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**WATERFLOOD
SERVICE & SALES
FWM JOB: 50-30-3740**



CONTROL SYSTEMS & SERVICES DIVISION
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**FWMURPHY
CONTROL SYSTEMS AND SERVICES**

P.O. BOX 1819, ROSENBERG, TX 77471
TEL. (281) 342-0297; FAX (281) 341-6006

FWMurphy would like to take this opportunity to thank you for purchasing your new *Murphymatic®* Control System. This system was designed and built by qualified engineers, and technicians, with your control requirements in mind. We use the best materials and equipment in fabricating your controls systems.

We continually strive to provide defect-free products and services on time. This dedication allows us to maintain ISO 9001 registration.

Whatever your instrumentation and automation control application needs, *FWMurphy* provides quality products and services. We are available to define your requirements, provide design solutions and customer support.

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Limited Warranty

MURPHY SWICHGAGE® and MURPHYMATIC® CONTROL SYSTEMS

This Murphy supplied product is warranted to be of good quality materials and workmanship. This limited warranty is for a period of ONE year. Any unit suspected of a quality flaw, verified by Murphy, will be either repaired or replaced, at our option, when returned to our factory, transportation charges paid. If a customer is requesting on-site service assistance for a MURPHYMATIC® control system, we will engage the proper resources to repair, adjust or replace the MURPHYMATIC® control system in accordance with our Service Philosophy and Limited Warranty. We are not responsible for damage caused by improper installation, neglect or abuse and are limited under warranty to repairing or replacing the item only and are not liable for equipment on which this product is installed.

Murphy SWICHGAGE® control instruments, MURPHYMATIC® control systems, or their parts, and supplied product shall be of kind and quality described in the

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You have purchased dependable instrumentation and with normal care, it will provide long and faithful service, and enhance the preventive maintenance program on your valuable equipment. Any claim for shortage or damage of this shipment must be accompanied by this Packing Slip within 15 days of receipt or invoice date, whichever is later.



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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.

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This Murphy supplied control device is warranted to be of good quality materials and workmanship. Murphy warrants this quality for a period of ONE FULL YEAR. (Parts and systems are code dated.) This is only a time limit extension of the standard warranty; all other statements in the Murphy Limited Warranty remain in effect.

As with any monitoring and/or control system, the purchase, installation and use of SWICHGAGE® control instruments and other Murphy Systems is NOT AN INSURANCE POLICY. It is, however, the simplest means of adding inexpensive, reliable protection—protection that is as sound as the instruments, installation, and follow-up preventive maintenance program that is applied to these instruments and to the equipment they help protect. SWICHGAGE® control instruments, properly installed and maintained, are important and effective tools in any preventive maintenance program.

All "work machines" have life signs such as pressures, temperatures, levels, and overspeed conditions. Each of these vital signs can be monitored by a SWICHGAGE® capable of accurate indication and reliable limit switching. Teamed with Murphy electrical and SELECTRONIC® components, SWICHGAGE® control instruments can constantly monitor pressures, levels, temperatures, vibration, and overspeed conditions and activate alarm and/or shutdown when preset limits are reached. As these vital signs are constantly monitored, the SWICHGAGE® control instruments and their related components must be periodically inspected,

both visually and physically. Look for frozen pointers, bad contacts, kinked or broken pressure tubing or capillaries. Check floats on Level SWICHGAGE® control instruments visually and, if possible, mechanically. Test electric circuits and move limit contacts into the operating range to see that the proper sequence of events occurs when the contacts meet.

If a SWICHGAGE®, TATTLETALE® or other component fails the visual, physical, or electrical check, then repair or replace the unit or its parts as necessary to bring it back to proper operation. When a question exists on warranty, the questionable part should be returned to the factory or affiliate company for warranty inspection. If within the warranty period the unit is found to operate improperly and it appears to be related to material quality or workmanship, Murphy will repair or replace the product. (See Warranty above.)

Murphy SWICHGAGE® control instruments, MURPHYMATIC® panels and SELECTRONIC® systems are not a substitute for, but can be important tools in, a routine preventive maintenance program. Since 1939 we have been building our worldwide reputation as the source for simple, reliable monitoring and protection, featuring simplicity of maintenance. Please refer any questions regarding tests, repair or replacement parts to the factory, your nearest affiliate company, or your authorized servicing dealer.

Limited Warranty

MURPHY SWICHGAGE® and MURPHYMATIC® CONTROL SYSTEMS

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FW MURPHY
CONTROL & INSTRUMENTATION SOLUTIONS

DC POWER CONNECTION SOURCE

FWMurphy recommends that the power source (+ and -) connection points of any panel containing any solid state device (i.e. EMS 447, 547, C267, ASM or AS series controllers, etc.) be made directly to the terminals of the battery (+ and -). This will allow the battery to act as a filter and absorb any voltage spikes or noise generated by the alternator or other devices located on the equipment being controlled by the solid-state device. The preferred method is to tie the negative battery terminal to proper earth ground, (i.e. earth ground rod) and tie any needed frame/chassis grounds to that same point as well. Connection of power and DC common at any other point will cause increased noise susceptibility in the system. Depending on the actual configuration of the end application, this can cause various control problems, such as erratic operation, inaccurate sender/transducer readings, remote communication problems, etc.

INDUCTIVE LOADS

FWMurphy recommends that any inductive load tied to a solid-state output (relays, solenoids, incandescent lamps, etc.) have a reverse biased diode across the coil to snub the inductive kickback. This prevents the field collapse of the coil from damaging the solid-state output devices and keeps the DC power "clean" from spikes.

WELDING PRECAUTION

FWMurphy recommends that no welding take place directly on the equipment or on the equipment that is physically connected to equipment where solid state electronics are used. If welding **must** be performed on this equipment, FWMurphy recommends that the following precautions are taken to reduce the chance of the solid state electronics being permanently damaged, or damaged enough to fail at some later time. FWMurphy will not warrant any device that has been subjected to damage caused by welding.

Open the control panel and any associated sub-panels or swing panels. Disconnect power and ground connections; and all ribbon and other cable types leading to or from any solid state device (i.e. EMS 447, 547, C267, etc.). Note: Most cables should have a keyed connector for ease of reconnection, or have removable terminal blocks. Even if this is an outdoor field repair, wires should be removed from screw terminals where necessary to prevent any possibility of damage.

Attach the welders' ground clamp as close as possible to the area where the welding will occur and use the lowest feasible setting of the welding machine output. These precautions will lessen the chance that a high electrical potential will pass through or across the control panel and/or its components.

IN ORDER TO GET THE MOST RELIABLE OPERATION OUT OF A MURPHY CONTROL SYSTEM, HERE ARE A FEW WIRING TIPS.
REVISED 30 NOVEMBER, 1997

ALWAYS CONNECT POWER TO A DC CRANKING BATTERY POWERED SYSTEM DIRECTLY FROM THE CRANKING BATTERY FOR BOTH POSITIVE AND GROUND CONNECTIONS. ANY OTHER CONNECTION POINT RATHER THAN DIRECTLY FROM THE BATTERY COULD RESULT IN PROBLEMS. THERE IS A GREATER VOLTAGE DROP SEEN AT OTHER CONNECTIONS POINTS WHEN THE ENGINE IS CRANKED, THAN AT THE BATTERY.

ALWAYS INSTALL DIODES, SUCH AS 1N4005 DIODES ACROSS INDUCTIVE LOADS LIKE SOLENOID COILS AS CLOSE AS POSSIBLE TO THE COIL. THE Banded END OF THE DIODE SHOULD BE TOWARDS THE POSITIVE SIDE OF THE COIL, OR INDUCTIVE LOAD.

ALWAYS USE SHIELDED WIRE FOR MAGNETIC PICK-UP, AND ANALOG WIRING. GROUND THE DRAIN WIRE (SHIELD) AT THE PANEL, ONLY.

PLEASE TRY TO INSURE THE FOLLOWING SEPARATION OF WIRING BY USING MULTIPLE RUNS OF CONDUIT. HERE ARE THE LEVELS OF SEPARATION FROM NOISIEST TO THE WEAKEST VICTIM. SOME OF THIS SEPARATION IS REQUIRED BY CODES AND RECOMMENDED PRACTICES. IN ANY CASE, THIS IS EXPLAINED WITH THE IDEA THAT AN OUNCE OF PREVENTION IS WORTH A POUND OF CURE.

1. IGNITION WIRING, THE "G" LEAD, AND CD IGNITION FUEL VALVE WIRING
2. AC WIRING
3. DC POWER WIRING (MAGNETIC PICK-UP CAN BE RUN WITH THIS, BUT IT MUST BE IN SHIELDED CABLE).
4. ANALOG SIGNALS, LIKE 4-20 MILLIAMPS AND SENDER SIGNALS. (MAGNETIC PICK-UP WIRING CAN BE RUN WITH THIS, BUT IT MUST BE IN SHIELDED CABLE).
5. THERMOCOUPLE WIRING (MUST USE SHIELDED THERMOCOUPLE GRADE EXTENSION WIRE FOR THE PROPER TYPE (TYPICALLY J & K))
6. SENSOR WIRES THAT ARE EITHER "NON-INCENDIVE" FOR CLASS I, DIVISION 2, OR "INTRINSICALLY SAFE" FOR CLASS I, DIVISION 1

GENERAL WIRING PRECAUTIONS

There are several precautions you can take on initial installation to reduce chances of failure over time. Many of these steps may take a few extra minutes to do at the time of installation; however, they can also save many headaches in the future. We strongly recommend that you follow these precautionary steps.

1. Suppression Diodes

Place suppression diodes across all inductive loads. These loads typically include pilot relays, solenoid valves, starter solenoids, etc. This helps increase contact life and eliminate a source of electrical interference.

2. Wire power leads directly to battery Post.

When hooking your power supply to your Test- Off - Auto switch (AUTOMATIC MODE) or OFF-ON switch (MANUAL MODE), run you're wiring directly to the battery post. This helps minimize noise generated from battery chargers and alternators.

3. Pilot excessive loads.

Many of the outputs on the EMS Controller are rated for low current, control type loads. Do not run high current loads directly to the unit.

4. Use stranded wire for hookup.

Solid wire transmits vibration and is more likely to crystallize and break when it is subjected to movement.

5. Separate AC and DC wiring.

Never run AC and DC handling wiring together. AC signals may get coupled into the control circuits leading to erratic operation.

6. Wire standby battery charger directly to battery.

Standby chargers must be wired directly to the battery. Failing to do this may result in erratic operation due to electronic "noise" coupled into the microprocessor.

7. Special precautions for spark ignition engines.

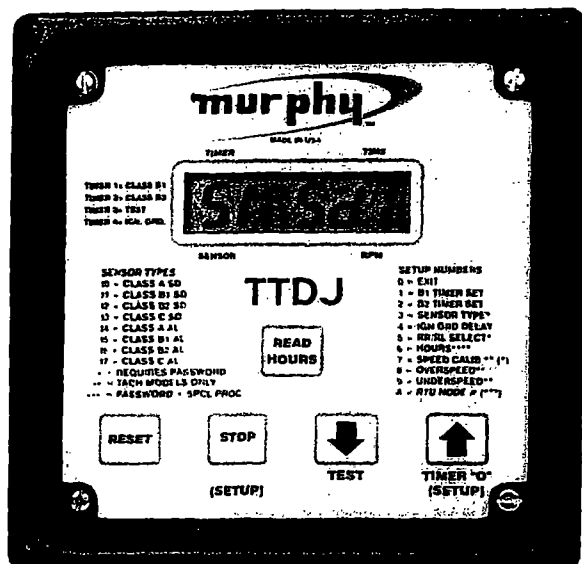
Magnetos and ignition coils produce high voltage and cause high frequency interference. The EMS Controller is designed to filter out much of this interference; however, precautions must be taken to protect the unit. Sender and shutdown wiring must be routed away from the magneto and spark coil wiring. Resistor spark plugs and spark plug wires reduce electrical interference and may also be required in especially "noisy" environments.

8. Use shielded cable on magnetic pickup.

Shielded cable is recommended for connecting the magnetic pickup to the EMS Controller. This helps prevent signal loss and the possible coupling of electrical interference into the relatively sensitive speed sensing circuit. The shield should only be grounded on one end.

Remember, proper care during installation will help your EMS Controller live a long and trouble-free operating life. If for any reason you have questions during installation, feel free to give us a call.

Digital Fault Annunciator



US Patent 6,144,116
(model TTDJ-IGN-T only)

TTDJ Series

- Alarm and Shutdown Control System for Engine-Driven Pumps and Compressors
- Monitors 32, User-Configurable, Sensor Inputs from N.O. and/or N.C. Sensors
- RS485 Serial Communications Port (DC Models)
- Built-In Power Supply and Elapsed Time Meter (Hour Meter) All Models
- Models with Tachometer and Overspeed Available
- Powered by 12/24VDC or CD Ignition (neg. grnd.)
- CSA Certified for Use in Class I, Division 2, Hazardous Areas



Description

The innovative new TTDJ Series now gives you a unique configurable annunciator with a built-in power supply and hourmeter. A new modular design for easy retrofit to most existing systems features an alpha-numeric Liquid Crystal Display window with 1/2 inch (13 mm), easy-to-read characters. It displays any fault from the sensor inputs, elapsed engine running time, and engine speed (optional, TTDJ-DC-T and TTDJ-IGN-T models only). Also located on the faceplate are membrane keys for easy operation and configuration.

Highly reliable and versatile, the TTDJ accepts 32 sensor inputs supplied from normally open and normally closed sensors. Plus each of the first 16 inputs can be easily configured for Shutdown or Alarm Before Shutdown*, can be locked out by one of two Start-Run timers or configured as a Class C lockout. The Start-Run timers are adjustable from: 0 to 5 minutes (B1); 0 to 9 minutes 59 seconds (B2).

The TTDJ-DC and TTDJ-DC-T are capable of communicating with controllers, PLC's, computers or SCADA systems by an RS485 serial communications port. An optional Tachometer with Overspeed sensing feature is available for all TTDJ Series models.

Test mode is provided for testing sensor circuits without shutting down the equipment, plus on-board Elapsed Time Meter is standard with all models.

Models are available for 12 or 24 VDC systems or for negative ground CD Ignition systems.

Basic Models

- TTDJ-DC:** 12-24 VDC powered w/o tachometer
- TTDJ-DC-T:** 12-24 VDC with tachometer
- TTDJ-IGN:** ignition powered w/o tachometer
- TTDJ-IGN-T:** ignition powered with tachometer

Features

- Fully-Configurable, with Internal Power Supply
- On-Board RS485 Serial Communications to PLC's, PC's, Controllers or SCADA systems (TTDJ-DC models only)
- Modular Design for Easy-Retrofit to most Existing Control Systems
- Accepts 32 N.O. or N.C. Sensor Inputs
- Remote Reset and Remote Lockout Options
- Built-In Elapsed Time Meter
- Time Delay to Allow Fuel Valve Closure prior to Killing Ignition

Applications

This solid-state fault alarm and shutdown control system is designed to protect engines, compressors, etc., and their associated equipment.

Warranty

A two-year limited warranty on materials and workmanship is given with this Murphy product. Details are available on request and are packed with each unit.

Specifications

Power Input (Operating Voltages):

TTDJ-DC; TTDJ-DC-T: 10-32VDC, 500 mW max.

TTDJ-IGN; TTDJ-IGN-T: 90-350 VDC negative

ground CD ignition; approx. 650µA @ 100VDC.

Sensor Inputs: 32 N.O. or N.C. passive switches.

Inputs 1-16: Configurable as Class "A", "B1",

"B2", or "C" shutdown or alarm before shutdown*

Inputs 17-29: Dedicated Class "A" shutdowns.

Input 30: Selectable Remote Reset or Class "A".

Input 31: Remote Lockout or Class "A"; inhibits the Class "B1 & B2" Lockout Timers.

Input 32: Overrides Test Timer, typically used for emergency shutdown.

Outputs: 0.5 A @ 350 VDC.

Outputs Selection: Ground ignition immediately or trip fuel valve and ground ignition after time delay.

Communications: RS485 Serial Port, Modbus RTU slave (TTDJ-DC models only).

Operating Temperature: -40 to 185°F (-40 to 85°C).

Storage Temperature: -40 to 185°F (-40 to 85°C).

Sensor Scan Rate: Within 1 second.

B1 Start/Run Timer: Adjustable, 0-5 minutes.

B2 Start/Run Timer: Adjustable, 0-9:59 minutes.

Tachometer Accuracy: ±0.5% of the display reading or ±1 RPM whichever is greater.

Hourmeter Range: 0 to 65535 hrs.

Hourmeter Accuracy: ±15 minutes per year.

Pulses per Revolution Range for Tach. Calibration: 32-360 (TTDJ-DC-T); 1-16 (TTDJ-IGN-T).

Overspeed Set point: 0-9999 rpm.

Underspeed Set point: 0-5000 rpm.

Magnetic Pickup: 5-120 Vrms, 0-10 kHz.

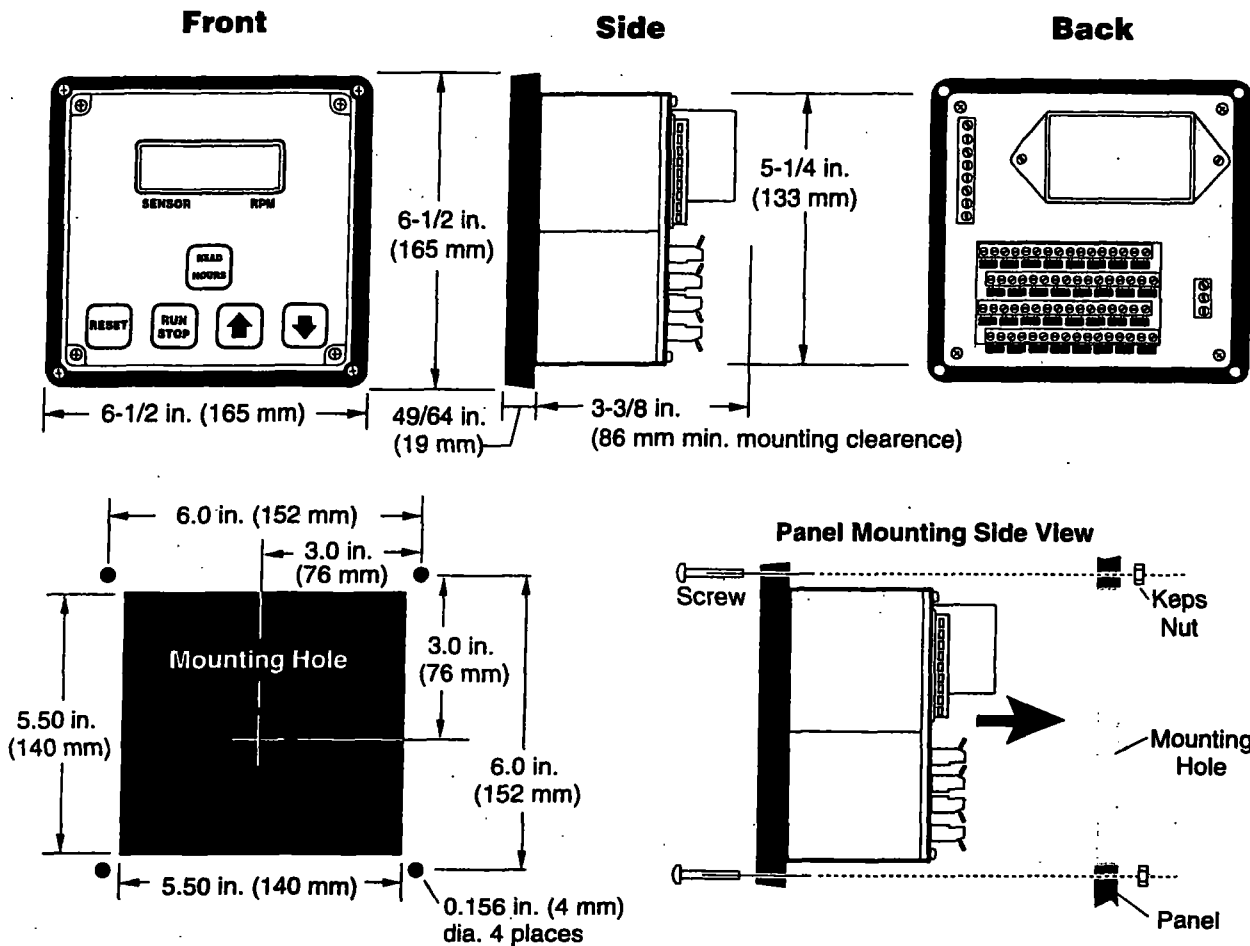
On-Board Backup Power (-IGN Versions only):

6 VDC, 1300 mAh, Duracell® DL223A or

Sanyo® CR-P2 Lithium battery.

*Alarm Before Shutdown is a function that causes annunciation and the alarm output, but will not cause a shutdown.

TTDJ Module Dimensions



How to Order Your TTDJ

Select from the following part numbers:

Head/Module

- TTDJ-DC (50700109): 12-24 VDC model, without tachometer.
- TTDJ-DC-T (50700110): 12-24 VDC with tachometer.
- TTDJ-IGN (50700111): CD ignition (negative ground) model, without tachometer.
- TTDJ-IGN-T (50700112): CD ignition (negative ground) model, with tachometer.

Replacement Battery

Duracell® DL223A or Sanyo® CR-P2 (0005125):
6 VDC, 1300 mAh, Lithium battery.

Shipping Weights and Dimensions

Shipping Weight (all Models): 3 lb. (1.36 kg) approximately.
Shipping Dimensions (all Models):
5-1/2 x 9 x 9-1/2 in. (140 x 229 x 241 mm) approximately.



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TTDJ Series Fully-Configurable Fault Annunciator Installation and Operations Manual

TTDJ-99062N
Revised 01-02
Section 50
(00-02-0412)



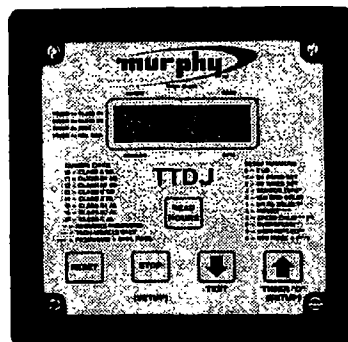
Please read the following information before installing. This installation information is intended for all TTDJ Series models. A visual inspection of this product before installation for any damage during shipping is recommended.

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.



US Patent 6,144,116
(model TTDJ-IGN-T only)

CSA Certified for Use in Class I, Div. 2,
Groups C and D Hazardous Areas.

Description

The TTDJ is a solid-state fault annunciator and shutdown control system, with hour meter, designed to protect engines, compressors and their associated equipment. Four TTDJ modules are available:

TTDJ-DC : Powered by 12 or 24 VDC systems without tachometer and overspeed sensing. Includes RS485 serial port.

TTDJ-DC-T : Powered by 12 or 24 VDC systems with internal tachometer and overspeed sensing. Includes RS485 serial port.

TTDJ-IGN : Powered by negative ground CD ignition systems without tachometer and overspeed sensing. Without RS485 port.

TTDJ-IGN-T : Powered by negative ground CD ignition systems with internal tachometer/overspeed sensing. Without RS485 port.

All TTDJ models will accept 32 sensor inputs from normally open and/or normally closed sensors. Each of the first 16 inputs can be configured for Shutdown or Alarm Before Shutdown*, and can be locked out by one of the Two Start-Run timers (B1:0-5 min.; B2:0-9:59 min.), or configured as Class C. The annunciator provides for both closing of a fuel valve, and grounding of an ignition after a time delay. The TTDJ has built-in Elapsed Time Meter. Run Hours and Tachometer Settings are stored in non-volatile memory, as well as the last 4 shutdowns and one alarm (alarm only stored if active at the time of shutdown). The TTDJ liquid crystal display annunciates any fault from the sensor inputs, displays engine speed and elapsed time.

Other features for all TTDJ models are: built-in Test Mode to test the sensor circuits without shutting down, on-board backup battery to retain the fault display after shutdown (IGN models only), and a history of the last 4 shutdowns with their associated Run Hours, also stored in non-volatile memory.

