, look for its 40 screw-type terminals (see 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 EMS447, jumpers LK1, LK2 and LK3 will be in the (7) position. The S449 Relay Board used with the EMS448; 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.
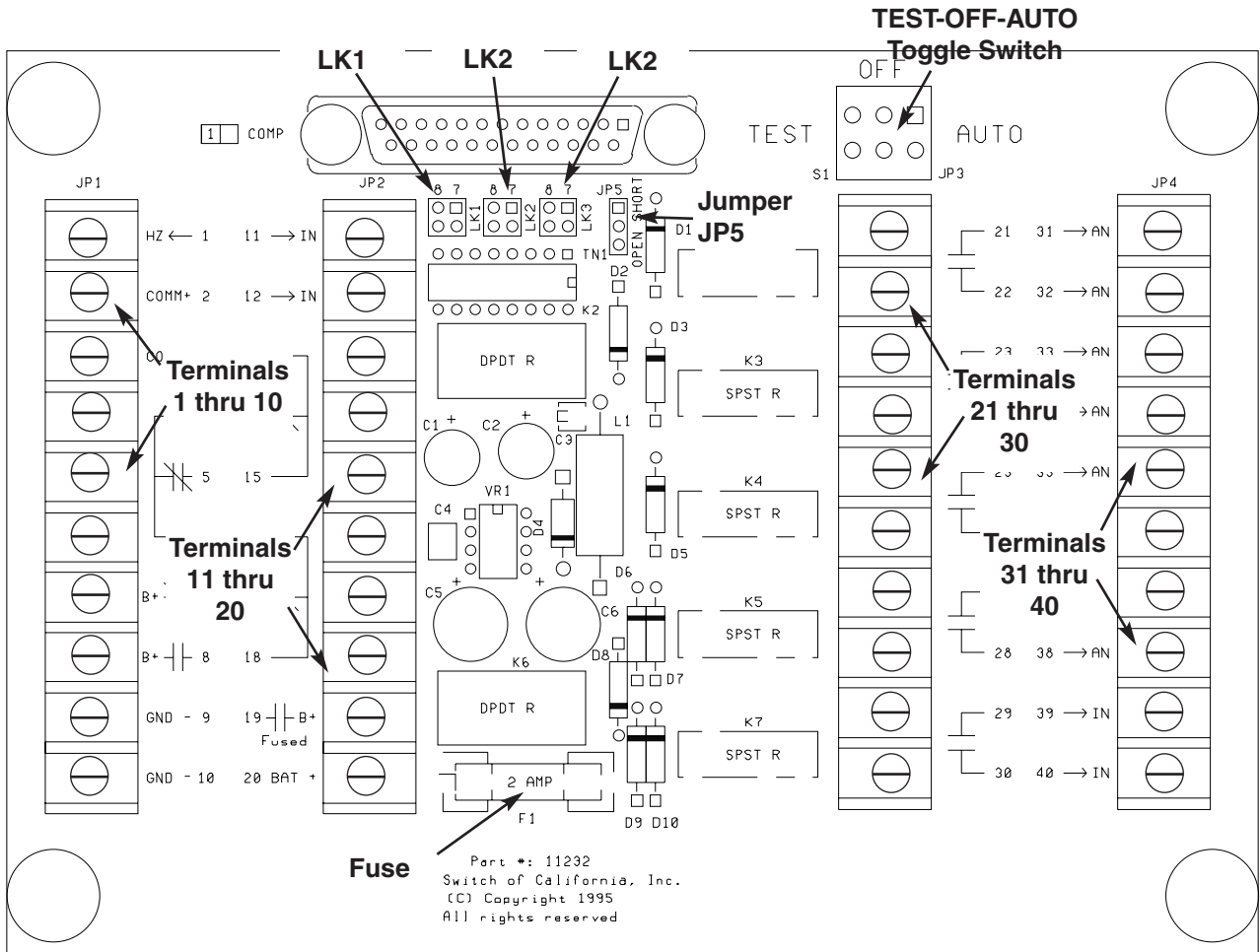
Warranty

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

NO

MURPHY EMS PROGRAM #

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

P-NUMBER DISPLAYS

S-NUMBER DISPLAYS

Scrolling the Main Displays

ENTER

ENTRY ACTIVE ENTER CODE: XX

YES OR NO

ENTER

ENTER YES   ENTER NO

SELECTING SCROLL ON   **SELECTING SCROLL OFF**

ENTER

ENTRY ACTIVE ENTER CODE: XX

YES OR NO

ENTER

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**

YES → ENTER
NO

YES   NO

LINE 1 XXX XXX XXXXXX ← ENTER → **ENG SPD 0 RPM P2 XXX XXX XX**

YES → ENTER
NO

YES   NO

LINE 1 XXX XXX XXXXXX ← ENTER → **ENG SPD 0 RPM P3 XX XXXX XX**

YES → ENTER
NO

YES   NO

LINE 1 XXX XXX XXXXXX ← ENTER → **ENG SPD 0 RPM P4 XX XXXX XX**

YES → ENTER
NO

YES   NO

LINE 1 XXX XXX XXXXXX ← ENTER → **ENG SPD 0 RPM P5 XX XXXX XX**

YES → ENTER
NO

YES   NO

P-Numbers continue

S-Number column

ENG SPD 0 RPM S1 LINE 1 SELECT ENTER → **LINE 1 XXX XXX XXXXXX**

NO   YES

ENTER ← YES
NO

ENG SPD 0 RPM S2 XXX XXX XX ENTER → **LINE 1 XXX XXX XXXXXX**

NO   YES

ENTER ← YES
NO

ENG SPD 0 RPM S3 XX XXXX XX ENTER → **LINE 1 XXX XXX XXXXXX**

NO   YES

ENTER ← YES
NO

ENG SPD 0 RPM S4 XX XXXX XX ENTER → **LINE 1 XXX XXX XXXXXX**

NO   YES

ENTER ← YES
NO

ENG SPD 0 RPM S5 XX XXXX XX ENTER → **LINE 1 XXX XXX XXXXXX**

NO   YES

ENTER ← YES
NO

S-Numbers continue

Main Displays continue

NO

ENG SPD 0 RPM P0 CIRCLE = EXIT

ENG SPD 0 RPM S0 CIRCLE = EXIT

ENTER →   ← ENTER

MURPHY EMS PROGRAM #