TTDJ-DC and TTDJ-DC-T models feature an RS485 serial communications port (MODBUS RTU slave) to interface with micro-controllers, PC's, PLC's and controllers.

Module/ Head

The module is the brain of the control system. It contains the microcomputer, the Liquid Crystal Display (LCD), the membrane keys for configuring the sensors inputs, the Sensor Inputs Terminal Blocks and the Power Inputs and Control Output Terminal Block. The TTDJ-DC module also includes an RS485 serial communications port (MODBUS RTU slave).

* Alarm Before Shutdown is a function that causes annunciation and the alarm output, but will not cause a shutdown.

Liquid Crystal Display

The Liquid Crystal Display sequentially provides shutdown/alarm condition, run hours, rpm, and timer information. A shutdown or alarm condition is indicated by the appropriate sensor number in the first two leftmost digits. Hours display uses all the digits. RPM display is shown in the rightmost digits with a Run Indicator in the first digit. The Timer display shows the timer number in the first digit and the time in the last three digits.

Timers

Active Timers are indicated by the timer number in the first digit of the display, and the remaining time in the last three digits. Timer 1= Class "B1", Timer 2= Class "B2", Timer 3= Test, Timer 4= Ignition Ground Delay.

Power and Control Inputs/Outputs

The TTDJ power and control inputs and outputs are connected to the Power Inputs terminal block on the back of the TTDJ.

In the TTDJ-IGN and TTDJ-IGN-T the FV+ output is a non-switched output that supplies stored energy from an internal capacitor. -FV and ALARM outputs are non reversible switched outputs (switched OFF for normal operation, switched ON for alarm and shutdown). When a shutdown fault is detected, the -FV and ALARM turn ON and after a time delay, the IGN input switches to ground.

On the TTDJ-DC and TTDJ-DC-T the IGN, FV, and ALARM outputs are programmed to switch ON for normal operation.

Sensor Inputs and Terminals

Up to 32 dry contact sensor inputs or Murphy device transistor outputs can be connected to the back of the TTDJ via a terminal block (32 pair, screw type, each with a jumper). Sensor inputs 1 to 16 are configurable as Class "A", Class "B1", Class "B2" or Class "C" functions, Shutdown or Alarm Before Shutdown*. The Class "B" timers allow sensor inputs to be locked out at start-up. Sensor inputs configured for Alarm Only will cause the Alarm Output to turn on when tripped, and the sensor number will be annunciated while the unit continues to run. TTDJ sensor inputs 17-28 are dedicated as Class "A" Shutdown only. Sensor input 29 can be configured as a Class "A", or Class "ESD" input. Sensor input 32 is dedicated as Class "ESD". Sensor inputs 30 & 31 can have special functions or be Class "A". Any tripped sensor is detected within 1 second after faulted.

Emergency Shutdown

Sensor input number 32 is dedicated to Emergency Shutdown. The Emergency Shutdown sensor input overrides the Test timer. Additionally, sensor input 29 can be configured as a Class "A" or Class "ESD" input.

Remote Reset (optional, Setup 5 = 1 or 3)

When the Remote Reset feature is selected, point 30 with a closed contact resets the TTDJ in the same manner as when using the Reset key. The closed contacts to operate the Remote Reset feature should be kept closed only momentarily for approximately 1 second to cause a remote reset.

Remote Lockout (optional, Setup 5 = 2 or 3)

The Remote Lockout inhibits the Class B1 and Class B2 Lockout timers. These Lockouts are ignored when a closed switch is seen at Input 31. An open switch at Input 31 allows the Lockouts to function normally. When the Remote Lockout is active it resets Class "C", "B1" and "B2" Lockout timers. This is intended to be used with automatic starting systems. With a contact closure on terminals 31 with the unit not running, the display will alternate between either RPM (-T models) and the Class "B1" timer, or the display will flash (non-T models). The TTDJ should be put into remote lockout immediately before stopping the engine. The contact closure should be opened once the engine is running. At that time the "B1" and "B2" timers will be allowed to count down.

Reset Key

The Reset key resets All faults and initiates the Class "B" timers.

Overspeed (-T models only)

These models feature an internal tachometer with Overspeed Shutdown (50). This shutdown bypasses the Ignition Ground Delay. It is not locked out by the Test Timer.

Underspeed Annunciation (-T models only)

TTDJ-IGN-T models display (51) when an underspeed condition occurs. It is not locked out by the Test Timer.

Loss of Ignition Annunciation (non -T models)

The TTDJ-IGN models will display (51) when ignition input is lost. It is not locked out by the Test Timer.

Run/Stop Key (Manual Stop)

The Manual Run/Stop key is used for system shutdown from the panel. When pressed, the unit will shutdown the system without turning on the Alarm Output (on -DC models the Alarm Output is turned off on Manual Stop). Manual Stop (Shutdown 52) is not locked out by the Test Timer.

Low Backup Battery Voltage (-IGN models)

The TTDJ-IGN models have an internal backup battery. When the "Lowbatt" display appears (this message will alternate with other displays) the battery needs to be replaced, see page 3 for details.

Timer "O" Key

This key zeros the current displayed timer: Class "B1", "B2", Ignition Ground Timer, or Test Timer. If the TTDJ is in the Test mode, it exits Test.

Test Key

Initiates the Test Timer with 5 minutes. Test mode is indicated by the "3" in the first digit of the display. Faulted inputs are displayed as in normal operation, but the system is not shutdown and the Alarm Output is not turned on. Press "Reset" to reset the fault and press the Timer "O" to exit. The following shutdowns override Test: Emergency Shutdown (32), Overspeed (50), Manual Stop (52), Underspeed (51), and Loss of Ignition (51). If Class "C" functions are used, they will need to be bypassed to test other sensors. When exiting "Test" with Class "C" functions, press "Reset" and "Timer O" simultaneously.

Shutdown History

The TTDJ models store the last 4 shutdown codes and any alarm present

at shutdown, as well as the elapsed time reading at which they occurred. For instance, if the unit is shutdown from sensor input 1, the display will show "01 SD1" to indicate the last shutdown. Shutdown #1 was sensor input #1. Press the "Up" key for "Shutdown 2", "3", "4", and for any present "Alarm". To view the elapsed time reading at which any of the shutdowns occurred, press "Push To Read Hours" key while viewing that shutdown.

Class "B" Lockout Timer

Allows the system to become fully operational without shutting down by start-up related conditions. Class "B1" and Class "B2" Sensor inputs are locked out until their corresponding timer expires. Class "B1" Timer is selectable from 0:00-5:00 minutes, and Class "B2" Timer from 0:00-9:59 minutes.

Class "C" Functions

There is a practical limit of sensor inputs defined as Class "C" Shutdown and/or Class "C" alarm of 8 points. The Class "C" function operation is that the sensor will be initially faulted on Start-up. If the sensor never clears there will not be any annunciation and alarm or shutdown. If the sensor clears for a full 2 seconds, then it is armed to alarm or shutdown. Pressing the Reset key will allow a Class "C" alarm function to go back to the Start-up state where it can remain faulted without annunciation and alarm. An example of a Class "C" function is Low Discharge pressure.

Ignition Ground Delay

This delay is selectable from 0-20 seconds. To select the delay use SETUP.4, see User Set Up Menus and To Enter User Set Up on page 5.

Hourmeter

The TTDJ internal hourmeter keeps track of Run Hours. To display Run Hours for 5 seconds, press the Push to Read key. Run Hours are stored in non-volatile memory, maintaining hours in the absence of power.

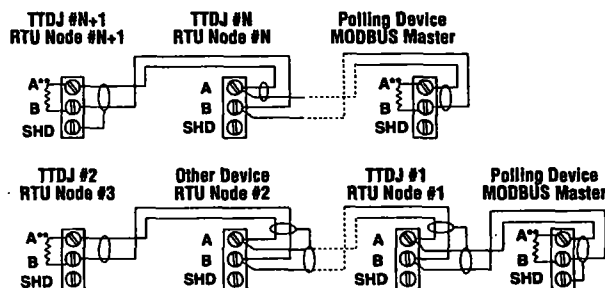
RS485 Serial Port (TTDJ-DC / TTDJ-DC-T)

The RS485 serial port (MODBUS RTU slave) on the back of the module is provided for communicating with micro-controllers, PC's, PLC's and SCADA systems (see RS485 Typical Connections, below). It is recommended that a termination resistor** (customer supplied) be used on the first and last device connected in a daisy-chain configuration.

The communication parameters are 9600 baud, no parity, 8 bits with 1 stop bit (9600,N,8,1), half-duplex. The shield terminal on the TTDJ terminal block should only be used if the drain wire on the shielded cable is not connected to ground anywhere else. Each device must have a unique RTU node number. A retry delay of 0.3 second may be helpful (set up for 3 retries).

Modbus Integer Holding Registers

- 40001= RPM
 - 40002= ETM (elapsed Time Meter 0-65535 Hrs.)
 - 40003= Class B1 (in seconds)
 - 40004= Shutdown Numbers (0=OK) (1-32, 50-52 =SD shutdown)
 - 40005= Output Status (Bit 0= IGN, Bit 1= FV, Bit 2= ALR)
 - 40006= Inputs 1-16 (Bit 0 = TB1..., Bit 15= TB16) (True 1= Inactive)
 - 40007= Inputs 17-32 (Bit 0= TB17..., Bit 15= TB32) (True 1= Inactive)
- If 40006 and 40007 both contain "FF" there are no active shutdowns.

RS485 typical connections

**Terminating resistor is 120 ohms. Install Terminating resistor at the master and the last slave. Use only Belden 9841 or 3105A cable or cabling with a characteristic impedance of 120 ohms.

SPECIFICATIONS

Power Input (Operating Voltages):

TTDJ-DC; TTDJ-DC-T Models: 10- 32VDC, 500 mW max.

TTDJ-IGN; TTDJ-IGN-T Models: 90-350 VDC negative ground
CD ignition; approx. 650 μ A @ 100VDC.

Sensor Inputs: 32 N.O. or N.C. passive switches.

Inputs 1-16: Configurable as Class "A", "B1", "B2", or "C" Shutdown or Alarm Before Shutdown*.

Inputs 17-28: Dedicated Class "A" shutdowns.

Inputs 29: Configurable as Class "A" or Class "ESD".

Input 30: Selectable Remote Reset or Class "A".

Input 31: Remote Lockout or Class "A"; inhibits the Class "B1 & B2" Lockout Timers.

Input 32: Class "ESD" Overrides Test Timer, typically used for emergency shutdown.

Outputs: 0.5 A @ 350 VDC.

Outputs Selection: Ground ignition immediately or trip fuel valve and ground ignition after time delay.

Communications: RS485 Serial Port, Modbus RTU slave (TTDJ-DC models).

*Alarm Before Shutdown is a function that causes annunciation and the alarm output, but will not cause a shutdown.

Operating Temperature: -40 to 185°F (-40 to 85°C).

Storage Temperature: -40 to 185°F (-40 to 85°C).

Sensor Scan Rate: Within 1 second.

B1 Start/Run Timer: Adjustable, 0 - 5 minutes.

B2 Start/Run Timer: Adjustable, 0 - 9:59 minutes.

Pulses per Revolution Range for Tach. Calibration:
32-360 (TTDJ-DC-T); 1 - 16 (TTDJ-IGN-T).

Overspeed Set point: 0 - 9999 rpm.

Underspeed Set point: 0 - 5000 rpm.

Magnetic Pickup: 5 - 120 Vrms, 0-10 kHz.

On-Board Backup Power 00005125 (-IGN Versions only):

6 VDC, 1300 mAh, Duracell® DL223A or Sanyo® CR-P2 Lithium battery.

Tachometer Accuracy: $\pm 0.5\%$ of the display reading or ± 1 RPM whichever is greater.

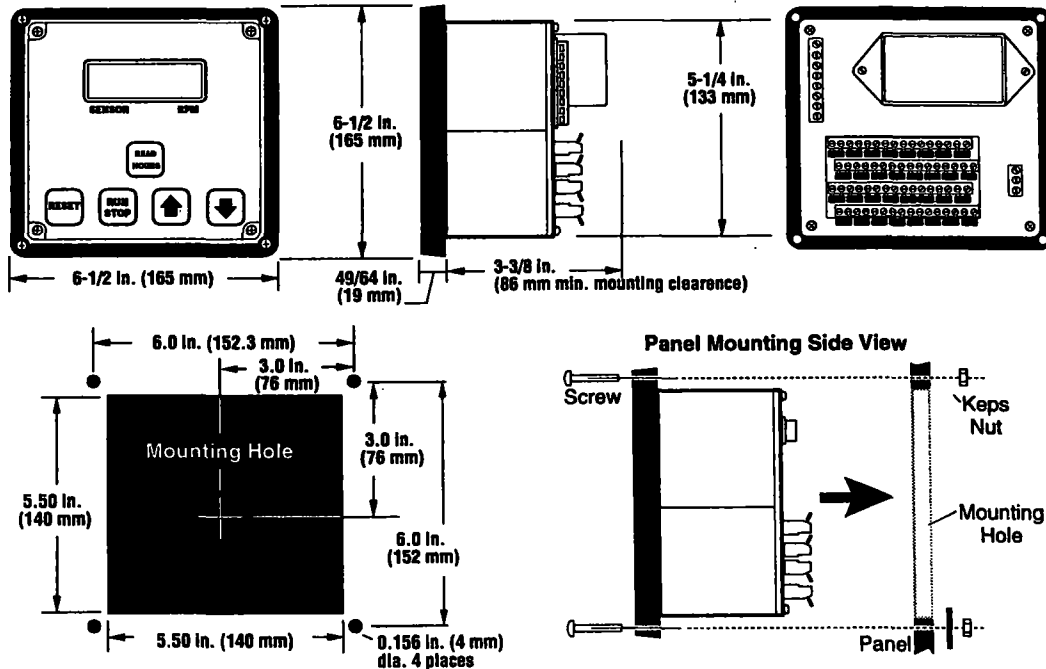
Hourmeter Range: 0 to 65535 hrs.

Hourmeter Accuracy: ± 15 minutes per year.

TTDJ MOUNTING DIMENSIONS (All Models)



WARNING: PERFORM THE MOUNTING OPERATION WITH POWER SOURCE OFF. THE TTDJ SERIES MODULE WAS DESIGNED TO BE MOUNTED WITHIN A WEATHERPROOF ENCLOSURE. IT IS INTENDED FOR MOUNTING IN A FLAT PANEL. A SQUARE MOUNTING HOLE OF 5-1/2 IN. (140 MM) AND FOUR MOUNTING SCREW HOLES ARE NEEDED. INSERT THE MODULE FROM THE FRONT SIDE OF THE PANEL AND SECURE THE FOUR MOUNTING SCREWS AND NUTS THROUGH THE BEZEL.



REPLACING THE BATTERY (-IGN Models only)



WARNING: THE BACKUP POWER BATTERY IS LOCATED WITHIN THE TTDJ MODULE. THEREFORE, EXTREME CAUTION MUST BE EXERCISED WHEN REPLACING IT. FOR CLASS I, DIVISION 2, HAZARDOUS AREAS INSTALLATIONS, FIRST, SHUTDOWN THE SYSTEM AND MAKE SURE THAT THE HAZARDOUS AREA IS KNOWN TO BE NON-HAZARDOUS BEFORE OPENING THE POWER SUPPLY COVER.

The TTDJ-IGN models include a Backup Power Battery located within the TTDJ module. To gain access to and to replace the battery do the following:

1. Make sure the area is made Non-Hazardous and shut down the System (remove power).
2. Using extreme caution remove the Power Supply Cover Screws (located on the back of the TTDJ module).
3. Gently pull the Power Supply Cover away from the back of the TTDJ to

have access to the old Backup Battery.

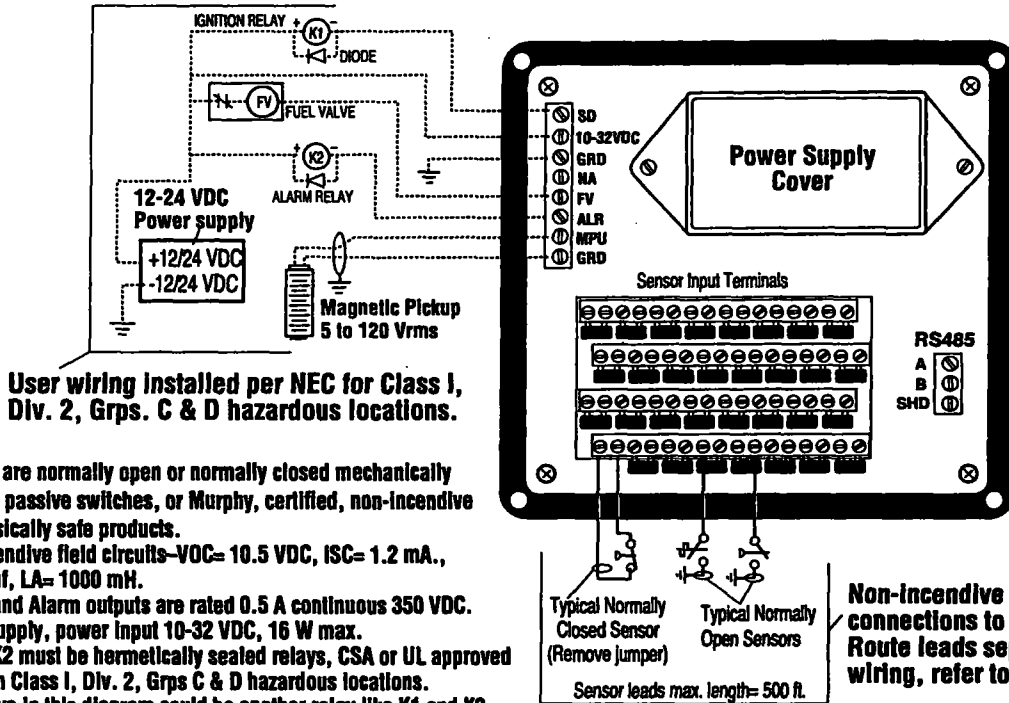
4. Locate the old Backup Battery.
5. Using extreme caution, not to damage any component, replace the battery with a 6 VDC, 1300 mAh, Duracell® DL223A or Sanyo® CR-P2 Lithium battery, available from Murphy (p/n 00005125).
6. Carefully proceed to replace the Power Supply Cover.
7. You are now ready to power up your system and resume operations.

TYPICAL WIRING DIAGRAMS (All Models)



WARNING: FOR HAZARDOUS APPLICATION REQUIREMENTS, THE TTDJ COMPLETE SYSTEM MUST BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) CLASS I, DIVISION 2, GROUPS C & D (ARTICLE 504) SPECIFICATIONS AND PER MURPHY DRAWING 50-08-0039. SENSOR INPUT WIRES MUST BE SEPARATED A MINIMUM OF 2 IN. (51 MM) FROM OTHER WIRES.

TTDJ-DC AND TTDJ-DC-T TYPICAL WIRING

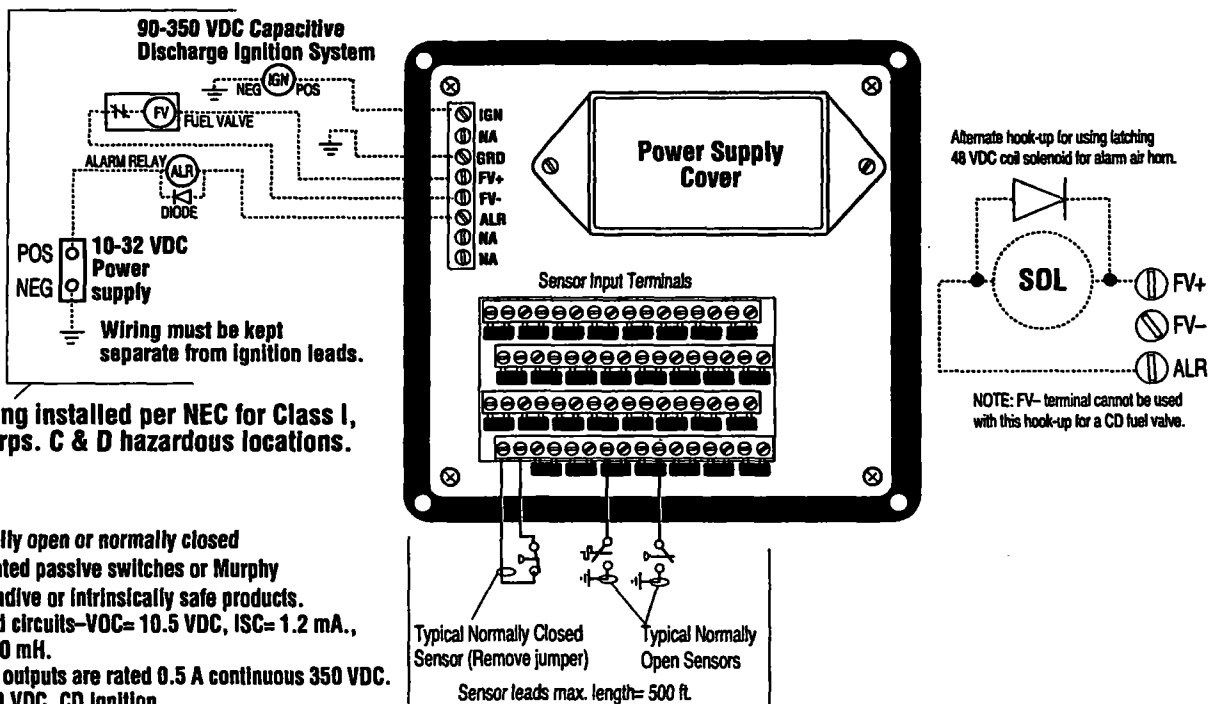


NOTES:

1. Sensors are normally open or normally closed mechanically actuated passive switches, or Murphy, certified, non-incendive or intrinsically safe products.
2. Non-incendive field circuits—VOC= 10.5 VDC, ISC= 1.2 mA., CA= 21 uf, LA= 1000 mH.
3. SD, FV and Alarm outputs are rated 0.5 A continuous 350 VDC.
4. Power supply, power input 10-32 VDC, 16 W max.
6. K1 and K2 must be hermetically sealed relays, CSA or UL approved for use in Class I, Div. 2, Grps C & D hazardous locations.
7. Fuel Valve in this diagram could be another relay like K1 and K2.

Non-incendive field wiring connections to passive switches. Route leads separate from other wiring, refer to Notes 1 and 2.

TTDJ-IGN AND TTDJ-IGN-T TYPICAL WIRING



NOTES:

1. Sensors are normally open or normally closed mechanically actuated passive switches or Murphy certified, non-incendive or intrinsically safe products.
2. Non-incendive field circuits—VOC= 10.5 VDC, ISC= 1.2 mA., CA= 21 uf, LA= 1000 mH.
3. IGN, FV and Alarm outputs are rated 0.5 A continuous 350 VDC.
4. Power input 90-350 VDC, CD Ignition.
5. ALR relay must be hermetically sealed relay, CSA or UL approved for use in Class I, Div. 2, Grps C & D hazardous locations.

Non-incendive field wiring connections to passive switches. Route leads separate from other wiring. Refer to Notes (1,2).

TTDJ SENSOR SETUP MAP

TYPE SETUP

Sensor 1-16 Setup Detail

TYPE SETUP

SEtUP.3

STOP

CDdE:00

DOWN

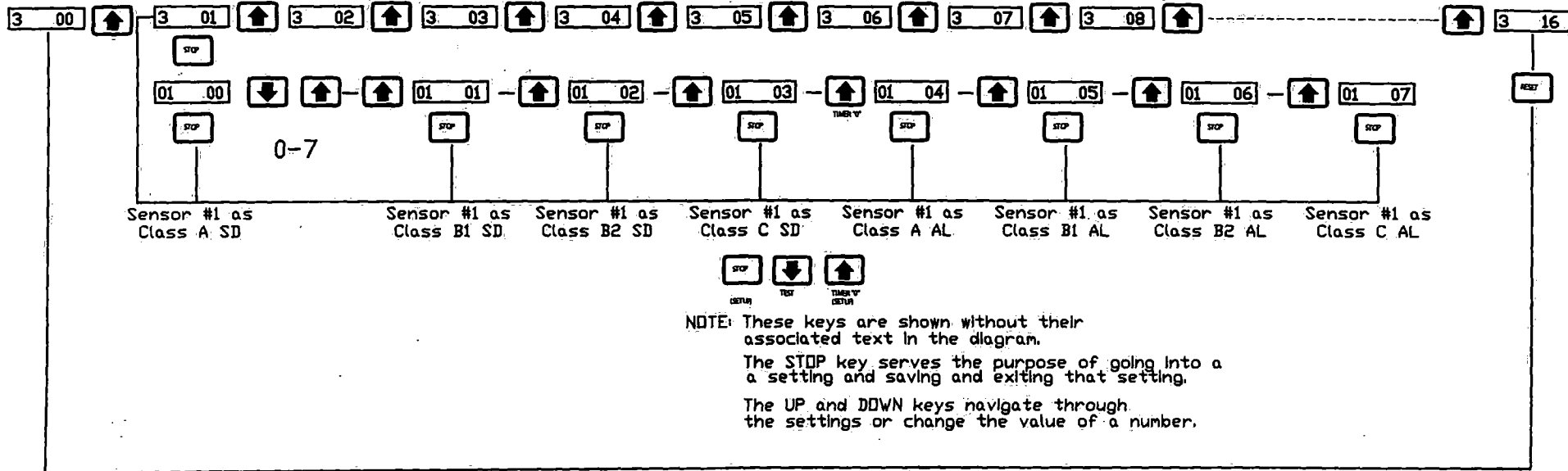
UP

CDdE:xx

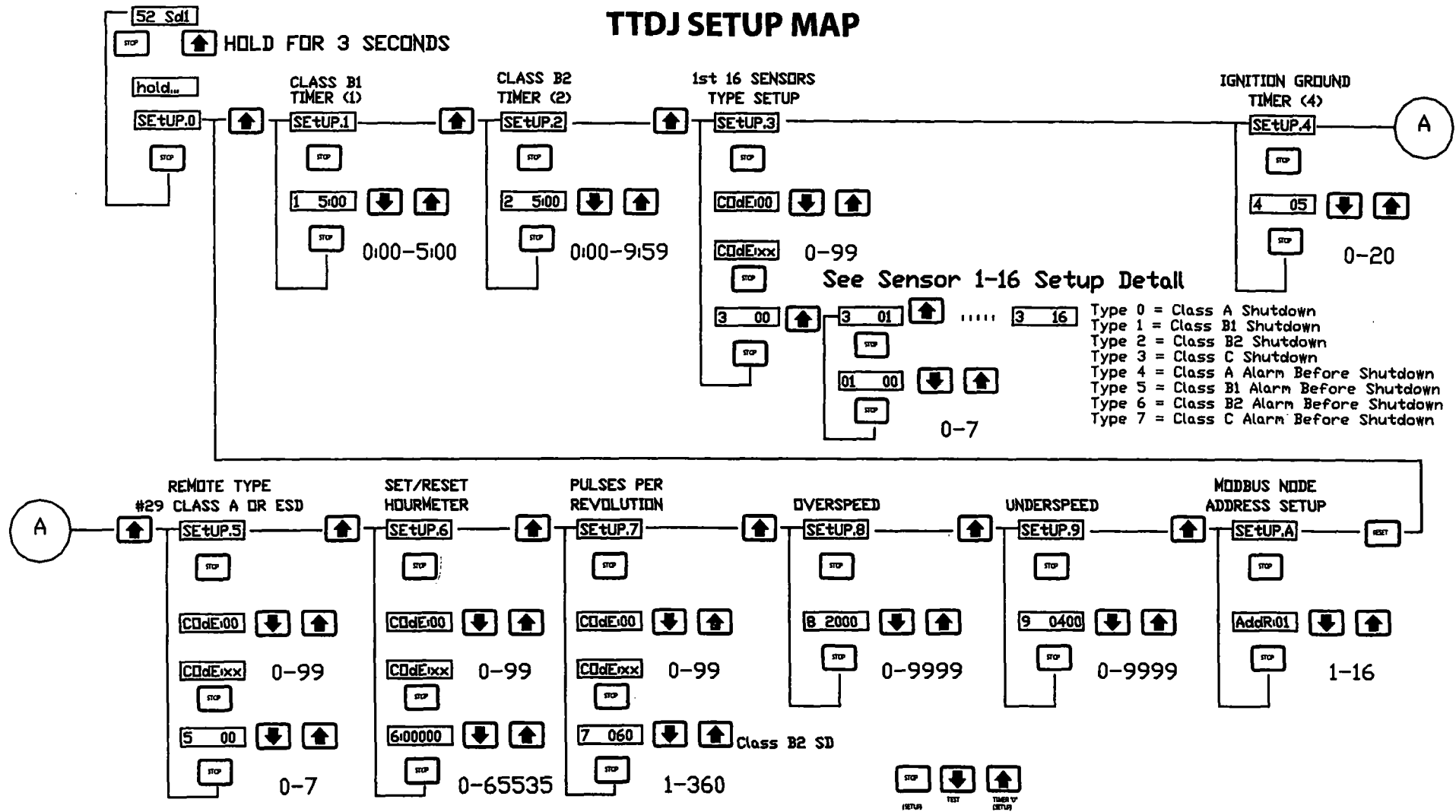
0-99

STOP

- Type 0 = Class A Shutdown
- Type 1 = Class B1 Shutdown
- Type 2 = Class B2 Shutdown
- Type 3 = Class C Shutdown
- Type 4 = Class A Alarm Before Shutdown
- Type 5 = Class B1 Alarm Before Shutdown
- Type 6 = Class B2 Alarm Before Shutdown
- Type 7 = Class C Alarm Before Shutdown



TTDJ SETUP MAP



- 0 = No Remote Lockout or Reset, #29 Is Class A
 1 = Remote Reset, No Remote Lockout, #29 Is Class A
 2 = Remote Lockout, No Remote Reset, #29 Is Class A
 3 = Remote Reset and Lockout, #29 Is Class A
 4 = No remote Reset or Lockout, #29 Is Class ESD
 5 = Remote Reset, No Remote Lockout, #29 Is Class ESD
 6 = Remote Lockout, No Remote Reset, #29 Is Class ESD
 7 = Remote Reset and Lockout, #29 Is Class ESD

NOTE: These keys are shown without their associated text in the diagram.

The STOP key serves the purpose of going into a setting and saving and exiting that setting.

The UP and DOWN keys navigate through the settings or change the value of a number.

User Set Up Menus

The following are the User Setup Menus for All TTDJ models:

- SETUP.1 **SETUP.1** = Class B1 Timer (0 – 5:00)
 SETUP.2 **SETUP.2** = Class B2 Timer (0 – 9:59)
 *SETUP.3 **SETUP.3** = Sensor 1-16 Type Setup
 SETUP.4 **SETUP.4** = Ignition Ground Delay (0 – 20 sec.)
 *SETUP.5 **SETUP.5** = Remote Setup
 0= No Remote Lockout or Reset, #29 is Class "A"
 1= Remote Reset, No Remote Lockout, #29 is Class "A"
 2= Remote Lockout, No Remote Reset #29 is Class "A"
 3= Remote Reset, and Lockout, #29 is Class "A"
 4= No Remote Reset or Lockout, #29 is Class "ESD"
 5= Remote Reset, No Remote Lockout, #29 is Class "ESD"
 6= Remote Lockout, No Remote Reset #29 is Class "ESD"
 7= Remote Reset and Lockout, #29 is Class "ESD"

*SETUP.6 **SETUP.6** = Hours Setup

The User Setup Menus shown below are also available for -T models:

- *SETUP.7 **SETUP.7** = Pulses per revolution
 SETUP.8 **SETUP.8** = Overspeed
 SETUP.9 **SETUP.9** = Underspeed

The User Setup Menu shown below is for ALL -DC models:

- SETUP.A **SETUP.A** = Modbus RTU node number 1-16 (-DC models)
 *These Set Up Menus are code protected (for all models).

To Enter User Set Up Menus

(Must be in Manual Stop #52)

To enter the User Setup Menus the TTDJ unit Must be in the Manual Stop (#52) condition. If a shutdown is present other than Manual Stop, press the "Reset" key, then immediately Press and Hold Both the Run/Stop and Up (Timer 0) keys. Now follow these steps:

- Press and hold both the Run/Stop and Up (Timer 0) keys until the LCD reads **hold...** (HOLD).
 - Continue to hold both keys for 3 more seconds approximately. The display reads **SETUP.0** (SETUP.0), you are now in the User Setup Menu.
 - Use the Up key (Timer 0) and Down (Test) keys to select the desired Setup Menu.
 - Press the Run/Stop key to enter the desired Setup Menu.
- NOTE: Some settings are password protected.**
- Use the Up and Down keys to preset the desired parameter. Press Reset to zero the value.
 - When the desired value is entered, press Run/Stop.
 - Repeat Steps 3-6 until all parameters are preset.
 - To exit User Setup, select SETUP.0 and press Run/Stop.

Code Protection

For Setup Menus that are code protected, the LCD will read "CODE.00" prompting the user to enter a code before allowing setup. Use the Up and Down keys to enter the code. If the code is entered incorrectly, the LCD will read "Error". After 3 incorrect entries, the Code Setup is exited. Once the correct Code is entered, the Setup Menu is accessed.

To Calibrate the Tachometer (TTDJ-DC-T and TTDJ-IGN-T models)

The TTDJ measures RPM based on the number of pulses per engine revolution. To calibrate the tachometer first enter the User Set Up Menus, see steps 1-3 from "To Enter User Set Up Menus" above.

Select SETUP.7. Enter the code, then enter your number of pulses per engine revolution (refer to Pulses/Revolution, above right).

Pulses/Revolution

TTDJ-IGN-T (Ignition Model)

For this model the number of pulses per revolution is determined by the number of cylinders and cycles of the engine, according to the following table:

Cylinders	Cycles	Pulses	Cylinders	Cycles	Pulses
1	2	1	6	2	6
2	2	2	6	4	3
2	4	1	8	2	8
3	2	3	8	4	4
4	2	4	10	4	5
4	4	2	12	4	6
5	2	5	16	4	8

NOTE: Divide the number of cylinders by 2 for split capacitor ignitions.
 Multiply the number of cylinders by 2 for throw away spark ignitions.

TTDJ-DC-T (DC Model)

For TTDJ-DC-T models the pulses per revolution can come from a magnetic pickup. The number of pulses per revolution is simply the number of teeth on the flywheel gear (32 to 360).

Sensor Input Set Up

Sensor inputs 1-16 are configurable. The following types are available:

- Type 0 = Class A, Shutdown
 Type 1 = Class B1, Shutdown
 Type 2 = Class B2, Shutdown
 Type 3 = Class C, Shutdown
 Type 4 = Class A, Alarm Before Shutdown†
 Type 5 = Class B1, Alarm Before Shutdown†
 Type 6 = Class B2, Alarm Before Shutdown†
 Type 7 = Class C, Alarm Before Shutdown†

To configure a Sensor Input:

- Enter the SETUP.3 menu (enter the code). The Display will read: **3 00** (3 00).
- Use the Up and Down keys to select the input to be configured. For example if you select Input #1 the display reads: **3 01** (3 01).
- Press the Run/Stop key. Assuming you selected Input #1, and that input is currently configured as a Class A, Shutdown, the display will read **01 0** (01 0).
- Use the Up and Down keys to select the desired Sensor Input Type.
- Press the Run/Stop key, the display reads: **3 01** (3 01).
- Repeat Steps 2-5 as necessary.
- To Exit press Reset, the display shows: **3 00** (3 00). Then press the Run/Stop key.

Elapsed Time Set / Reset

Enter the Elapsed Time Set Up, SETUP.6. First make sure the jumper for Input #30 is installed. To Set the time do the following:

- Enter the SETUP.6 menu (enter the code). The display will read the elapsed time in hours, after the 6 (for example: **6.00001** (6.00001) if the elapsed time is 1 hour).
- Set the desired time using the Up/Down keys. Press Reset to zero the time.
- When the desired time is entered, press the Run/Stop key.
- To exit User Setup, press Reset, the display will show: **SETUP** (SETUP 0) and press the Run/Stop key.

NOTE: Decimal fractional of the elapsed time is lost when the Elapsed Time Setup is entered, and it can only be set to the nearest hours.

† Alarm Before Shutdown is a function that causes annunciation and the alarm output, but will not cause a shutdown.

System Start Up

Press the **RESET** key to clear any faulted sensor input and unground/enable ignition for engine operation. Apply starting power to the engine.

Engine Speed (-T models only)

The first thing displayed on versions with Tachometer is the engine speed. While there is time remaining in either of the Class "B" timers, the display will alternate between engine speed and the Class "B" timers (4 seconds each). Once the Class "B1" timer expires, while there is time remaining in the Class "B2" timer, the display will alternate between the engine speed and the Class "B2" timer (4 seconds each). Once both Class "B" timers expire, the engine speed is displayed continuously.

Class "B1" Timer

While there is time remaining in the Class "B1" timer, the display will alternate between engine speed and the Class "B1" time remaining for example: "1 0.30" (4 seconds each). All sensor inputs configured as Class "B1" are locked out at this point. For non -T models the "B1" display will be steady. To zero this timer, press **TIMER "0"**.

Class "B2" Timer

Once the Class "B1" timer expires while there is time remaining in the Class "B2" timer, the display will alternate between engine speed and the Class "B2" time remaining for example: "2 0.30" (4 seconds each). All sensor inputs configured as Class "B2" are locked out at this point. For non -T models the "B2" display will be steady. To zero this timer press the **TIMER "0"** key, after the Class "B2" timer has expired.

Elapsed Time

To display the run hours, press the "**Display Hours**" key. The current Run hours will be displayed for 5 seconds. **NOTE:** On all non tachometer models (non -T) the **RUN HOURS** are displayed after the Class "B" Timers expire, instead of **ENGINE SPEED**. The decimal point flashes to indicate the unit is running.

Alarm Only Condition

If any one of the sensor inputs configured as an **ALARM-ONLY** is faulted, the Alarm Output will turn ON, and the sensor number will be displayed in the first two digits. Press the **RESET** key after the sensor input has cleared, to clear the display and to turn OFF the Alarm output.

Overspeed (-T models only)

If the engine speed exceeds the Overspeed Set point the engine will shutdown, bypassing the Ignition Ground Delay. The TTDJ-T models will display "50". Overspeed overrides the Test mode.

Underspeed (-T models only)

If after the Class "B1" Timer expires the engine speed falls below the Underspeed Setpoint, the engine will shutdown. The TTDJ will annunciate/display "51". Underspeed overrides the Test mode.

Manual Stop

To manually shutdown the engine, press the **STOP/RUN** key. The TTDJ will shutdown the system and the display will indicate "52". Manual Stop overrides the Test mode.



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Ignition Ground Delay

Upon reaching a shutdown condition, the unit will trip the fuel valve, and, after the delay expires, ground the ignition. This delay is bypassed on **Overspeed** (50), **Emergency Shutdown** (32), and sensor input #29 if configured as Class "ESD".

Loss of Ignition

TTDJ-IGN models annunciate/display "51" when ignition input is lost.

The energy stored in the FV+ circuit will trip the fuel valve.

Resetting Shutdown Fault

After the shutdown condition is cleared on the equipment, press **RESET** key.

Test Timer

The Test Timer is used to verify that sensors are wired properly and working correctly. To perform a sensor test while running do the following:

1. Press the **TEST** key and verify that the Test Timer is shown with 5 minutes: (3 5.00).
2. Trip the first sensor to be tested and verify that the sensor number and class type appear on the display (see displays below). The display will alternate between the Sensor Number and the Test timer.
3. Clear the sensor then press the **RESET** key. Verify that the sensor number is cleared from the display.
4. Repeat Steps 2 and 3 for each sensor.
5. To exit, press the **TIMER "0"** key or allow the Test Timer to expire.

NOTE: Any of the following conditions will override the Test Timer: **Emergency Shutdown** (32), **Overspeed Shutdown** (50), **Underspeed Shutdown -T models** (51), **Loss of Ignition** (51) non-T models, **Manual Stop** (52), and sensor input #29, if configured as a Class "ESD"..

Test Mode Display

In Test, when a sensor is tripped, he sensor number and the Class type are displayed, for example if sensor #1 (01) a Class "B1" shutdown is tripped in the Test the LCD reads "01 t1". The following are the Test Mode Displays:

	(t0): Class "A" Shutdown
	(t1): Class "B1" Shutdown
	(t2): Class "B2" Shutdown
	(t3): Class "C" Shutdown
	(t4): Class "A" Alarm
	(t5): Class "B1" Alarm
	(t6): Class "B2" Alarm
	(t7): Class "C" Alarm

Warranty

A two year limited warranty on materials and workmanship is provided with this Murphy product. Details are available on request and are packed with each unit.

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CONFIDENTIAL

SECURITY ACCESS CODE INFORMATION



MURPHY has made efforts to ensure the reliability of the TTDJ Series Digital Fault Annunciator. Please note that the TTDJ's "User Set Up Menus" are critical operating parameters. These numbers contain information that only qualified personnel should be allowed to access.

Items set improperly within these parameters can cause serious damage to the TTDJ Series Digital Fault Annunciator and to your equipment.

Access to the "User Set Up Menus" is password protected.

Please keep this access code away from unauthorized personnel.

The access code is designated as follows:

User Set Up Menus code = 35

Read all TTDJ Series installation and operation instructions before attempting to edit the User Set Up Menus, and make sure that the device is correctly installed.

Please contact Murphy if you have any questions.

1/2 in. (114 mm) Dial Temperature SWITCHGAGE®

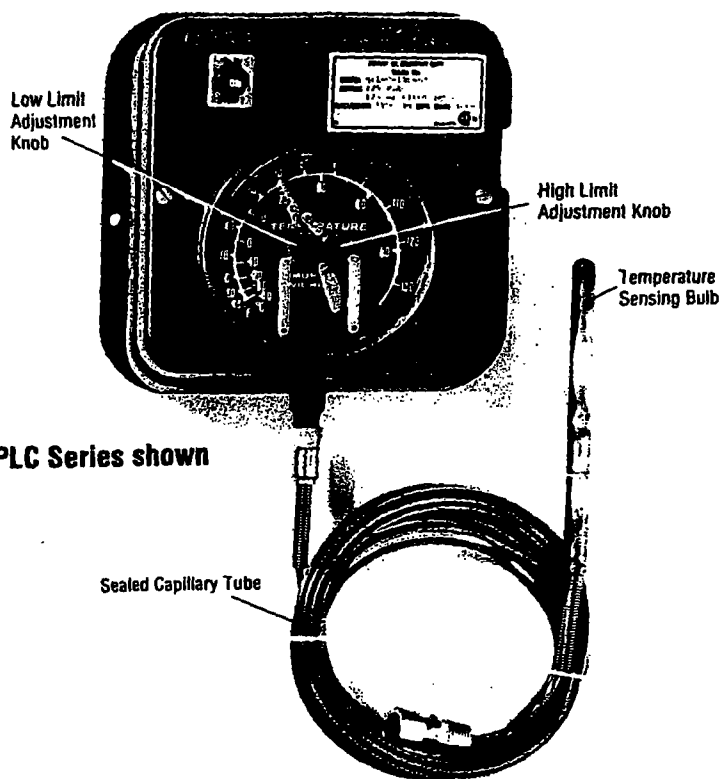
SPL Series

- Combination Indicating Gage with Independent Low and High Limit Switches
- Field-Adjustable and Highly Visible Low and High Temperature Contact Indicators
- For Start/Stop Operation or To Trip Alarms
- Panel and Wall Mount Versions
- Latching Control Relay Versions Available



Selected configurations are third party listed. Consult Murphy for details.

* Products covered by this bulletin comply with EMC Council directive 89/336/EEC regarding electromagnetic compatibility except as noted.



SPLC Series shown

Description

The 4.5 in. (114 mm) dial size SWITCHGAGE® is a mechanical gage for temperature indication. Its built-in adjustable, electrical contacts can be used for start/stop, to trip alarms and to shut down equipment. Ranges are available from 260 to 450°F (127 - 232°C) see p-2.

Basic Operation

This vapor actuated gage features a sealed capillary tube and sensing bulb. When subjected to heat, the liquid in the sensing bulb expands to vapor pressure that translates into a mechanical gage reading.

For models SPLC and SPLFC, the gage pointer acts as a pressure indicator and as one switch pole which completes a circuit when it touches the adjustable limit contacts. SPLC and SPLFC contacts have self-cleaning motion to ensure electrical continuity. A toggle switch is provided on SPLC models to override the low contact for equipment start-up.

Applications

- Gas Compressors
- Engine Coolant Temperature
- Process Temperature
- Heaters, Coolers and Water Pump Temperature

Specifications

Dial: White on black, dual scale, °F and °C standard, 4-1/2 in. (114 mm) diameter.

Case: Die cast aluminum, surface or panel mount.

Capillary: PVC armored copper tube, 5 ft. long (1.5 m.) standard—see options next page.

Sensing Bulb: Copper bulb: 1/2 in. (13 mm) OD; Length: 7 in. (178 mm). See "Dimension" page 2.

Pressure Rating: 600 psi (4.1 MPa) [41 bar].

Connection: 1/2 NPT compression fitting.

(optional stainless steel bulb available)

NOTE: use of thermowell is highly recommended

Overrange: Do not exceed 10% above full range.

Limit Contacts (SPLC and SPLFC): 1 SPDT center off; 2 A @ 30 V; 1 A @ 125 VAC pilot-duty.

Normally Open when pointer is in normal operating range. Contacts are gold plated silver.

Dry Relay Contact ("BP" Models):

10 A @ 28 VDC or 10 A @ 120 VAC.

Surface Mount Models Wire Connections:

1/2 NPT conduit and terminal block.

Panel Mount Models Wire Connections:

Wire leads, 18 AWG (1.0 mm²) x 9 in. (229 mm) long.

"-ES, -OS, -CC" Models Wire Connections:

1/2 NPTM conduit/ wire leads, 18 AWG (1.0 mm²) x 9 in. (229 mm) long.

Basic Models

SPLC Series SWITCHGAGE®

Surface mount version of the SWITCHGAGE®. For these models the gage pointer makes with two adjustable contacts to complete a pilot duty circuit.

SPLFC Series SWITCHGAGE®

Panel-mounting (round case) version of the SPLC.

SPLBP Latching Control Relay SWITCHGAGE®

This version of the SPLC Series is designed to start and to stop electric motor driven equipment. The pilot duty contacts of the SPLBP are connected to a latching control relay for automatic ON/OFF control, either directly or through a motor starter.

Shipping Weight: 8 lb. (3.6 kg) approximately.

Explosion-proof models: 22 lb. (10 kg) approx.

Shipping Dimensions: 16 x 11 x 5-1/2 in.

(406 x 279 x 140 mm). Explosion-proof models:

12 x 12 x 9 in. (305 x 305 x 229 mm).

Murphy offers square case configurations altered to fit round panel openings, see "Dimensions", next page.

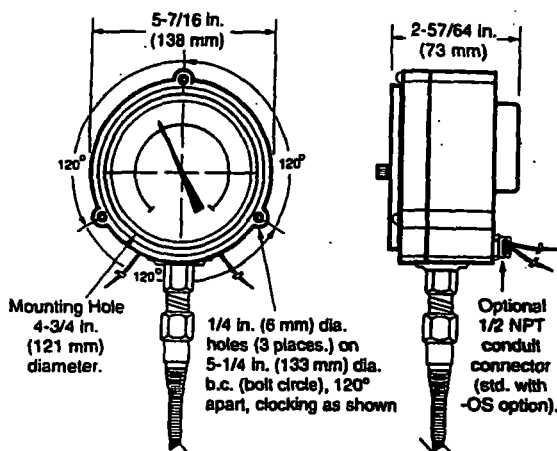
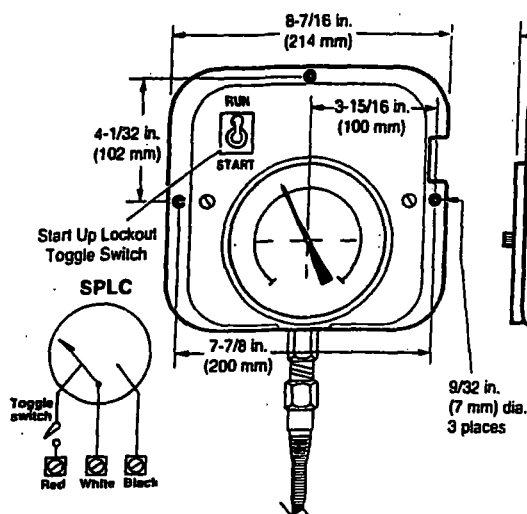
Warranty

A two-year limited warranty on materials and workmanship is given with this Murphy product. Details are available on request and are packed with each unit.

Surface Mount Models*

Dimensions

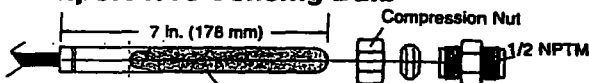
Panel Mount Models



* SPLCE, SPLBPE, 45TEE and 45TEBPE versions feature square case but altered to fit standard round panel mounting—not pictured.

NOTE: The use of a thermowell is highly recommended. For Murphy thermowell specs., see bulletin T-9003B, Murphy catalog sect. 10.

Temperature Sensing Bulb



Bulb Insertion: For 120° - 250° ranges: 5 in. min./6 in. max. (127-152 mm). For 350° - 450° ranges: 2-1/2 in. min./6 in. max. (64 / 152 mm).

How to Order (see example below)

Specify model number. Designator is not required for Standard configurations. List options alphabetically (A to Z) and place a dash (-) between each option.

SPLBP - 4 - 350 G 10 - EX

Base Model

SPLC
SPLCE
SPLFC

SPLBP*
SPLBPE*

*These version not covered by CE mark.

Voltage: (BP models only, feature NOT covered by CSA or CE marks)

Blank = 120 VAC
= 12 VDC

3 = 24 VAC
4 = 24 VDC

Ranges and Accuracy

	Lower 1/4	Middle 1/2	Upper 1/4
36 = -40 to 136°F (-40° to 58°C)	±4°F/±2°C	±2°F/±1°C	±2°F/±1°C
50 = 15 to 250°F (9° to 121°C)	±8°F/±4°C	±2°F/±1°C	±2°F/±1°C
10 = 130 to 350°F (60° to 180°C)	±8°F/±4°C	±2°F/±1°C	±3°F/±1.5°C
10 = 260 to 450°F (127° to 232°C)	±8°F/±4°C	±2°F/±1°C	±3°F/±1.5°C

Material / Capillary / Bulb

= PVC / Copper / Copper
= Stainless Steel / Copper / Copper
= 302 Stainless steel / 316 Stainless steel / 304 Stainless Steel

Options

Note: Not all options available for every model.

BC = Capillary tubing exits from back of case
ES = Environmentally sealed from the elements (F models only)
EX = Explosion-proof; SWITCHGAGE® within explosion proof case; Cl. 1, Div. 1, Grps. C & D
EL = (EXLC) Explosion-proof less case; internal gage mechanism only—without case
LC = Less case; SWITCHGAGE® mechanism and hardware connections—without case
OS = Silicone Oil filled case for resistance against corrosion, environment, vibration, electrical arc
TA = Tickler contact includes 1 auxiliary contact (tickler) and 2 limit contacts, all face-adjustable (SPL series)

Capillary Length (specify in feet or meters):

05 = 5 feet
10 = 10 feet
Etc.
1.5M = 1-1/2 meters
2M = 2 meters
Etc.
5 ft. increments are available up to 30 ft., thereafter, 10 ft. increments only. Some ranges are not available over 50 ft.

CSA Certified Models: SPL Series models are CSA approved for Non-Hazardous locations, except options BC, CC, ES, LC and OS. Explosion-proof "EX" models are CSA approved for Hazardous locations Class I, Groups C & D. SPLBP and SPLBPE models are not CSA certified.

murphy

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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.

Installation for 4-1/2 in. (114 mm) dial Temperature MURPHYGAGE® and SWICHGAGE®

SPL-92106N
Revised 04-02
Section 10
(00-02-0167)

Model Series: SPLG, SPLC, SPLBP, 45TE and 45TEBP
Options: -OS and -ES



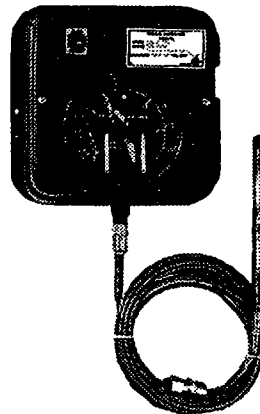
Please read the following instructions before installing. A visual inspection is recommended before mounting. General Information and these installation instructions are intended for all 4-1/2 in. (114 mm) dial temperature models.

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.



SPLC and SPLFC SWICHGAGE® instruments have high and low limit contacts to monitor, alarm or shutdown. The SPLC has a flanged case. SPLFC has a flush mount case intended for installation within a panel. A method to override the low limit contact for startup is provided on most models (see Operation Test Instructions on page 3).

45TE and 45TEF Series are versions of the SPL Series with 2-snap acting SPDT switches instead of the pointer type contacts. The 45TE Series does not include low contact lockout.

SPLBP and 45TEBP models are designed to start and stop electric motor driven equipment. The pilot duty contacts are connected to a latching control relay for automatic ON/OFF control, either directly or through a motor starter.

Options -OS and -ES

The -OS (oil sealed case) and the -ES (environment sealed case) options for corrosive environment feature flush mount case design to be installed within a panel.

Precautions

- Do NOT exceed rated temperature range.
- Use shock mounts as necessary to protect from vibration.
- Cutting or sharp bending the capillary will cause permanent damage to the SWICHGAGE® and will void the warranty.
- Excess capillary should be carefully coiled and secured away from damage.
- Do not route capillary along exhaust manifold.
- Avoid routing capillary at level higher than gage mounting.

Specifications

Dial: White on black, dual scale, °F and °C standard, 4-1/2 in. (114 mm) diameter.

Case: Die cast aluminum, surface or panel mount.

Capillary: PVC armored copper tube, 5 ft. (1.5 m) long standard.

Sensing Bulb: Copper bulb std.: 1/2 in. (13 mm) OD; Length 7 in. (178 mm). Pressure rating: 600 psi (4.1 MPa) [41 bar]. Connection: 1/2 NPTM compression fitting.

NOTE: Use of thermowell is highly recommended.

Switch Reset Deadband: Approximately 10% FS.

Snap-Acting Switches: See wiring information (page 4).

Dry Relay Contact ("BP" Models): 10 A @ 28 VDC or 10 A @ 120 VAC.

Wire Connections (Surface Mount): 1/2 NPTF conduit/terminal block.

Wire Connections (Panel Mount): Wire leads, 18 AWG (1.0 mm²) x 9 in. (229 mm) long.

Wire Connections (-ES, -OS, -CC): 1/2 NPTM conduit and wire leads, 24 AWG (0.22 mm²) x 33 in. (838 mm) long.

Overrange: Do not exceed 10% FS above full range.

Item Weight: 8 lbs (3.6 kg) approx. Explosion-proof models: 22 lb. (10 kg) approx.

Item Dimensions: 16 x 11 x 5-1/2 in. (406 x 279 x 140 mm) approximately. Explosion-proof: 12 x 12 x 9 in. (305 x 305 x 229 mm) approximately.

Accuracy

Temperature Range	Lower 1/4	Middle 1/2	Upper 1/4
-40 to 136°F (-40 to 58°C)	± 4°F (± 2°C)	± 2°F (± 1°C)	± 2°F (± 1°C)
15 to 250°F (9 to 121°C)	± 8°F (± 4°C)	± 2°F (± 1°C)	± 2°F (± 1°C)
130 to 350°F (54 to 177°C)	± 8°F (± 4°C)	± 2°F (± 1°C)	± 3°F (± 1.5°C)
260 to 450°F (127 to 232°C)	± 8°F (± 4°C)	± 2°F (± 1°C)	± 3°F (± 1.5°C)

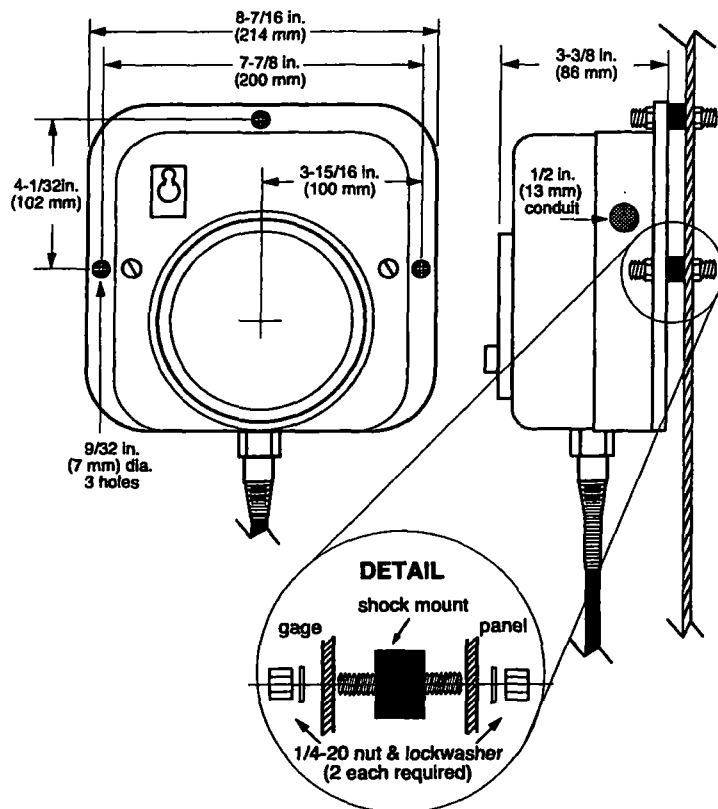
*Selected configurations are CSA approved. Consult factory for details.

**Products covered by this literature comply with EMC Council directive 89/336/EEC regarding electromagnetic compatibility as noted. Does not cover "BP" models.

CASE MOUNTING

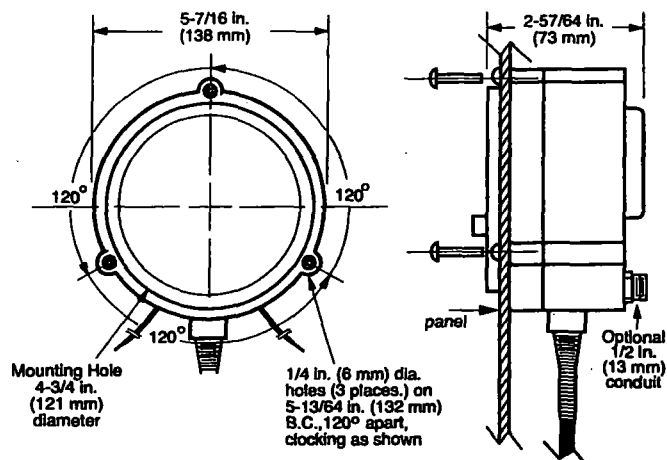
Wall Mount

Flanged case design intended for wall mount. Shown with shock mounts (optional).

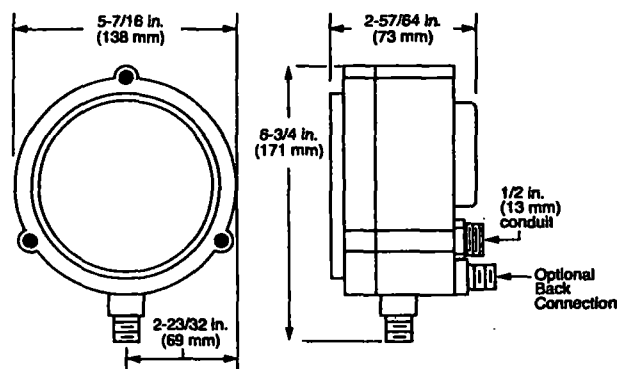


Flush Mount

A round case design to be mounted within a panel from 1/32 in. (1 mm) to 1/8 in. (3 mm) thick.

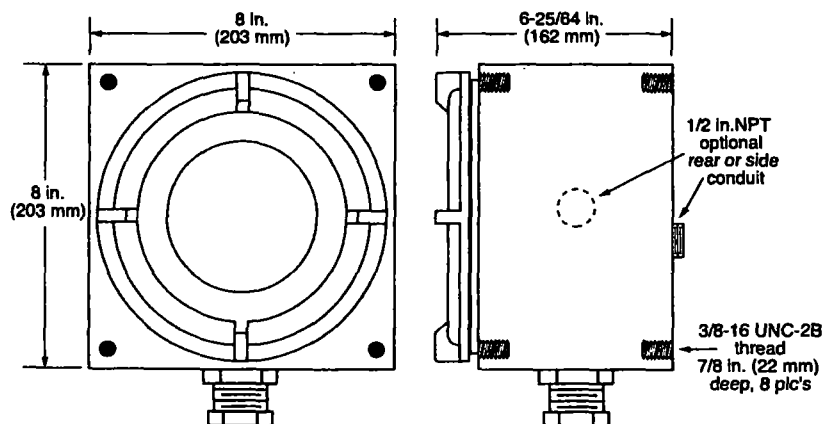


Options -OS, -ES (flush mount case)

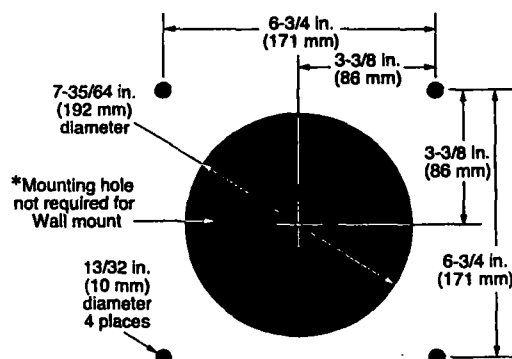


Explosion-proof Case Mount

Explosion-proof case can be mounted from face or rear.



Flush mount/Wall mount*



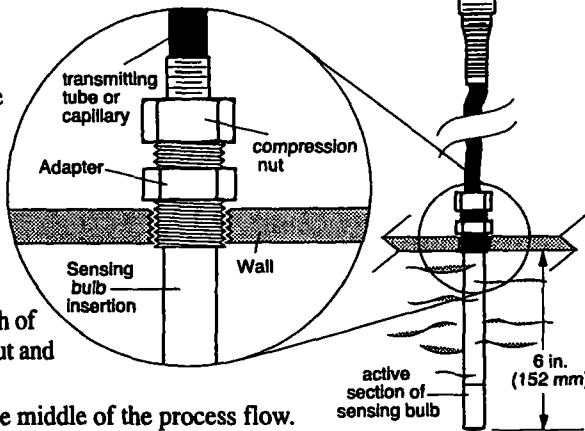
SENSING BULB-THERMOWELL INSTALLATION

Precautions

Cutting or sharp bending the capillary will cause permanent damage to the SWICHGAGE® and will void the warranty. Excess capillary should be carefully coiled and secured away from damage. Do not route capillary along exhaust manifold. Avoid routing capillary at a level higher than gage mounting.

Installing Sensing Bulb

1. Install the 1/2 NPT adapter into the application.
2. Slip compression nut and ferrule onto bulb.
3. Insert the sensing bulb directly through the adapter and fully immerse it into the process without interference. Be sure to leave enough of the bulb to allow the compression nut and ferrule to be tightened.
4. Keep the bulbs active section in the middle of the process flow.
5. Tighten the compression nut and ferrule. This will keep the bulb in place and obtain a full seal.



Installing Thermowell

Thermowell is recommended for high pressure applications or corrosive environments. It also allows temperature sensor to be changed or adjusted without opening connection to process.

1. First screw the thermowell into the process (pipe line).
2. Pass the sensing bulb through the nut and ferrule.
3. Fully insert the sensing bulb into the thermowell housing and secure it with the compression nut.

NOTE: The use of temperature transmitter grease or silicon grease on the tip of the sensing bulb is recommended to facilitate heat transfer to sensing bulb junction.

LIMIT CONTACTS / INDICATION POINTER ADJUSTMENTS

Limit Contact Adjustments

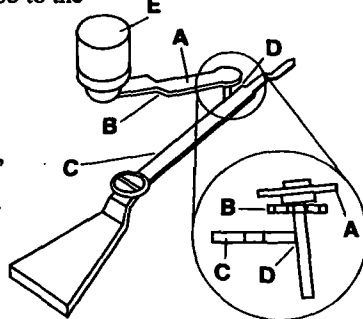
Facing the dial, left side knob is "Low limit" contact. Right side is "High limit" contact.

NOTE: the 45TE Series features a stacked limit indicator knob with both limit adjustments included. The bottom half knob adjusts the "Low" limit indicator, the top half is to adjust the "High" limit indicator.

To set limit contact, turn the knob to the desired point on the scale.

Limit Contact Wiping Feature (SPL)

The force of pointer causes the flexible contact arm (A) to "tilt" resulting in a wiping action (D). This clears away film or corrosion formed on the contact surfaces.



Indication Pointer Adjustments

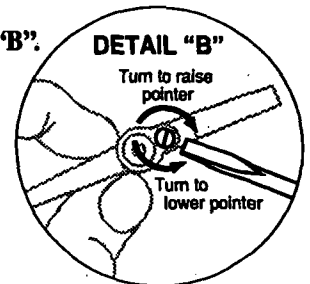
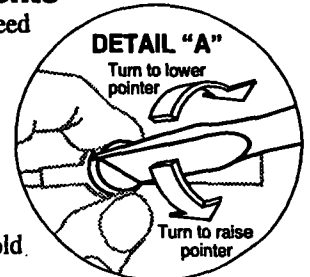
To reset to zero or to a known value proceed as follows:

1. Turn off power. Remove the snap ring and the lens/contact assembly (or open hinged cover).
2. Hold the pointer hub with thumb and forefinger then turn screw to desired point. Avoid touching the gold flashed, silver contact areas. See DETAIL "A"

For the 45TE Series see DETAIL "B".

3. Replace lens contact assembly and snap ring (or close hinged cover), and turn on power.

NOTE: Span adjustments and recalibration must be performed by an authorized mechanic or return the unit to Frank W. Murphy Mfr.



OPERATION TEST INSTRUCTIONS

SPLC and SPLFC Series

1. Perform operation test after the unit is installed and wired appropriately (see Typical Electrical Diagrams on page 4).
2. When temperature is applied to the sensing bulb the pointer will travel in a clockwise direction. (Adjust contacts to desired set points.)
3. Place the toggle switch (SPLC Series only) in the "start" position or otherwise override low contact. After the indication pointer rises past the low limit contact, return the toggle switch to the "run" position.
4. To test the limit contacts, turn the limit contact to be tested until it touches the pointer. That will trip the control circuit.
5. Reset the shutdown or alarm circuit device.

45TE Series

1. Perform steps 1 and 2 in the SPLC Operation Test Instructions.
2. To test the switches, turn the limit indicator until it touches the pointer, then continue to rotate until the snap-switch operates*
3. Reset the shutdown or alarm circuit device.

*The trip point indicator will stop the pointer movement slightly before the snap-switch operates. As temperature continues to increase or decrease, the trip point setting is reached.

TYPICAL ELECTRICAL DIAGRAMS

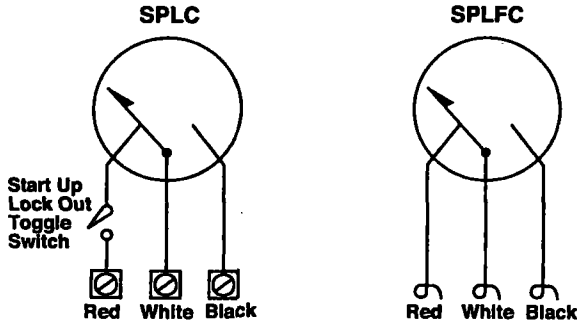


WARNING: Perform the wiring operation with the power source "OFF". Make sure the voltage and current requirements are within the SWITCHGAGE® ratings. Before wiring determine voltage and polarity for the application. Use the appropriate wire size. All connections should be made using a spade (forked) or ring terminals. For pigtail connections use wire nuts. Conduit is recommended to protect wires from damage.

SPLC and SPLFC

Contact Ratings: 1 SPDT, Center off; 2A, 30VDC, 1A, 125VAC pilot duty.

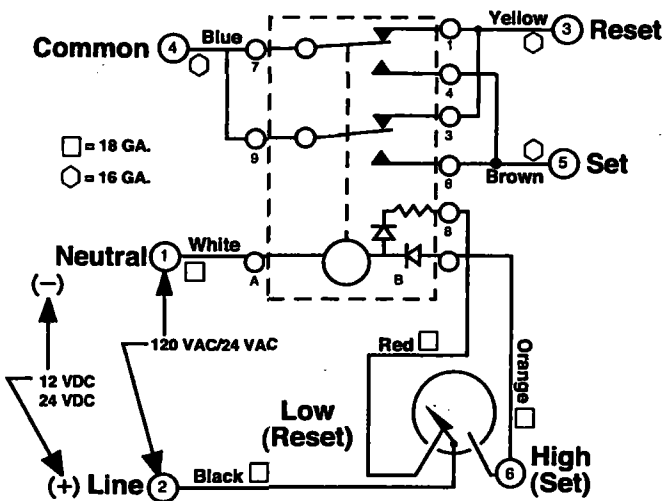
NOTE: Diagrams below show the pointer in the at rest (shelf) position.



SPLBP

Contact Ratings: SPDT dry relay contacts; 10 A, 125 VAC.

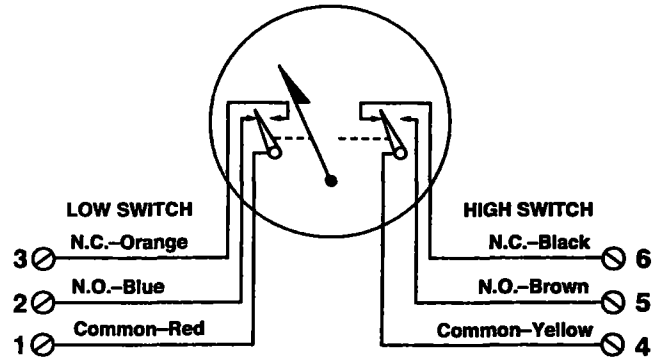
NOTE: Diagrams below show the pointer in the at rest (shelf) position.



45TE and 45TEF

Contact Ratings: 2-SPDT snap-switches (One for high and low temperature); 2 A inductive, 250 VAC each switch.

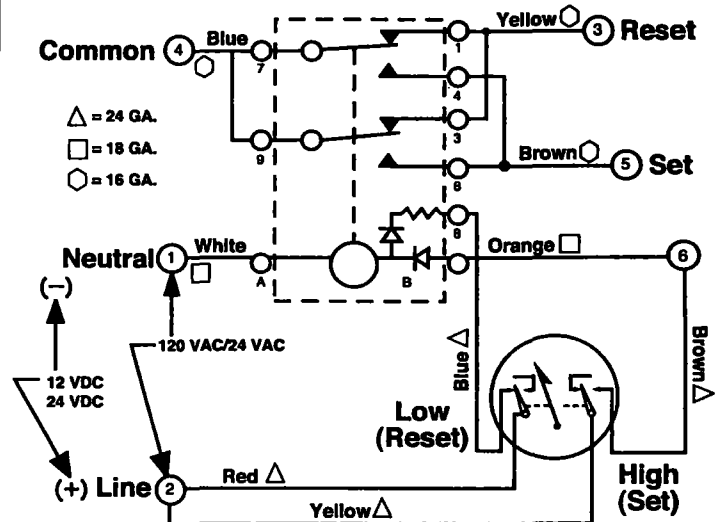
NOTE: Diagram below show the pointer in the at rest (shelf) position.



45TEBP

Contact Ratings: SPDT dry relay contacts; 10 A, 125 VAC.

NOTE: Diagrams below show the pointer in the at rest (shelf) position.



Transformer Relay Assemblies

For higher voltages the Murphy TR Assemblies can be used in conjunction with any SWITCHGAGE®.



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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.

Installation for 4-1/2 in. (114 mm) dial Pressure MURPHYGAGE® and SWICHGAGE®

Model Series: OPLC, OPLG, OPLBP, 45PE, 45PEBP and 45 Series

Options: -OS, -ES, -P4 and -P6



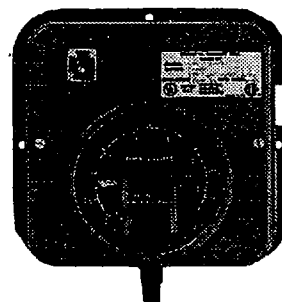
Please read the following instructions before installing. A visual inspection is recommended before mounting. General Information and these installation instructions are intended for all 4-1/2 in. (114 mm) dial pressure models.

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.



OPLC and OPLFC SWICHGAGE® instruments have high and low limit contacts to monitor, alarm or shut down. The OPLC has a flanged case. A method to override the low limit contact for start-up is provided on most models. See Operation Test section—page 3. OPLFC can be direct or panel mounted (see page 2).

OPLG and OPLFG MURPHYGAGE® instruments are indication-only pressure gages. Same as OPLC and OPLFC models except without switch (limit) contacts.

45 Series includes a magnetic switch to stop an engine or electric motor each time the gage contact operates. A lockout push button overrides low contact for startup. Other variations available.

45PE and 45PEF Series are versions of the OPLC Series featuring 2 snap-acting SPDT switches instead of the pointer type contacts. These units do not include low contact lockout.

OPLBP and 45PEBP are versions of the OPLC and 45PE models. They feature pilot duty limit switches connected to an internal latching control relay for "on/off" control directly or through a motor starter.

Specifications

Dial: White on black, dual scale, psi and kPa standard, 4-1/2 in. (114 mm) diameter.

Case: Die cast aluminum, surface or panel mount.

Overrange: Do not exceed 10% FS above full range.

Process Connection: 1/4 NPTM thru 1000 psi;

1/2 NPTM 1500 - 20,000 psi; back connection optional.

Sensing Element: Bronze or 316 stainless steel bourdon tube.

Gage Accuracy:

Indicating pointer within switch points with hysteresis of <1%:
±2% for first and last quarters of scale; middle half of scale is ±1%.

Pressure Relief Disc: Back of case (except EX models).

Switch Reset Deadband: Approximately 10% FS.

Snap-Acting Switches: See wiring information (page 4).

Dry Relay Contact ("BP" Models): 10 A @ 28 VDC
or 10 A @ 120 VAC.

Wire Connections (Surface Mount): 1/2 NPTF conduit/ terminal block.

Wire Connections (Panel Mount): Wire leads, 18 AWG
(1.0 mm²) x 9 in. (229 mm) long.

Wire Connections (-ES, -OS, -CC): 1/2 NPTM conduit
and wire leads, 24 AWG (0.22 mm²) x 33 in. (838 mm) long.

Item Weight: 5 lbs 6 oz (2.4 kg) approximately.

Explosion-proof models: 21 lb. (9.5 kg) approx.

Item Dimensions: 10 x 9 x 6 in. (254 x 229 x 152 mm) approximately.

Explosion-proof models: 12 x 12 x 9 in. (305 x 305 x 229 mm)
approximately.



Precautions

- Do NOT exceed rated pressure range.
- Do not use teflon tape on connection threads. Do not block the inlet orifice.
- For direct mount into the process, a vertical or ninety degree mounting is recommended.
- Use wrench on shank to tighten or loosen connection.
- Do not twist case when installing, this will damage internal components and will void the warranty. **Do not overtighten.**
- Use shock mounts as necessary to prevent excessive vibration.
- **COLD WEATHER WARNING:** If liquid in the system is allowed to freeze, it will expand and may damage the tube.
- Drain the system when freezing temperatures are expected.

Warranty

A two-year limited warranty on materials and workmanship is given with these Murphy products. Details are available on request and are packed with each unit.

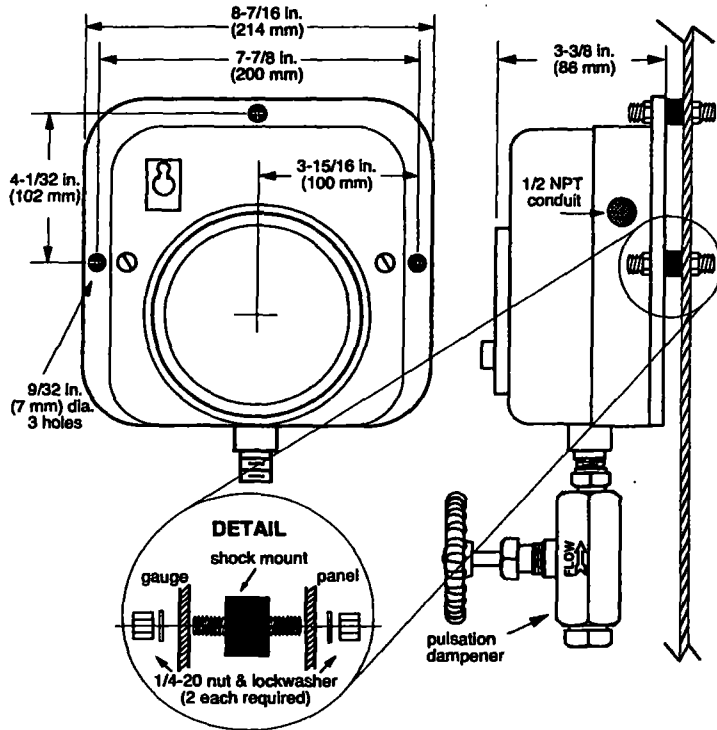
*Selected configurations are third party listed. Consult factory for details.

**Products covered by this bulletin comply with EMC Council directive 89/336/EEC regarding electromagnetic compatibility except as noted. Does not cover "BP" models.

CASE MOUNTING

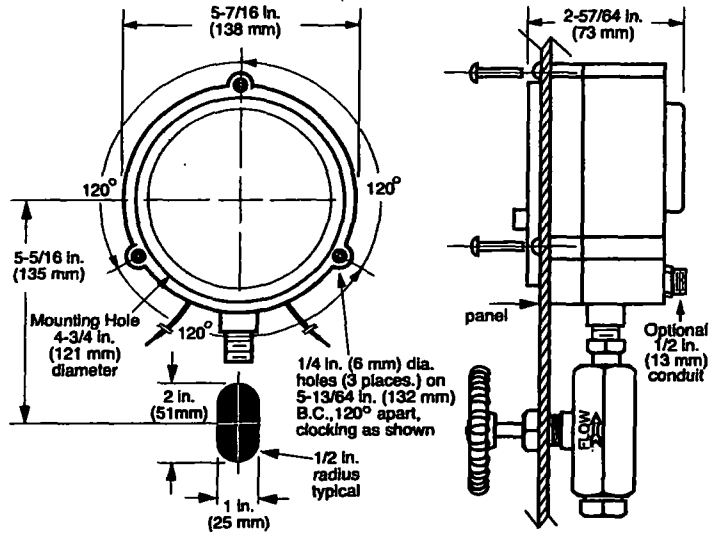
Wall Mount

Flanged case design intended for wall mount, it can also be direct mounted. Shown with shock mounts and pulsation dampener, (optional).

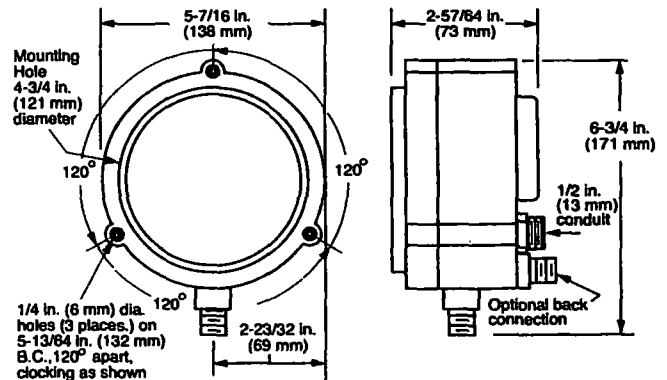


Flush Mount

A round case design to be mounted within a panel from 1/32 in. (1 mm) to 1/8 in. (3 mm) thick. It can also be direct mounted. Shown with pulsation dampener option.

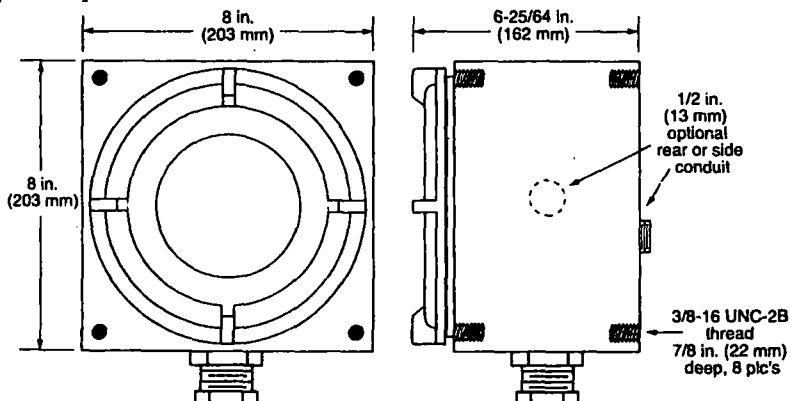


Options "OS" and "ES" (flush mount case)

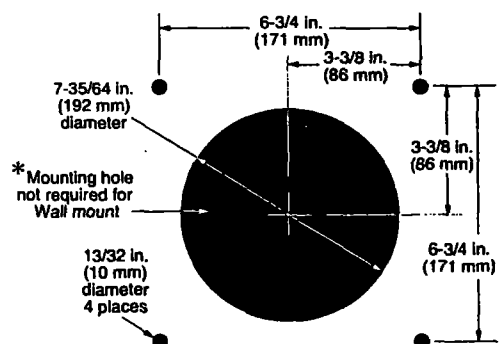


Explosion-proof Case Mount

Explosion-proof case can be mounted from face or rear.



Flush mount/Wall mount*



OPTIONS

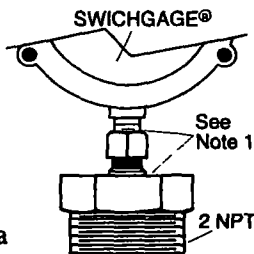
"OS" and "ES": The "OS" (oil sealed case) and the "ES" (environment sealed case) options for corrosive environment feature a panel mount case design or screw directly into the process. See page 2 for mounting.

Pulsation Dampener controls any pressure indicating instrument subject to pulsation. This device is NOT intended as a "shutoff" valve. (See mounting instructions, page 2).

P6 (was PT167) is a sealed mechanism with a typical application for oil well lead lines. It consists of a 2 NPT housing with a diaphragm seal filled with silicon fluid which attaches directly into the process.

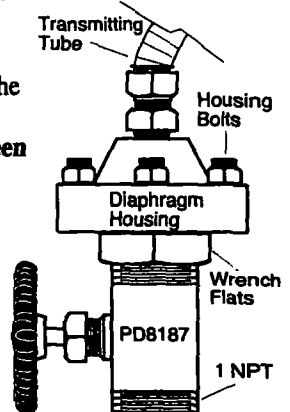
NOTES:

1. Do not tamper with or break sealed connections.
2. The pressure transmitter threads into a 2 NPT tee on the lead line. Tighten only the 2-5/8 in. (67 mm) hex fitting.



P4 (was PT147) is a remote seal mechanism with stainless steel armored capillary to protect the SWICHGAGE® from highly viscous and/or corrosive fluids.

1. Install the pulsation dampener into the source pressure connection. Use of thread sealant is suggested.
2. Loosen the eight housing bolts until the bottom housing is free to turn.
CAUTION: do not unscrew the green diaphragm capsule.
3. Tighten the bottom housing to the 1 NPT on pulsation dampener.
4. Tighten the eight housing bolts to 25 ± 3 foot lbs. by staggering the tightening to assure even clamping.
5. Route capillary away from heat source such as exhaust manifold.
6. Excess transmitting tube should be carefully coiled and secured to avoid any damage.
7. Do NOT cut capillary or make sharp bends.



LIMIT CONTACT / INDICATION POINTER ADJUSTMENTS

Limit Contact Adjustments

Facing the dial, left side knob is "Low limit" contact. "High limit" contact is located next to the "Low" limit contact.

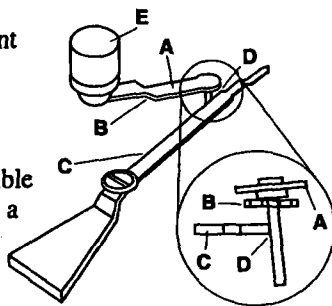
NOTE: the 45PE Series features a stacked limit indicator knob with both limit adjustments included. The bottom half knob adjusts the "Low" limit indicator, the top half is to adjust the "High" limit indicator.

- A. Contact arm-flex
- B. Contact arm
- C. Pointer Contact
- D. Initial point of contact
- E. Limit contact knob

To set limit contact simply turn the fingertip type knob to the desired point on the scale.

Limit Contact Wiping Feature

The force of pointer causes the flexible contact arm (A) to "tilt" resulting in a wiping action (D). This clears away film or corrosion formed on the contact surfaces.



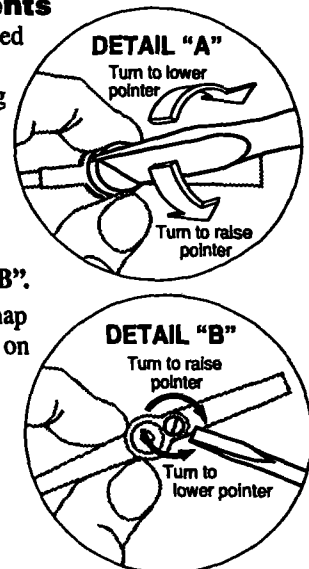
Indication Pointer Adjustments

To reset to zero or to a known value proceed as follows:

1. Turn off power. Remove the snap ring and the lens/contact assembly (or open hinged cover).
2. Hold the pointer hub with thumb and forefinger then turn screw to desired point. See **DETAIL "A"**.
3. Replace lens contact assembly and snap ring (or close hinged cover), and turn on power.

For the 45PE Series see DETAIL "B".

NOTE: Span adjustments and recalibration must be performed by authorized mechanic or return the unit to Frank W. Murphy Mfr.



OPERATION TEST INSTRUCTIONS

OPLC, OPLFC, OPLFDP and OPLBP

1. Perform operation test after the unit is installed and wired appropriately. (See typical wiring diagram page 4.)
2. When pressure is applied to the instrument either directly from a process variable or through a fluid/gas filled capillary, the pointer will travel in a clockwise direction. (Adjust contacts to desired set points.)
3. To start, place the toggle switch in the "start" position or otherwise override low contact.
4. After the indication pointer rises past the low limit contact, return the toggle switch or override device to the "run" position.
5. To test the limit contacts, turn the limit contact to be tested until it touches the pointer. That will trip the control circuit.
6. Reset the shutdown or alarm circuit device and repeat above sequence.

45 Series

1. Repeat steps 1 and 2. (See OPLC operation test instructions.)
2. Press the semi-automatic pushbutton located on the low contact knob.
3. Reset the magnetic switch pushbutton.
4. After the indication pointer rises past the low limit contact the lockout-pushbutton automatically disengages and the low limit is armed.
5. Repeat steps 5 and 6. (See OPLC operation test instructions.)

45PE, 45PEF and 45PEBP

1. Repeat steps 1 and 2. (See OPLC operation test instructions.)
2. To test the switches, turn the limit indicator until it touches the pointer, then continue to rotate until the snap switch operates*.
3. Reset the shutdown or alarm circuit device.

* The trip point indicator will stop the pointer movement slightly before the snap switch operates. As pressure continues to increase or decrease, the trip point setting is reached.

TYPICAL ELECTRICAL DIAGRAMS



WARNING: PERFORM THE WIRING OPERATION WITH THE POWER SOURCE "OFF". MAKE SURE THE VOLTAGE AND CURRENT REQUIREMENTS ARE WITHIN THE SWITCHGAGE® RATINGS. BEFORE WIRING DETERMINE VOLTAGE AND POLARITY FOR THE APPLICATION. USE THE APPROPRIATE WIRE SIZE. ALL CONNECTIONS SHOULD BE MADE USING A SPADE (FORKED) OR RING TERMINALS. FOR PIGTAIL CONNECTIONS USE WIRE NUTS. CONDUIT IS RECOMMENDED TO PROTECT WIRES FROM DAMAGE.

OPLC and OPLFC

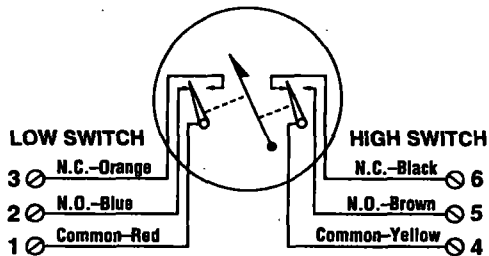
Contact Rating: 1 SPDT, Center Off; 2 A, 30 VDC, 1 A, 125 VAC pilot duty.



NOTE: Diagrams above show the pointer in the at rest (shelf) position.

45PE and 45PEF

Contact Rating: 2-SPDT snap-switches (one for high and low pressure), 2 A inductive, 250 VAC each switch. **NOTE:** Diagram below shows the pointer in the at rest (shelf) position.



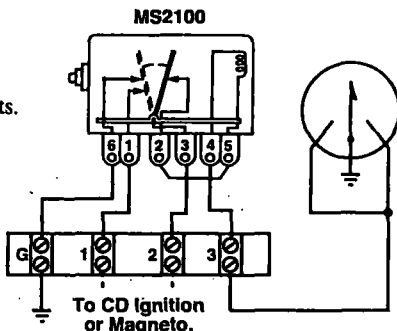
45 Series with MS2100

Contact Rating: 12/32 VDC coil, 10 A, 32 VDC battery ignition contacts; Magneto ignition coil, 10 A magneto ignitions contacts; CD ignition coil, 10 A CD ignition contacts; 120 VAC coil, 10 A, 120 VAC contacts.

NOTE: Diagram below shows the pointer in the operating position.

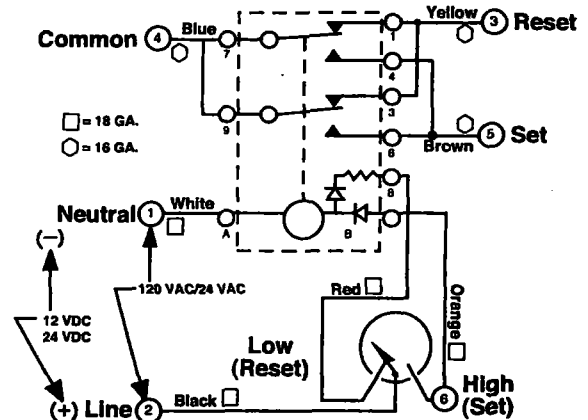
IMPORTANT:

Use with 110/120 VAC requires isolated ground SWITCHGAGE® instruments.



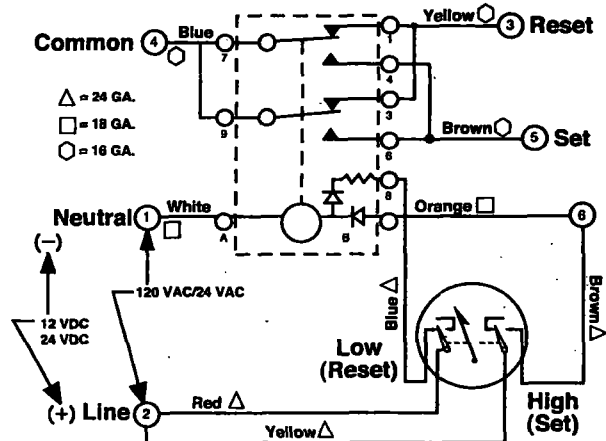
OPLBP

Contact Rating: SPDT dry relay contacts; 10 A, 125 VAC. **NOTE:** Diagram below shows the pointer in the at rest (shelf) position.



45PEBP

Contact Rating: SPDT dry relay contacts; 10 A, 125 VAC. **NOTE:** Diagram below shows the pointer in the at rest (shelf) position.



Transformer Relay Assemblies

For higher voltages, Murphy TR Assemblies can be used in conjunction with any SWITCHGAGE®.

murphy

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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.

Installation Instructions for Pressure and Vacuum 2 and 2-1/2 in. (51 and 64 mm) Dial MURPHYGAGE® and SWICHGAGE® Instruments. 20, 25, A20, A25 Series

P-95033N
Revised 02-02
Section 05
(00-02-0162)



Please read the following instructions before installing. A visual inspection of this product for damage during shipping is recommended.

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.

Description

The 2 and 2-1/2 in. (51 and 64 mm) dial size MURPHYGAGE® and SWICHGAGE® instruments are diaphragm-actuated, pressure or vacuum gages with a 1/8-27 NPTM pressure port connection (2 pressure ports for differential pressure models).

Models with face-adjustable contact(s) are rated for 2 A @ 30 V (pilot duty). If the gage case is steel (20P, 25P, 20DP, 25DP etc.) the ground path for the contact circuit is through the case. Therefore, the case must be installed in the ground plane of the electrical power supply.

If the case is polycarbonate (A20P, A20DP, A25P, A25DP etc.) the ground path is isolated and is made through the "C" or "P" terminals on the back of the gage case ("C" for A20 models; "P" for A25 models).

Models 20PE, 25PE, A20PE, A25PE etc. have a snap-acting switch instead of the face adjustable pointer type contact. Electrical rating is 3 A @ 30 VDC, 4 A @ 125 VAC. Reset differential for the switch is approximately 10% of the scale.

NOTE: Select a scale so your normal operating pressure is in the upper middle of the scale.



CAUTION: Certain dangers to human safety and to equipment may occur if some equipment is stopped without pre-warning. It is recommended that monitored functions be limited to alarm-only or to alarm before shutdown.

Alarm Before Shutdown Models

The 20PABS, A20PABS, 25PABS and A25PABS feature a front limit contact for equipment shut-down and an internal SPDT snap switch for Alarm Before Shut-Down. When the low side (preset point) of the snap switch trips, the N.C. terminal completes a circuit to activate an alarm. A continued decrease in pressure will complete the shutdown circuit. An increase in pressure of approximately 10% of scale is necessary before the snap-switch (alarm) will RESET and open the circuit.

NOTE: Face contact shut-down limit setting and snap switch low point are factory-set; specify when ordering if setting is other than standard.

Typical TATTLETALE® Magnetic Switch

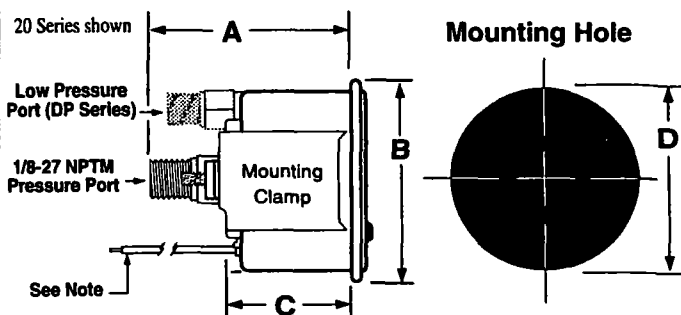
Murphy manufactures several, patented Magnetic Switches for protection of the pilot duty SWICHGAGE® contacts and to ensure positive shut-down of equipment. There are Magnetic Switches for CD ignition, Magneto, Battery systems and electric motor driven equipment. TATTLETALE® annunciators show the cause of shut-down. The first one to trip will lockout all other TATTLETALE® annunciators. Be sure the type of Magnetic Switch/TATTLETALE® matches the power source used to trip it.

NOTE: At equipment start-up (for models not having a built-in time delay) the reset button must be held in until normal operation occurs, or an external time delay may be used. Instructions are packed with each Magnetic Switch/TATTLETALE®.



Products covered by this literature comply with EMC Council directive 89/336/EEC regarding electromagnetic compatibility except as noted.

Typical Mounting Dimensions



	20 Series	A20 Series	25 Series	A25 Series
A	2-7/32 (56)	2-9/16 (65)	2-1/8 (54)	1-51/64 (46)
B	2-15/64 (57)	2-1/4 (57)	3-1/8 (79)	2-29/32 (74)
C	1-5/16 (33)	1-1/4 (32)	1-3/8 (35)	1-27/64 (36)
D	2-1/16 (53)	2-1/16 (53)	2-11/16 (68)	2-11/16 (68)

NOTES: 20/25 Series: 18 AWG pigtails. A20/A25 series: #4/#6 screws. The dimensions above are in inches and (millimeters).

Panel Mounting

All models can be installed in a panel from 0.032 to 0.250 in. (1 to 6 mm) thick. Remove the mounting bracket and insert the gage from the front side of the panel. Replace bracket and secure it. Do NOT overtighten. (See Figure 2).

Connecting the Pressure Port

1. Pressure tubing is generally not provided. Use of good quality flexible pressure tubing/hose and fittings is strongly suggested. Use at least 3/16 in. (5 mm) I.D. tubing. If using copper or rigid tubing, install at least 12 in. (305 mm) flexible hose from the gage to the rigid tubing. This prevents damaging vibration from reaching the gage. For most models a pulsation orifice, within the pressure port, is provided and it is removable for cleaning (Figure 2).

2. Connect tubing to the 1/8-27 NPTM port. Use of non-hardening thread sealing compound is recommended although thread is "dry seal".

IMPORTANT: Make sure NOT to foul pressure orifices with sealant. NEVER exceed maximum pressure rating for the gage range; see chart on p-2.

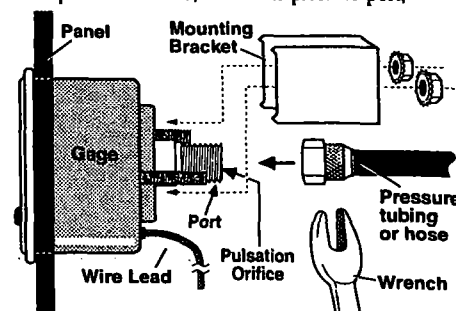


Figure 2

IMPORTANT: SWICHGAGE® instruments, Magnetic Switches and shut-down or alarm devices, properly used, are effective tools in any preventive maintenance program. For optimum performance, check these tools periodically: look for frozen pointers, kinked/worn tubing, broken wiring or loose connections; operate the contacts and watch for expected results. Replace damaged/worn parts; clean/repair as necessary. Check for correct/complete wiring, unbroken insulation and no accidental grounds. DO NOT run shut-down wires with ignition wiring. Check all tubing and connections for leaks. Mount Magnetic Switches and valves upright, to prevent moisture collection.

Pressure Ranges and Factory Settings

Ranges Available		Maximum Pressure	Std. Settings*		Hi Settings**		20/25PABS Settings				Start-up Lockout Settings					
psi	Bar		psi	Bar	psi	Bar	Low		Alarm†		Contact		Lockout		Release (max.)	
0-15 (103)	1.0	30 psi (21 MPa)	3 (21)	0.2	12 (83)	0.8	3 (21)	0.2	6 (41)	0.3	3 (21)	0.2	4 (28)	0.3	6 (41)	0.4
0-30 (207)	2.0	60 psi (21 MPa)	7 (48)	0.4	24 (165)	1.6	7 (48)	0.4	10 (69)	0.6	4 (28)	0.4	7 (48)	0.5	10 (69)	0.7
0-50 (345)	3.5	100 psi (21 MPa)	10 (69)	0.8	40 (276)	2.8	10 (69)	0.8	13 (90)	1.0	10 (69)	0.5	13 (90)	1.0	20 (138)	1.4
0-75 (517)	5.0	150 psi (21 MPa)	15 (103)	1.0	60 (414)	4.0	15 (103)	1.0	18 (124)	1.5	10 (69)	0.7	15 (103)	1.0	23 (159)	1.6
0-100 (690)	7.0	200 psi (21 MPa)	20 (138)	1.5	80 (552)	5.5	20 (138)	1.0	23 (159)	1.5	20 (138)	1.0	25 (173)	2.0	35 (241)	2.4
0-150 (1.0 MPa)	10	300 psi (3.4 MPa)	30 (207)	2.0	120 (827)	8.0	30 (207)	1.5	33 (228)	2.0	20 (138)	1.5	30 (207)	2.0	45 (310)	3.1
0-200 (1.4 MPa)	14	400 psi (3.4 MPa)	50 (345)	3.0	150 (1 MPa)	10	50 (345)	3.0	53 (365)	4.0	40 (276)	3.0	50 (345)	3.5	70 (482)	4.8
0-300 (2.1 MPa)	20	500 psi (3.4 MPa)	75 (517)	5.0	225 (1.6 MPa)	15	75 (517)	5.0	78 (538)	5.0	50 (345)	3.5	75 (517)	5.0	105 (724)	7.2
0-400 (2.8 MPa)	28	500 psi (3.4 MPa)	150 (1MPa)	7.0	300 (2.1 MPa)	20	75 (517)	5.0	150 (1MPa)	10	100 (690)	6.0	—	7.0	150 (1MPa)	10

Values in () are mathematical conversions from psi to kPa/MPa—they do not reflect second scale range. U.S.A. standard scale is psi/kPa; U.K. standard scale is psi/bar. Consult factory for other scales.

* Standard setting for 20P/25P and 20PE/25PE models.

** Low settings for Hi/Lo option same as standard settings. Hi/Lo option available for 20P/25P models only.

† SPDT Snap-switch is the alarm switch.

Connecting Vacuum Models

The vacuum SWICHGAGE®/MURPHYGAGE® measures intake manifold vacuum and gives an indication of the load applied to the engine.

1. Mount the gage in a suitable location so that the face is visible and easily accessible.



CAUTION: Make SURE NOT TO FOUL the pressure orifices with pipe dope or dirt or the SWICHGAGE® instrument will not operate.

2. Connect suitable tubing to the 1/8-27 NPT port of the gage and to an open port in the intake manifold. Mounting kit V5179 is suggested and includes tubing and necessary fittings. The manifold fitting is 1/4 NPT. Figure 3 shows a typical mounting using V5179 kit. A Murphy PD2160 is also recommended.
3. Be sure connections are tight—gage will not operate properly if line leaks.

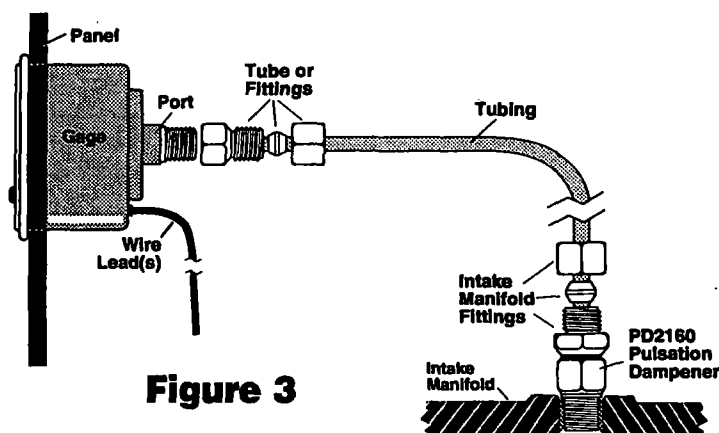


Figure 3

Connecting Differential Pressure Models

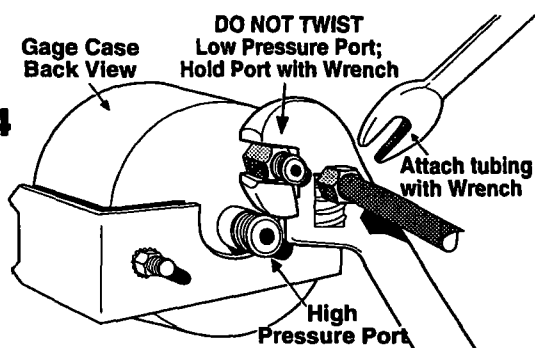
Differential pressure models are typically applied to indicate restriction in oil/fuel filters. The "High" pressure port (center mounted) is piped to the Inlet side of the filter. The "Low" pressure port (top center mounted) is piped to the Outlet side of the filter.



CAUTION: Make SURE NOT TO FOUL the pressure orifices with pipe dope or dirt or the SWICHGAGE® instrument will not operate.

1. To connect the high pressure tubing use at least 3/16 in. (5 mm) I.D. flexible pressure tubing/hose and fittings. If using copper or rigid tubing, install at least 12 in. (305 mm) flexible hose from the gage to the rigid tubing (to prevent damaging vibration to the gage, see Figure 2).

Figure 4



2. You **MUST** use a second wrench on the **Low Pressure** port when tightening tube fittings. (Figure 4). Notice that a wrench is used for holding the low pressure port while a second wrench will tighten the pressure tubing/hose fitting onto the port.



WARNING: Failure to use a second wrench on the low pressure port when tightening tube fittings may result in damage to the internal pressure tubing. Do NOT overtighten connection to port.

IMPORTANT: NEVER exceed maximum static pressure or differential pressure ratings for your gage range; stated in chart below.

Ranges* Available	Max. Static Pressure	Max. Differential Pressure	Contact Setting
0-15 (0-103) [0-1.0]	200 (1.4) [14]	30 (207) [2.0]	10 (69) [0.8]
0-30 (0-207) [0-2.0]	300 (2.1) [20]	60 (414) [4.0]	20 (138) [1.0]
0-50 (0-345) [0-3.5]	300 (2.1) [20]	100 (690) [7.0]	30 (207) [2.0]
0-75 (0-517) [0-5.0]	300 (2.1) [20]	150 (1.0) [10]	50 (345) [3.5]
0-100 (0-690) [0-7.0]	300 (2.1) [20]	200 (1.4) [14]	60 (414) [4.0]

* Values are shown in psi, (kPa/MPa) and [bar]. Values in kPa/MPa and bar are mathematical conversions from psi—they do not reflect actual second scale range.

Setting the SWICHGAGE® contacts



IMPORTANT: If the SWICHGAGE® has a lockout push button on the face, a contact setting higher than the factory setting will make the lockout device inoperative.

For 20PE, 25PE, 25DPE, A20PE, A25PE and A25DPE models the switch trip point **CANNOT** be set at either the lowest or the highest extremes of the scale. Trip point **MUST** allow for the switch reset differential. For adjustable switch versions, the switch point is adjustable **ONLY** over the lower half of the scale.

1. All contacts are set using a 1/16 in. hex wrench (Figure 5).
2. Some models such as A20PE, A25PE, etc. may not have field adjustment. Consult the factory if in doubt. For adjustable models, 1/4 turn clockwise lowers switch operating point approximately 7% of scale.
3. Observe the "normal operating" pressure or vacuum readings. Set the contact slightly **below** minimum reading observed or slightly **above** minimum pressure recommended by equipment manufacturer. For differential pressure models set the contact slightly **below** the desired maximum differential pressure.

Testing the Contacts

1. With equipment running; use a 1/16 in. hex wrench to rotate contact until it touches the pointer. Do NOT force contact against the gage pointer. Equipment should shut down and/or alarm should operate. Reset the contact (See Figure 5).
2. **VERY IMPORTANT** Each time you start the machine, observe that the SWICHGAGE® is indicating pressure or vacuum. Visual inspection and regular testing should be normal procedure to ensure proper operation and to achieve maximum results from your SWICHGAGE®.

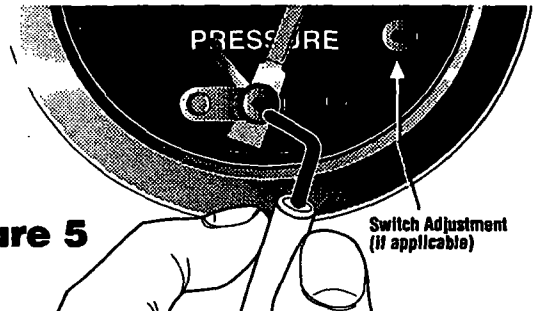


Figure 5

Wiring Installation



WARNING: DISCONNECT ALL ELECTRICAL POWER BEFORE BEGINNING THE WIRING INSTALLATION. FOR BATTERY IGNITION SYSTEMS, DISCONNECT THE BATTERY GROUND STRAP. FACE ADJUSTED POINTER TYPE CONTACTS ARE PILOT DUTY. DO NOT EXCEED CONTACT RATINGS ON ANY SWICHGAGE® MODEL.

20 and 25 Series models wire leads are 18 AWG or 20 AWG, 12 in. (305 mm) long. A20 and A25 Series models have number 4 or number 6 screw terminals.

When installing the SWICHGAGE® on a ungrounded panel, you **MUST** provide a ground wire from the SWICHGAGE® to a common ground. Install **ONLY** in a 12 or 24 V system. Warning lights or audible signal **MUST** be of the same voltage as the battery. Current draw should **NEVER** exceed SWICHGAGE® contact ratings.

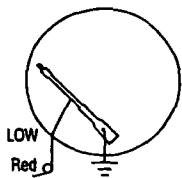
CAUTION: Ordinary incandescent lights are damaging to SWICHGAGE® contacts. We recommend using our direct connected alarms TL-7 flashing lamp and/or SAH MINI-SIREN.

The pictorial below shows typical wirings for each base model. Look for specific typical wiring diagram with your base model number and wire accordingly.

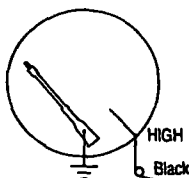
The pointer is shown in the **Shelf Position**. Face adjusted pointer type contacts are rated pilot duty 2 A @ 30 VAC/DC. Snap-switch contacts are rated 3 A @ 30 VDC; 4 A @ 125 VAC.

CAUTION: On some models pointer contact and ABS switch share the same "Common". Voltage source **MUST** be the same. Maximum voltage is 30 V. Consult factory for applications with 120 VAC systems.

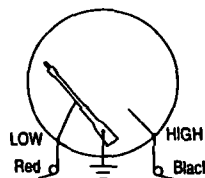
20P and 25P



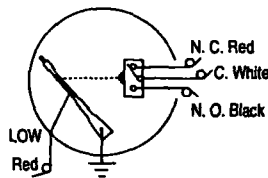
20DP and 25DP



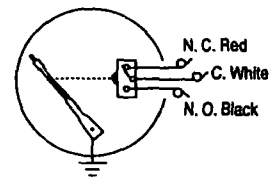
20P-HL and 25P-HL
20V and 25V



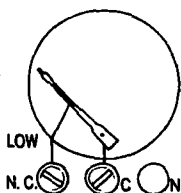
20PABS and 25PABS



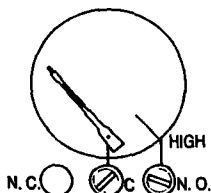
20PE, 20DPE,
25PE and 25DPE



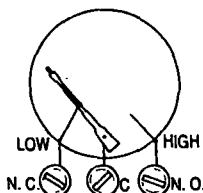
A20P



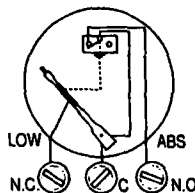
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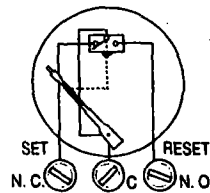
A20P-HL and A20V



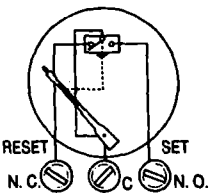
A20PABS



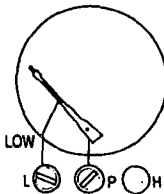
A20PE



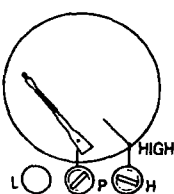
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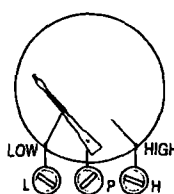
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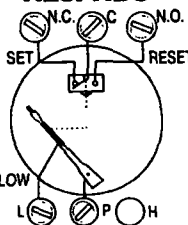
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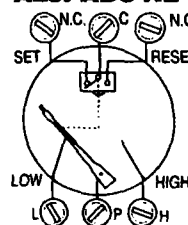
A25P-HL and
A25V



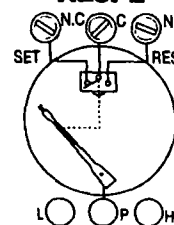
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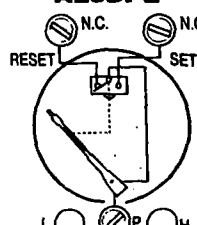
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A25PE



A25DPE



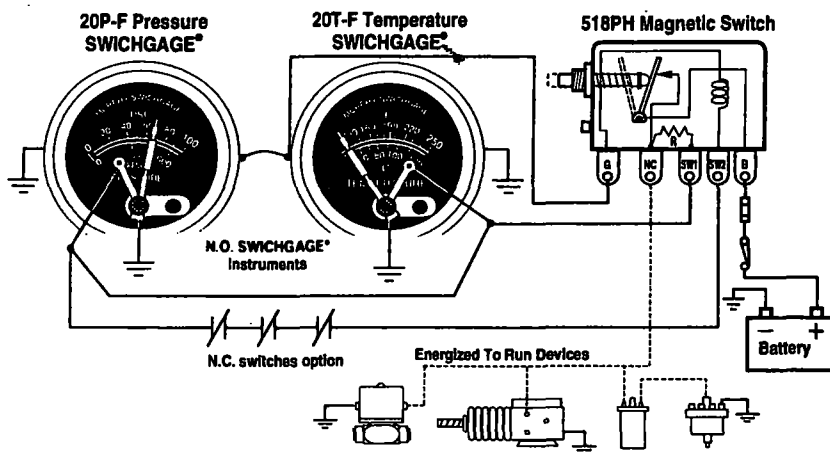
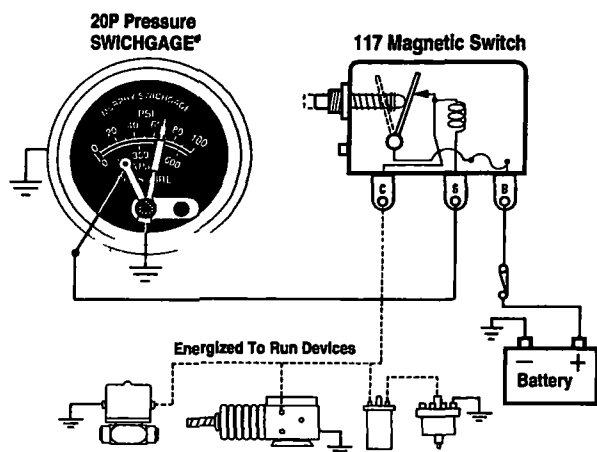
Installing The Magnetic Switch



WARNING: DISCONNECT THE BATTERY OR POWER SOURCE BEFORE BEGINNING THE INSTALLATION. SEE SPECIFIC WIRING INSTRUCTIONS PACKED WITH EACH MAGNETIC SWITCH / TATTLETALE®.

1. Mount with electrical lugs down. Drill mounting holes in panel.
2. Clean away burrs and filings. Position the Magnetic Switch in the panel, making sure the pilot stud is in place.
3. Add decal, then washer, then nut and tighten.

NOTE: Murphy components are easily wired and maintained. Use good quality wire and terminals. The type of Magnetic Switch differs for various applications. See typical wirings below. Wiring and instructions are packed with each Magnetic Switch.



Troubleshooting

DO THIS FIRST: Look for broken wiring, frozen pointer, dirty contacts (will not make), burnt pointer or contact. Verify that all wiring is intact and connections are tight. Verify that SWICHGAGE® has not been damaged (hit or dropped). Verify that there is pressure/vacuum supplied to the gage. Verify that the SWICHGAGE® is operative (it reads). Verify that the alarm or shutdown device is fully operable; and check other components such as spark plugs, ignition, fuel pump and filter, etc. Reset Magnetic Switch and verify that it stays latched.

SYMPTOM	CAUSE	TEST/REMEDY
Engine will not start.	<ol style="list-style-type: none"> 1. Short or Open circuit, be sure the Magnetic Switch latches and puts out power to the run device or removes ground (ignition). Check for power/ground at run device. 2. Control circuit overloaded by accessories (blown fuse in Magnetic Switch). 3. False ground in control circuit. 	<ol style="list-style-type: none"> 1. Reset Magnetic Switch and make sure it stays latched. Refer to installation instructions for 518PH Magnetic Switch (provided with unit). 2. Find blown fuse and replace (use 14 A fuse). Reroute the accessories. 3. Repair.
False shutdown.	<ol style="list-style-type: none"> 1. SWICHGAGE® circuit has intermittent open or short. 2. Vibration causes the Magnetic Switch to trip. 	<ol style="list-style-type: none"> 1. Check all wiring and repair/replace as necessary. 2. Repair and relocate the switch as needed.
SWICHGAGE® closes but does not trip the magnetic switch or kill the engine.	<ol style="list-style-type: none"> 1. Incomplete shutdown circuit. 2. Dirty SWICHGAGE® contacts. 3. Ignition not providing power to primary terminal post. 4. SWICHGAGE® case may not be grounded. 5. Incorrect Magnetic Switch for type of power. 	<ol style="list-style-type: none"> 1. Locate open circuit and repair. 2. Clean and check that contacts make. 3. Repair ignition. 4. Ground case. 5. Replace with correct Magnetic Switch.
Magnetic Switch tripped but engine is still running.	<ol style="list-style-type: none"> 1. Open circuit between the Magnetic Switch and the shutdown device. 2. Lost ground to kill the engine. 	<ol style="list-style-type: none"> 1. Check wiring from Magnetic Switch to shutdown device, repair or replace. 2. Check all wiring and connections and repair.
Pointer will not operate properly. Inaccurate reading.	<ol style="list-style-type: none"> 1. Frozen pointer 2. Loose pointer spring (caused by hitting or dropping gage). 3. Plugged pressure orifice. 	<ol style="list-style-type: none"> 1. Return for repair or replacement. 2. Return for repair or replacement. 3. Remove and clean.
Pointer/contact burned-in two.	Without exception this condition is caused by incorrect wiring or short circuit.	Recheck wiring; replace SWICHGAGE® or return for repair.

WARRANTY

A two year limited warranty on materials and workmanship is provided with this Murphy product. Details are available on request and are packed with each unit.



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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.

Instructions for Installation and Maintenance

For all 2 in. (51 mm) and 2-1/2 in. (64 mm) Dial Temperature MURPHYGAGE® and SWICHGAGE®

T-8446N
Revised 09-02
Section 10
(00-02-0168)



Please read the following information before installing. A visual inspection of this product for damage during shipping is recommended before mounting. General information and these installation instructions are intended for all 20T, 25T, A20T, and A25T series models.

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.

Description

Murphy 2 in. (51 mm) and 2-1/2 in. (64 mm) MURPHYGAGE® and SWICHGAGE® instruments have a remote sensing bulb connected to the gauge head by a sealed capillary system. **DO NOT CUT THIS CAPILLARY OR BEND AT A SHARP ANGLE.** The sensing bulb and capillary are filled with a liquid.

When heat is applied to the sensing bulb the liquid turns to vapor which exerts pressure against the diaphragm movement of the gauge. This movement is read on the dial face as temperature.

Models having face adjustable contact(s) are rated for 2 A @ 30 V (pilot duty). If the case is steel (models 20T, 20SD, 25T, etc.), the ground path for the contact circuit is through the case. Therefore, the case must be installed in the ground plane of the electrical power supply.

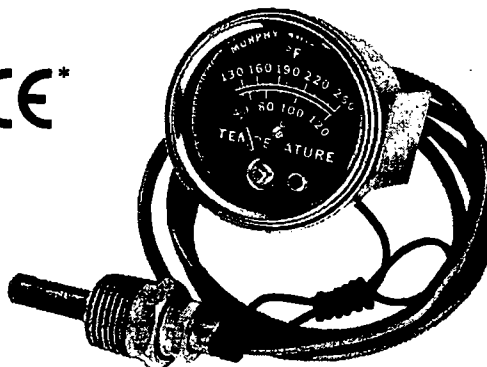
If the case is polycarbonate (models A20T, A25T), the ground path is isolated and is made through the "C" or "P" terminal on the back of the case.

Models 20TE, A20TE, 25TE and A25TE have a snap-acting switch instead of the face adjusted pointer type contact. Electrical rating is 3 A @ 30 VDC, 4 A @ 125 VAC. Reset differential for the switch is approximately 10% of the scale below the trip point. Trip point is factory set and must be special ordered for field adjustable.

SWICHGAGE® models with Alarm Before Shut-down

The 20TABS, A20TABS, 25TABS and A25TABS feature a front limit contact for high temperature equipment shut-down and an internal SPDT snap switch for Alarm Before Shut-Down (see Wiring Diagram, page 3). When the high side (preset high temperature point) of the snap switch trips, the N.O. terminal completes a circuit to activate an alarm. A continued increase in temperature will complete the shutdown circuit. A decrease in temperature of approximately 10% of scale is necessary before the snap-switch (alarm) will RESET and open the circuit.

NOTE: The front contact shut-down limit setting (adjustable) and snap switch high point are preset at the factory; if settings other than standard are necessary, then specify when ordering.



Typical TATTLETALE® Magnetic Switch

Murphy manufactures several, patented Magnetic Switches for protection of the light duty SWICHGAGE® contacts and to ensure positive shut-down of equipment. There are Magnetic Switches for Capacitor Discharge ignition, Magneto, or Battery systems, and models for electric motor

driven equipment. TATTLETALE® annunciators are indicators that show the cause of shut-down. TATTLETALE® annunciators are used in conjunction with several different SWICHGAGE® instruments. Selected TATTLETALE® models can be wired so that the first one to trip will lockout all other TATTLETALE®s. Be sure the type of Magnetic Switch matches the power source used to trip it.

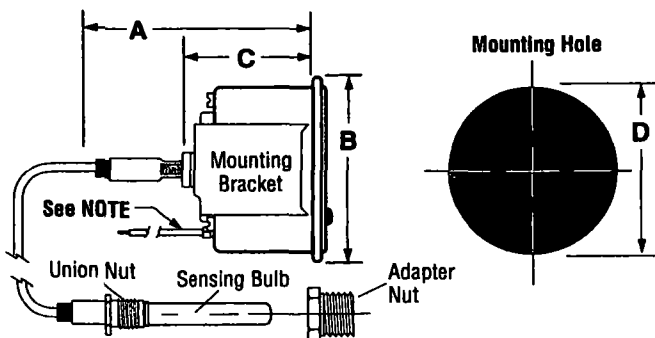
NOTE: At equipment start-up, the Magnetic Switch reset button must be held in until normal operation occurs, or an external time delay may be used. See examples of typical wiring and instructions packed with each Magnetic Switch.



CAUTION: Certain dangers to human safety and to equipment may occur if some equipment is stopped without pre-warning. It is recommended that monitored functions be limited to alarm-only or to alarm before shutdown.

IMPORTANT: SWICHGAGE® instruments, Magnetic Switches and shut-down or alarm devices, properly used, are effective tools in any preventive maintenance program. For optimum performance, check these tools periodically: look for frozen pointers, kinked/worn tubing, broken wiring or loose connections; operate the contacts and watch for expected results. Replace damaged/worn parts; clean/repair as necessary. Check for correct/complete wiring, unbroken insulation and no accidental grounds. **DO NOT** run shut-down wires with ignition wiring. Check all tubing and connections for leaks. Mount Magnetic Switches and valves upright, to prevent moisture collection.

MOUNTING DIMENSIONS



NOTE: 20 and 25 Series have 18 AWG pigtails. A20 series has #4 screws. A25 series has #6 screws.

For All 20, 25, A20, and A25 Series Temperature MURPHYGAGE® and SWICHGAGE® Instruments

	20 Series	A20 Series	25 Series	A25 Series
A	2-7/32 (56)	2-9/64 (54)	2-1/8 (54)	1-51/64 (46)
B	2-15/64 (57)	2-1/4 (57)	3-1/8 (79)	2-29/32 (74)
C	1-5/16 (33)	1-27/64 (36)	1-3/8 (35)	1-27/64 (36)
D	2-1/16 (53)	2-1/16 (53)	2-11/16 (68)	2-11/16 (68)

NOTE: The dimensions above are in inches and (millimeters).

* Products covered by this literature comply with EMC Council directive 89/336/EEC regarding electromagnetic compatibility except as noted.

INSTALLATION

WARNING: DISCONNECT THE BATTERY OR POWER SOURCE BEFORE BEGINNING THE INSTALLATION. DO NOT OPEN RADIATOR CAP OR FITTINGS ON A HOT ENGINE. DANGEROUS BURNS CAN OCCUR.

Panel Mounting

The 20, 25, A20 and A25 series models can be installed in a panel from 0.032 in. (1 mm) to 0.250 in. (6 mm) thick. See Mounting Dimensions, page 1. Remove the mounting bracket completely and insert the MURPHYGAGE®/SWICHGAGE® from the front side of the panel. Replace the bracket and secure it in place. **IMPORTANT:** Do NOT overtighten the mounting bracket. Shockmount the panel as necessary.

LIQUID COOLED ENGINES:

1. Drain engine coolant to a level below the temperature sensing connection/plug. This connection is on the engine side of the thermostat generally near thermostat housing. Consult your engine manual.
2. Remove adapter nut from temperature sensing bulb and union nut.
3. Apply a non-hardening thread sealant to the adapter nut and screw securely into the water jacket opening in the engine.
4. Route the temperature capillary AWAY from hot surfaces such as exhaust manifolds.
5. Place the sensing bulb into the adapter nut and observe that the sensing bulb does not "bottom" in the water jacket nor are there other obstructions in the water jacket opening. Secure sensing bulb into the adapter nut with the 5/8-18 union nut. See Figure 2.

CAUTION: Do NOT cut or bend the temperature capillary at a sharp angle. Excess capillary must be carefully coiled and secured. The temperature sensing bulb must be immersed directly into the water jacket flow to sense coolant temperature. Do NOT install into a tee or other fitting. Use only Murphy adapter nuts.

6. Coil excess temperature capillary into a 2 in. (51 mm) diameter minimum coil. Tie the coil to prevent excessive movement.
7. Allow the engine to warm up and the thermostat to open. Slightly loosen the 5/8-18 union nut on the temperature sensing bulb to allow trapped air to escape from the cooling system. Retighten the nut.

WARNING: Perform this operation using appropriate protection. Trapped air and coolant may cause burns.

AIR COOLED ENGINES:

Temperature for air cooled engine can be measured in the cylinder head or in the lubricating oil. Oil temperature will give a more uniform reading than cylinder head since the oil circulates throughout the engine. Refer to specific instructions supplied, if any, for your specific application.

1. Oil Temperature

- a. The SWICHGAGE® sensing probe must be fully immersed in the oil pan, oil filter housing, oil cooler, etc. depending on engine model and configuration.

- b. Observe all precautions for liquid cooled engines.

2. Cylinder Head Temperature

- a. Generally the cylinder head must already have a hole drilled and tapped for insertion of the temperature sensing probe.
- b. If a hole is not provided in the cylinder head and no provision is made to drill and tap one, it may be possible to install an external bolt on heat sink such as the Murphy HS7.
- c. Coat the temperature sensing probe with a high temperature grease. A mixture of silicone and graphite flakes is recommended although grease alone can be used.

CAUTION: Do NOT apply too much grease. If grease is pushed out of the hole when temperature probe is inserted, remove some grease.

- d. Observe all precautions for liquid cooled engines.

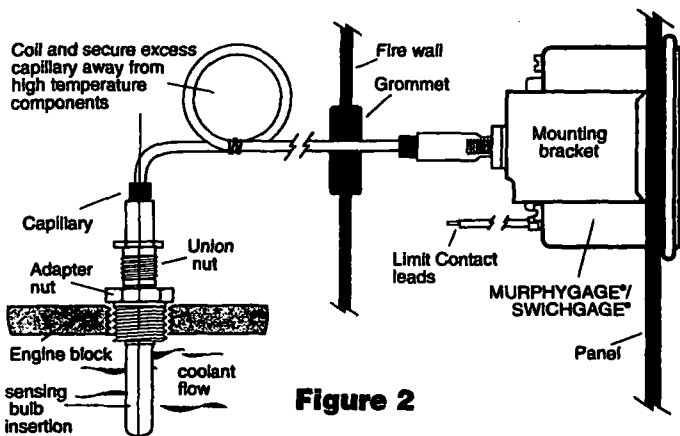


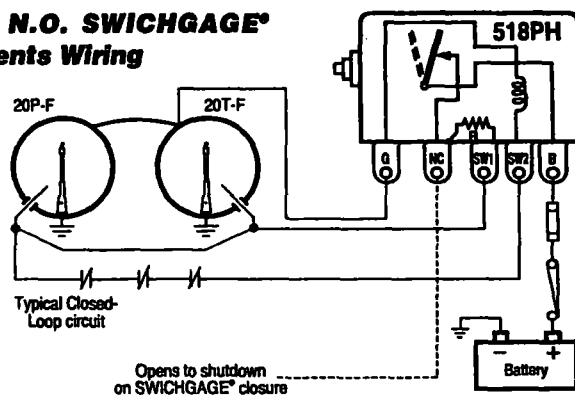
Figure 2

Connecting the TATTLETALE®/Magnetic Switch

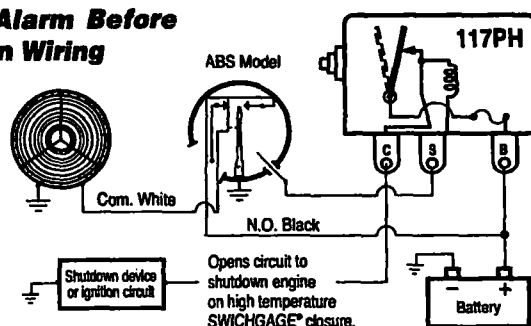
1. Mount with electrical lugs down. If necessary, drill the case and pilot-stud holes (template provided).
2. Clean away burrs and filings. Position the Magnetic Switch in the panel, making sure the pilot stud is in place.
3. Add decal, then washer, then nut and tighten.

NOTE: Murphy components are easily wired and maintained. Use good quality wire and terminals. The type of Magnetic Switch differs for various applications. See examples of typical wiring (below). Wiring and instructions are packed with each Magnetic Switch.

Typical N.O. SWICHGAGE® Instruments Wiring



Typical Alarm Before Shutdown Wiring



IMPORTANT INFORMATION: Do NOT clean MURPHYGAGE®, SWICHGAGE® and Magnetic Switch with steam or high pressure washes. Many solvents and cleaners can haze and permanently damage the clear, polycarbonate. Clean your devices with: mild soap and water, mineral spirits, methy/isopropyl/isobutyl alcohols, or 1 & 3 denatured alcohols. **WARNING:** Do not clean the MURPHYGAGE®/SWICHGAGE® - Magnetic Switch when equipment is running or very hot.

Setting the SWICHGAGE® contacts



IMPORTANT: For 20TE, 25TE, A20TE and A25TE models the switch trip point **CANNOT** be set at either the lowest or the highest extremes of the scale. Trip point **MUST** allow for the switch reset differential. For adjustable switch versions, the switch point is adjustable **ONLY** over the upper half of the scale.

1. All contacts are set using a 1/16 in. hex wrench (Figure 3).
2. Some models such as A20TE, A25TE, etc. may not have field adjustment. Consult the factory if in doubt.
3. Observe the "normal operating" temperature readings. Set the contact slightly **above** maximum reading observed or slightly **below** maximum temperature recommended by equipment manufacturer.

Testing the Contacts

1. With equipment running; use a 1/16 in. hex wrench to rotate contact until it touches the pointer. Do **NOT** force contact against the gage pointer. Equipment should shut down and/or alarm should operate.

Reset the contact (Figure 3).

2. **VERY IMPORTANT** Each time you start the machine, observe that the SWICHGAGE® is indicating temperature. Visual inspection and regular testing should be normal procedure to ensure proper operation and to achieve maximum results from your SWICHGAGE®.

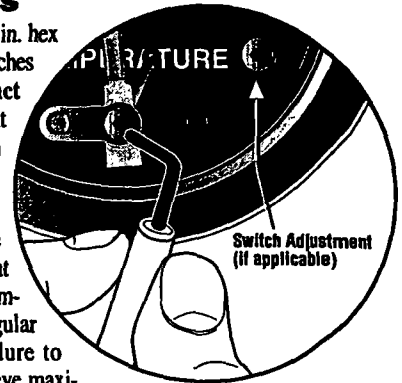


Figure 3

TYPICAL WIRING DIAGRAMS



WARNING: DISCONNECT ALL ELECTRICAL POWER BEFORE BEGINNING THE WIRING INSTALLATION

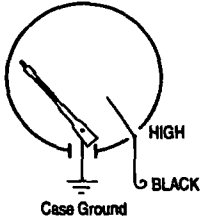
20 and 25 Series models

These diagrams are shown with the pointer in the at rest (shelf) position.

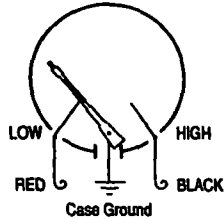
Pointer contact rating: pilot duty 2 A @ 30 VAC/DC.

Snap-switch rating: 3 A @ 30 VDC, 4 A @ 125 VAC.

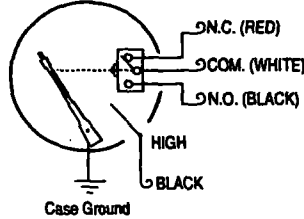
20T and 25T



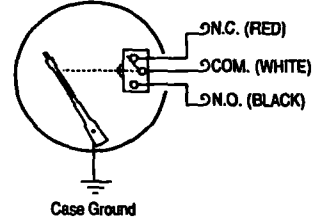
20T-HL and 25T-HL



20TABS and 25TABS



20TE and 25TE



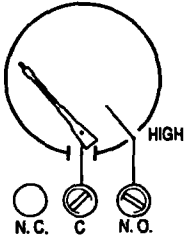
A20 Series models

These diagrams are shown with the pointer in the at rest (shelf) position.

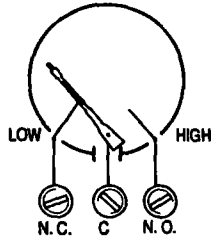
Pointer contact rating: pilot duty 2 A @ 30 VAC/DC.

Snap-switch rating: 3 A @ 30 VDC, 4 A @ 125 VAC.

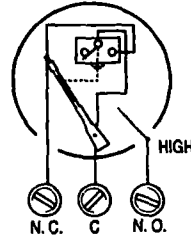
A20T



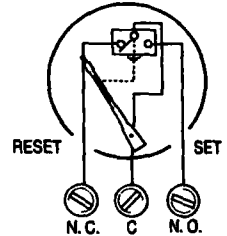
A20T-HL



A20TABS*



A20TE



* CAUTION Pointer contact and ABS switch share the same "Common". Voltage source **MUST** be the same. Maximum voltage is 30 V. Consult factory for 120 VAC applications.

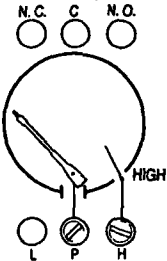
A25 Series models

These diagrams are shown with the pointer in the at rest (shelf) position.

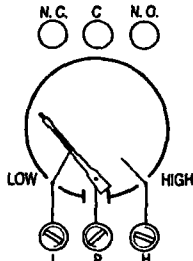
Pointer contact rating: pilot duty 2 A @ 30 VAC/DC.

Snap-switch rating: 3 A @ 30 VDC, 4 A @ 125 VAC.

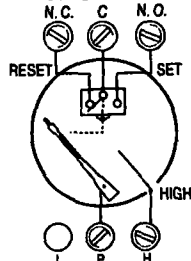
A25T



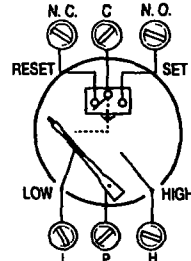
A25T-HL



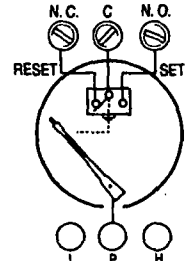
A25TABS



A25TABS-HL



A25TE



TROUBLESHOOTING TIPS

DO THIS FIRST:

- Verify that the SWICHGAGE® has not been damaged (hit or dropped).
- Check for kinked or broken/worn capillary tubing.
- Verify that the sensing bulb is immersed in coolant flow.
- Look for broken wiring, frozen pointer, dirty contacts (will not make).
- Verify that there is coolant or water flowing inside the engine.
- Reset Magnetic Switch and verify that it stays latched.

The following information will assist in the correction of most problems which you may encounter with the unit. If any problems persist after you have made these checks, consult your nearest Murphy facility.

SYMPTOM	CAUSE	TEST/REMEDY
Engine will not start.	<ol style="list-style-type: none"> 1. Short or Open circuit, be sure that the Magnetic Switch latches and either puts out power to run device or removes ground (magneto or CD ignition). Check for power or ground at run device. 2. Control circuit overloaded by accessories (blown fuse in Magnetic Switch). 3. False ground in control circuit. 	<ol style="list-style-type: none"> 1. Reset Magnetic Switch and make sure it stays latched. For 518PH check battery voltage and place a jumper between SW1 and SW2. If switch latches, check SWICHGAGE® wiring circuit and repair. If switch does not latch, repair or replace Magnetic Switch. 2. Find the cause of the blown fuse and replace it (use a 14 A fuse). Reroute the accessories. 3. Repair.
False shutdown.	<ol style="list-style-type: none"> 1. SWICHGAGE® circuit has intermittent open or short. 2. Vibration causes the Magnetic Switch to trip. 	<ol style="list-style-type: none"> 1. Check all wiring and replace as necessary. 2. Repair and relocate the switch as needed.
SWICHGAGE® closes but does not trip the magnetic switch or kill the engine.	<ol style="list-style-type: none"> 1. Incomplete shutdown circuit. 2. Dirty SWICHGAGE® contacts. 3. Magneto not providing power to primary terminal post. 4. SWICHGAGE® case may not be grounded. 5. Incorrect Magnetic Switch for type of power. 	<ol style="list-style-type: none"> 1. Locate open circuit and repair. 2. Clean and check that contacts make. 3. Repair magneto. 4. Ground case. 5. Replace with correct Magnetic Switch.
TATTLETALE® tripped but engine is still running (magneto or CD ignition)	<ol style="list-style-type: none"> 1. Open circuit between the TATTLETALE® and the shutdown device. 2. Lost ground to kill the engine. 	<ol style="list-style-type: none"> 1. Check wiring from TATTLETALE® to shutdown device, repair or replace. 2. Check all wiring and connections and repair.
Pointer will not operate properly. Inaccurate reading.	<ol style="list-style-type: none"> 1. Frozen pointer 2. Loose pointer spring (caused by hitting or dropping gauge). 3. Bulb not inserted to full length or low coolant level. 4. Kinked/crimped/broken capillary. 5. Height difference between gage and bulb not taken in consideration. 6. Over temperature. 	<ol style="list-style-type: none"> 1. Return for repair or replace. 2. Return for repair or replace. 3. Correct. 4. Correct. 5. Specify height difference (over 5 feet) when ordering gage. 6. Return for repair or replace.
Pointer or contact burned-in-two.	<ol style="list-style-type: none"> 1. Without exception this condition is caused by incorrect wiring or a short circuit. 	<ol style="list-style-type: none"> 1. Refer to wiring diagram and recheck wiring; replace SWICHGAGE® or return for repair. Observe voltage and current ratings.

WARRANTY

A two-year limited warranty on materials and workmanship is provided with this Murphy product. Details are available on request and are packed with each unit.



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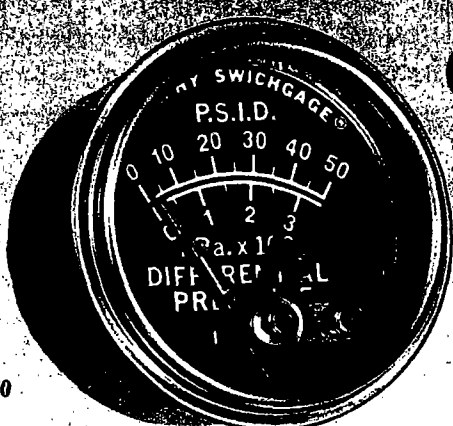
Differential Pressure for Filter Restriction

DP-96041B
Revised 01-01
Catalog Section 05
(00-02-0025)

FWMurphy

20DP, 25DP, A20DP and A25DP Series

2 and 2-1/2 in. (51 and 64 mm) Dial



20DP-50

- Monitors Engine Oil and Fuel Filters
- Actuates Alarm or Shutdown System When Filter Becomes Clogged
- Combination Indicating Gage and Limit Switch
- Actuates Filter Backwash
- Signals Coolant Loss or Aeration On Engine Water Pump

Description

The 20DP and A20DP Series (2 inch/51 mm dial) and the 25DP and A25DP Series (2-1/2 inch/64 mm dial) SWICHGAGE® models are diaphragm-actuated, differential pressure-indicating gages, with a built-in electrical switch. This switch is used for tripping alarms and/or shutting down equipment. These gages are intended to monitor and indicate oil, fuel or water filter restriction and can reduce the risk of dangerously high pressure which may rupture the filter, resulting in contaminants entering the system.

The 20DP and 25DP series mechanism is enclosed in a steel case coated to resist corrosion. The A20DP and A25DP series have a polycarbonate case and are sealed from the environment. All feature a polycarbonate, break-resistant lens and a polished, stainless steel bezel to help protect these rugged, built-to-last instruments.

The gage pointer acts as a pressure indicator and as one switch pole which completes a circuit when it touches the adjustable limit contact. Contacts have self-cleaning motion to ensure electrical continuity.

Features

- **CONSTANT VISUAL INDICATION** of the condition of your filter is shown on the dial.
- **TWO INSTRUMENTS IN ONE** – an accurate indicating gage and adjustable p.s.i.d. limit switch. Reduces inventory and installation time.
- **ADJUSTABLE CONTACT** lets you set the monitoring range of the gage. The contact is tamperproof and can be set only with a 1/16 Allen-head wrench.
- **DURABILITY** – All gages are made of durable materials allowing them to withstand rugged applications.

- **EARLY FILTER CHANGES** cost you money and increase the risk of contaminants entering the system. A Murphy filter restriction SWICHGAGE® will let you know when to change the filter and maintain peak efficiency.

Specifications

Dial: White on black, dual scale; U.S.A. standard scale is psi/kPa. Other scales available—inquire.

Case: 20DP and 25DP Series: *plated steel.*

A20DP and A25DP Series: *polycarbonate.*

Bezel: Polished stainless steel, standard; others are available (see How to Order).

Lens: Polycarbonate, high-impact.

Temperature Range:

Ambient: -40°F (-40°C) thru 150°F (66°C).

Process: -40°F (-40°C) thru 250°F (121°C).

Process Connection: 1/8-27 NPTM brass.

Sensing Element: Beryllium copper diaphragm.

Gage Accuracy: ±3% maximum across scale.

Adjustable Limit Contact: SPST contact; pilot-duty only, 2 A @ 30 VAC/DC; closed when the low limit is met, open when pointer is in normal operating range. Contacts are gold flashed silver.

Limit Contact Adjustment: by 1/16 in. hex wrench thru 100% of scale.

Limit Contact Wire Leads (20DP and 25DP Series): 18 AWG (1.0 mm²) x 12 in. (305 mm).

Limit Contact Terminals: A20DP Series number #4 screw terminals. A25DP Series number 6 terminals.

Snap-Switch Rating ("DPE" models):

SPDT, 3 A @ 30 VDC inductive; 4 A @ 125 VAC inductive.

Unit Weight:

20DP and A20DP Series: 9 oz. (0.25 kg);

25DP and A25DP Series: 11 oz. (0.29 kg).

Unit Dimensions:

20DP and A20DP Series: 3 x 2-3/4 x 2-3/4 in. (76 x 70 x 70 mm).

25DP and A25DP Series: 4-3/4 x 4-3/4 x 2-3/4 in. (121 x 121 x 70 mm).

Base Models

20DP, 25DP, A20DP and A25DP SWICHGAGE®

The gage pointer makes with an adjustable contact to complete a pilot-duty circuit.

20DPE, 25DPE, A20DPE and A25DPE SWICHGAGE®

20DPE (was 20DPEO), 25DPE (was 25DPEO), A20DPE (was A20DPEO) and A25DPE (was A25DPEO).

Features an internal snap-acting SPDT switch, instead of the single pole/pointer contacts. When the switch closes on rising pressure, it becomes Set, as pressure falls the switch Resets.

20DPG, 25DPG, A20DPG and A25DPG MURPHYGAGE®

Gage without contact(s).

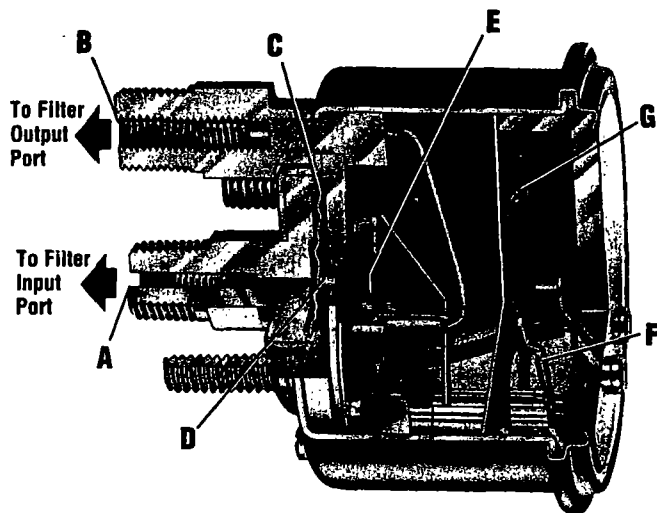
Warranty

A two-year limited warranty on materials and workmanship is given with this Murphy product. Details are available on request and are packed with each unit.

** Products covered by this bulletin comply with EMC Council directive 89/336/EEC regarding electromagnetic compatibility except as noted.

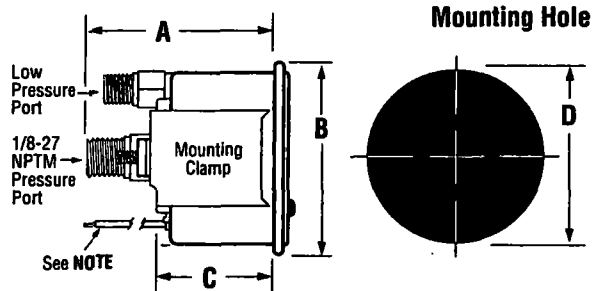
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Operating Characteristics



Port **A** connects to the input side of the filter. Pressure pushes diaphragm **C** forward thus pushing the button **D** which turns the crank arm **E** which in turn moves pointer **F** to register the amount of pressure on dial **G**. Port **B** connects to the outlet side of the filter. Pressure is exerted through tube **H** and pushes on the diaphragm thus applying pressure on both sides of the diaphragm. The pointer displays pressure in the amount that the input pressure is greater than the outlet pressure. As the filter is restricted by contaminants and the pressure difference reaches the critical point, the pointer touches the pre-set limit contact and shuts down the system or activates a visual or audible signal to alert the operator.

Dimensions



	20DP Series	A20DP Series	25DP Series	A25DP Series
A	2-7/32 (56)	2-9/64 (54)	2-1/8 (54)	1-51/64 (46)
B	2-15/64 (57)	2-1/4 (57)	3-1/8 (79)	2-29/32 (74)
C	1-5/16 (33)	1-27/64 (36)	1-3/8 (35)	1-27/64 (36)
D	2-1/16 (53)	2-1/16 (53)	2-11/16 (68)	2-11/16 (68)

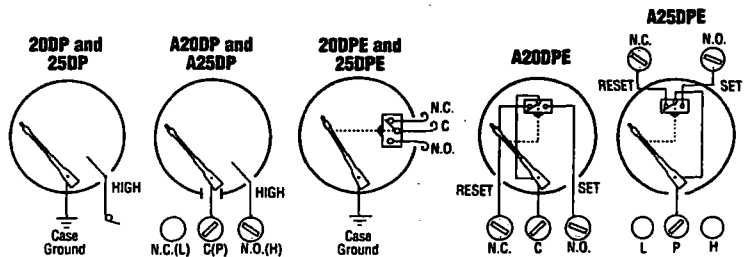
NOTE: 20 and 25 Series have 18 AWG (1.0 mm²) wire. A20 Series has #4 screw terminals and A25 Series has #6 terminals. Dimensions are in inches and (millimeters).

Ranges and Factory Settings

Ranges* Available	Max. Static Pressure	Max. Differential Pressure	Contact Setting
0-15 (0-103) [0-1.0]	200 (1.4) [14]	30 (207) [2.0]	10 (69) [0.8]
0-30 (0-207) [0-2.0]	300 (2.1) [20]	60 (414) [4.0]	20 (138) [1.0]
0-50 (0-345) [0-3.5]	300 (2.1) [20]	100 (690) [7.0]	30 (207) [2.0]
0-75 (0-517) [0-5.0]	300 (2.1) [20]	150 (1.0) [10]	50 (345) [3.5]
0-100 (0-690) [0-7.0]	300 (2.1) [20]	200 (1.4) [14]	60 (414) [4.0]

*Values are shown in psi, (kPa/MPa) and [bar]. Values in kPa/MPa and bar are mathematical conversions from psi—they do not reflect actual second scale range.

Internal Wiring



How to Order

To order, use the diagram below. List options in ascending alphabetical order (A-Z). Example: 20DP-F-30.

Base Model	Range ^{††}
20DP	15 = 0-15
25DP	30 = 0-30
A20DP	50 = 0-50
A25DP	75 = 0-75
20DPE	100 = 0-100
25DPE	
A20DPE	
A25DPE	
20DPG	
25DPG	
A20DPG	
A25DPG	

^{††}Select scale so your normal operating pressure is in the middle half of the scale.

Options[†]

A = Argon filled case (not available for A25DP, 25DPE, 20DPE Series)
B1 = Black bezel
B2 = Bezel 05051857 (was "HP")
B3 = Bezel 05051836 (was "HBB")
EX = Explosion-proof
EL = Explosion-proof less case

F = "FS" contact (includes "ES" as appropriate)
K = Knob adjusting face contact

[†]Options not available on all models or configurations.

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SERIES "B" VALVES:

1/8" NPT, 3/16" (4.7mm) Orifice, Two- & Three-Way, Brass & SS Construction, Manual, Pilot & Cam Actuation, Pneumatic Service Vacuum to 200 psi (14 bar).
Bulletin B.

SERIES: "B-316" VALVES FOR PANEL BUILDERS:

Suitable for Offshore, Process Control, Material Specs Meet NACE MR-01-75, Viton Seals, 1/4" NPT, 3/16" (5mm) Orifice, Three-Way, Solenoid/Pilot, Remote Pilot, Mechanical, Manual & Many Special Actuators, Pneumatic Service Vacuum to 200 psi (14 bar).
Bulletin B316.

SERIES "C" VALVES:

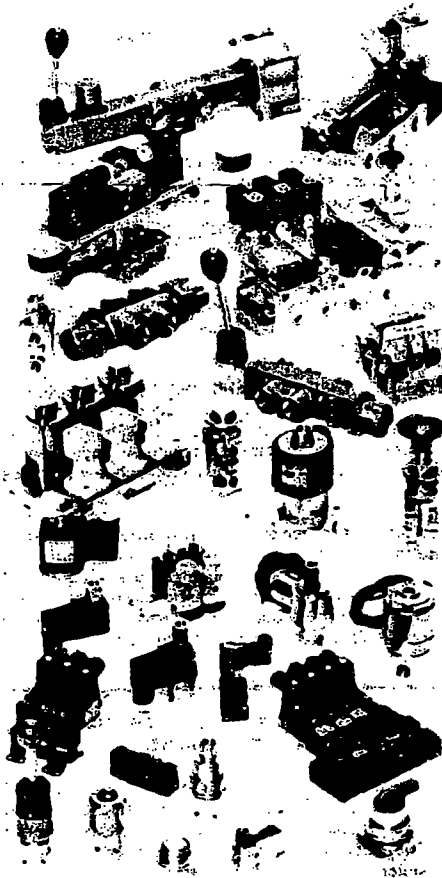
10-32 (M5), 1/8" NPT or G1/8, 1/4" NPT or G1/4, 0.6 to 7mm Orifice, Three- & Four-Way, Multi-purpose, Individual Mount, Stacking, or Manifold Mounted, Aluminum, SS & Nylon Construction, Solenoid/Pilot, Pilot, Manual & Mechanical Actuation, Pneumatic Service Vacuum to 115 psi (8 bar).
Bulletin C/C3.

SERIES "E" VALVES:

1/8" NPT or G1/8" & 1/4" NPT or G1/4, 1/32" (0.8mm) thru 1/4" (6.4mm) Orifice, Two- & Three-Way, Directional, Multi Purpose, Sideported, Stacking, and Manifold Mounted, SS or Aluminum Construction, Direct Solenoid Actuation, Including LOW WATT, Pneumatic & Hydraulic Service Vacuum to 500 psi (35 bar).
Bulletin E.

SERIES "K" VALVES:

Packair ® (Air Management System), 1/4" NPT or G1/4,



4.7mm & 6.5mm Orifice, Two-, Three-, Four- & Five-Way, Selector, Diverter, Manifold Mounted, Integrated Circuitry, Aluminum Construction, Viton Seals, Solenoid/Pilot, Remote Pilot, Cam & Manual Actuation, Pneumatic Service Vacuum to 175 psi (12 bar).
Bulletin K.

SERIES "L-MINI" VALVES:

1/8" NPT Standard & 1/4" NPT Heavy-Duty, 9/64" (3.6mm) Orifice, Two- & Three-Way, Replace Electrical Limit Switches, Hand, Cam & Panel Actuators, Aluminum & SS Construction, Pneumatic Service Vacuum to 200 psi (14 bar).
Bulletin L-Mini.

SERIES "V" & "T" VALVES:

1/8" thru 1-1/4" NPT or G, Full Ported, Two-, Three-, Four- & Five-Way, Selector, Diverter, All types of Actuation, Forged Brass Construction, Pneumatic Service Vacuum to 200 psi (14 bar), Hydraulic Service To 500 psi (35 bar).
Bulletin V1.

SERIES "V-316" STAINLESS STEEL VALVES:

Suitable for Offshore, Process Control, Material Specs Meet NACE MR-01-75, Viton Seals, 1/4", 3/8", 1/2" NPT, Full Ported, Two-, Three-, Four-, & Five-Way, Selector, Diverter, All types of Actuation, Pneumatic Service Vacuum to 200 psi (14 bar).
Bulletin V316.

ACCESSORIES:

Shuttle Valves, Bleed Control Valves, Dust Excluders, Foot Guards, Bleed Valves, Quick Exhaust Valves, Status Indicators.
Bulletin ACC.

Versa Products Company, Inc., 22 Spring Valley Road, Paramus NJ, USA 07652, (201) 843-2400, FAX: (201) 843-2931
Versa BV, Halstraat 3, 7321 AG Apeldoorn, The Netherlands 55-660704 FAX: 55-670704

WARNINGS REGARDING THE DESIGN APPLICATION, INSTALLATION AND SERVICE OF VERSA PRODUCTS

The warnings below must be read and reviewed before designing a system utilizing, installing, servicing, or removing a Versa product. Improper use, installation or servicing of a Versa product could create a hazard to personnel and property.

DESIGN APPLICATION WARNINGS

Versa products are intended for use where compressed air or industrial hydraulic fluids are present. For use with media other than specified or for non-industrial applications or other applications not within published specifications, consult Versa.

Versa products are not inherently dangerous. They are only a component of a larger system. The system in which a Versa product is used must include adequate safeguards to prevent injury or damage in the event of system or product failure, whether this failure be of switches, regulators, cylinders, valves or any other system component. System designers must provide adequate warnings for each system in which a Versa product is utilized. These warnings, including those set forth herein, should be provided by the designer to those who will come in contact with the system.

Where questions exist regarding the applicability of a Versa product to a given use, inquiries should be addressed directly to the manufacturer. Confirmation should be obtained directly from the manufacturer regarding any questioned application prior to proceeding.

INSTALLATION, OPERATION AND SERVICE WARNINGS

Do not install or service any Versa product on a system or machine without first depressurizing the system and turning off any air, fluid, or electricity to the system or machine. All applicable electrical, mechanical, and safety codes, as well as applicable governmental regulations and laws must be complied with when installing or servicing a Versa product.

Versa products should only be installed or serviced by qualified, knowledgeable personnel who understand how these specific products are to be installed and operated. The individual must be familiar with the particular specifications, including specifications for temperature, pressure, lubrication, environment and filtration for the Versa product which is being installed or serviced. Specifications may be obtained upon request directly from Versa. If damages should occur to a Versa product, do not operate the system containing the Versa product. Consult Versa for technical information.

LIMITED WARRANTY DISCLAIMER AND LIMITATION OF REMEDIES

Products sold by Versa are warranted to be free from defective material and workmanship for a period of ten years from the date of manufacture, provided said items are used in accordance with Versa's specifications. Versa's liability pursuant to that warranty is limited to the replacement of the Versa product proved to be defective provided the allegedly defective product is returned to Versa or its authorized distributor.

Versa provides no other warranties, express or implied, except as stated above. There are no implied warranties of merchantability or fitness for a particular purpose. Versa's liability for breach of warranty as herein stated is the only and exclusive remedy and in no event shall Versa be responsible or liable for incidental or consequential damages.



VERSA PRODUCTS COMPANY, INC.
RAMUS, NEW JERSEY 07652

**PIPING ARRANGEMENT & FLOW PATTERN
for VERSA SERIES "E" TYPE VALVES**
(Includes Series E fullsize, Series E5 compact, Series EZ bantam)
PIPE AS SHOWN BELOW ACCORDING TO THE FIRST FOUR
DIGITS OF THE PRODUCT NUMBER STAMPED ON NAMEPLATE:
Maximum Operating Pressure is Also Shown on Nameplate of Valve.

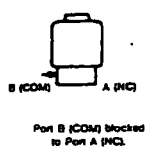
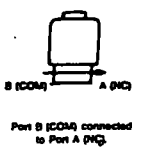
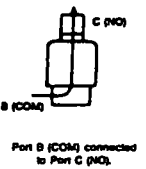
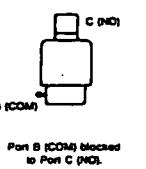
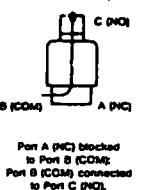
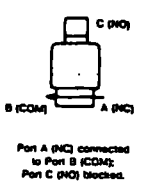
FORM
PA-1E-R
1/94

Product Number		Product Number <small>(One-Inlet Two-Outlets)</small>		Product Number	
Series E or E5: -3202 & -3302	Series EZ: -32** *=2 thru 8	Series E or E5 -7202 & -7302	Series EZ: -72** *=2 thru 6	Series E or E5: -8202 & -8302	Series EZ: -82** *=2 thru 6
Three-Way, Normally Open		Three-Way, Directional <small>(One-Inlet Two-Outlets)</small>		Multi-Purpose	
<p>DE-ENERGIZED</p> <p><small>Port C (NO) connected to Port B (COM); Port A (NC) blocked.</small></p>		<p>DE-ENERGIZED</p> <p><small>Port B (COM) connected to Port C (NO); Port A (NC) blocked.</small></p>		<p>DE-ENERGIZED</p> <p><small>Port C (NO) connected to Port B (COM); Port A (NC) blocked.</small></p>	
<p>ENERGIZED</p> <p><small>Port C (NO) blocked; Port B (COM) connected to Port A (NC).</small></p>		<p>ENERGIZED</p> <p><small>Port B (COM) connected to Port A (NC); Port C (NO) blocked.</small></p>		<p>ENERGIZED</p> <p><small>Port B (COM) connected to Port A (NC); Port C (NO) blocked.</small></p>	



PIPING ARRANGEMENT & FLOW PATTERN
for VERSA SERIES "E" TYPE VALVES
 (Includes Series E fullsize, Series E5 compact, Series EZ bantam)
PIPE AS SHOWN BELOW ACCORDING TO THE FIRST FOUR
DIGITS OF THE PRODUCT NUMBER STAMPED ON NAMEPLATE.
 Maximum Operating Pressure is Also Shown on Nameplate of Valve.

FORM
PA-1E-R
1/94

Product Number		Product Number		Product Number	
Series E or E5: -2201 & -2301	Series EZ: -21*0 *=2 thru 8	Series E or E5 -2202 & -2302	Series EZ: -220* *=2 thru 6	Series E or E5: -3201 & -3301	Series EZ: -31** *=2 thru 8
Two-Way, Normally Closed		Two-Way, Normally Open		Three-Way, Normally Closed	
<p>DE-ENERGIZED</p>  <p>Port B (COM) blocked to Port A (NC).</p>	<p>ENERGIZED</p> <p><u>SERIES E fullsize</u> Port B = Inlet Port A = Outlet</p> <p><u>SERIES E5 compact or SERIES EZ bantam</u> Port COM = Inlet Port NC = Outlet</p>  <p>Port B (COM) connected to Port A (NC).</p>	<p>DE-ENERGIZED</p>  <p>Port B (COM) connected to Port C (NO).</p>	<p>ENERGIZED</p> <p><u>SERIES E fullsize</u> Port B = Inlet Port C = Outlet</p> <p><u>SERIES E5 compact or SERIES EZ bantam</u> Port COM = Inlet Port NO = Outlet</p>  <p>Port B (COM) blocked to Port C (NO).</p>	<p>DE-ENERGIZED</p>  <p>Port A (NC) blocked to Port B (COM); Port B (COM) connected to Port C (NC).</p>	<p>ENERGIZED</p> <p><u>SERIES E fullsize</u> Port A = Inlet Port B = Outlet Port C = Exhaust</p> <p><u>SERIES E5 compact or SERIES EZ bantam</u> Port NC = Inlet Port COM = Outlet Port NO = Exhaust</p>  <p>Port A (NC) connected to Port B (COM); Port C (NO) blocked.</p>

67CF Series Installation Sheet

Introduction

This installation sheet covers the installation and startup of the 67CF Series filter regulators. If maintenance is required, refer to the 67CF Series Instruction Manual, form 5469. Contact your Fisher Sales Representative or Sales Office to receive a copy of the instruction manual.

Specifications

- **Maximum Inlet Pressure:**
250 psig (17,2 bar)
- **Maximum Outlet Pressure:**
50 psi (3,4 bar) over outlet pressure setting
- **Outlet Pressure Ranges:**
0 to 35 psig (0 to 1,4 bar)
0 to 60 psig (0 to 2,4 bar)
0 to 125 psig (0 to 8,6 bar)
- **Temperature Capabilities with Nitrile (NBR):**
-40° to 180°F (-40°C to 82°C)

Installation



WARNING

Personal injury, property damage, equipment damage, or leakage due to escaping gas or bursting of pressure-containing parts may result if this regulator is overpressured or is installed where service conditions could exceed the limits given in the specifications, or where conditions exceed any ratings of the adjacent piping or piping connections. To avoid such injury or damage, provide pressure-relieving or pressure-limiting devices (as required by the appropriate code, regulation, or standard) to prevent service conditions from exceeding those limits.

The internal relief valve in the Type 67CFR regulator does not provide full overpressure protection. The internal relief valve is designed for minor seat leakage only. If maximum inlet pressure to the Type 67CFR exceeds the maximum pressure ratings of the downstream equipment or exceeds the maximum allowable outlet pressure of the Type 67CFR, additional overpressure protection is required.

1. Regulator operation within ratings does not preclude the possibility of physical damage from external sources

or debris in the lines. Regulators should be inspected for damage periodically and after an overpressure condition.

2. Only personnel qualified through training and experience should install, operate, and maintain a regulator. Make sure there is no damage to or foreign material in the regulator and all tubing/piping is free of debris.

3. Install the regulator so that flow is from the IN to the OUT connection as marked on the regulator body.

4. For best drainage, orient the drain valve (key 2) to the lowest possible point on the dripwell (key 5). This orientation may be improved by rotating the dripwell with respect to the body (key 1).



WARNING

A regulator may vent some gas to the atmosphere. In hazardous or flammable gas service, vented gas may accumulate and cause personal injury, death, or property damage due to fire or explosion. Vent a regulator in hazardous gas service to a remote, safe location away from air intakes or any hazardous area. The vent line or stack opening must be protected against condensation or clogging.

5. A clogged spring case vent hole may cause the regulator to function improperly. To keep this vent hole from being plugged (and to keep the spring case from collecting moisture, corrosive chemicals, or other foreign material) orient the vent to the lowest possible point on the spring case or otherwise protect it. Inspect the vent hole regularly to make sure it is not plugged. Spring case vent hole orientation may be changed by rotating the spring case with respect to the body. A 1/4-inch NPT spring case vent may be remotely vented by installing tubing or piping into the vent.

6. For regulator shutdown, install upstream block and vent valves and downstream block and vent valves (if required), or provide some other suitable means of properly venting the regulator inlet and outlet pressures.

7. Apply a good grade of pipe compound to the male pipe threads before making connections, making sure not to get the pipe compound inside the regulator.

8. Install tubing fitting or piping into the 1/4-inch NPT inlet connection on the body (key 1) and into the 1/4-inch NPT body outlet connection.

9. The second 1/4-inch NPT outlet can be used for a gauge or other use. If not used, it must be plugged.

FISHER

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67CF Series

10. When installing a 67CF Series regulator in an existing installation, it may be necessary to use spacers to adapt the installation. If the mounting bolts are too long, place a spacer on the bolt. To be sure the regulator is secure, the bolts should have at least two full threads of engagement.

Startup and Adjustment

1. With proper installation completed and downstream equipment properly adjusted, slowly open the upstream and downstream shutoff valve (when used) while using pressure gauges to monitor pressure.



WARNING

To avoid personal injury, property damage, or equipment damage caused by bursting of pressure containing parts or explosion of accumulated gas, never adjust the control spring to produce an outlet pressure higher than the upper limit of the outlet pressure range for that particular spring. If the desired outlet pressure is not within the range of the control spring, install a spring of the proper range.

2. If outlet pressure adjustment is necessary, monitor outlet pressure with a gauge during the adjustment procedure. The regulator is adjusted by loosening the locknut (key 19), if used, and turning the adjusting screw or handwheel (key 18) clockwise to increase or counter-clockwise to decrease the outlet pressure setting. Tighten the locknut to maintain the adjustment position.

Parts List

Key	Description	Key	Description
1	Body	16 ⁽¹⁾	Diaphragm Assembly
2	Drain Valve	17	Spring
3	Flange Screw	18	Adjusting Screw
4 ⁽¹⁾	O-Ring	19	Locknut
5	Dripwell	20	Upper Spring Seat
6 ⁽¹⁾	Filter Element	22	Pressure Gauge
7	Spring Case	23	1/4-Inch Pipe Plug
9	Filter Retainer	24	Tire Valve
10 ^(1, 2)	Valve Cartridge	26 ⁽¹⁾	Filter Gasket
11 ^(1, 2)	Valve Plug	31	Panel Mounting Nut
12 ^(1, 2)	Valve Spring	32	Wire Seal
13 ^(1, 2)	Valve Retainer	33	Closing Cap
14 ^(1, 2)	O-Ring	34	Spacer
15 ^(1, 2)	Soft Seat		

1. Recommended Spare Part

2. Valve cartridge assembly includes keys 10, 11, 12, 13, 14, and 15.

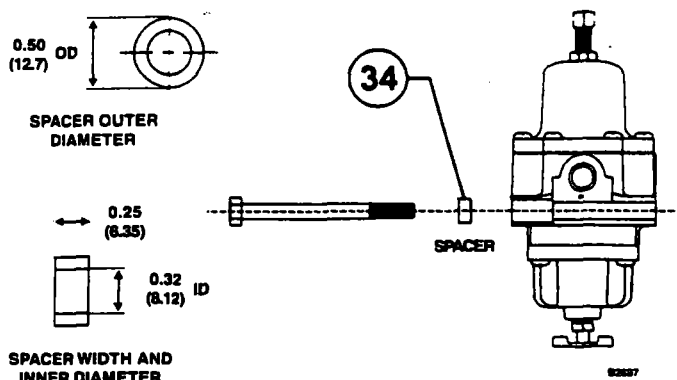


Figure 1. Spacer Diameter and Installation

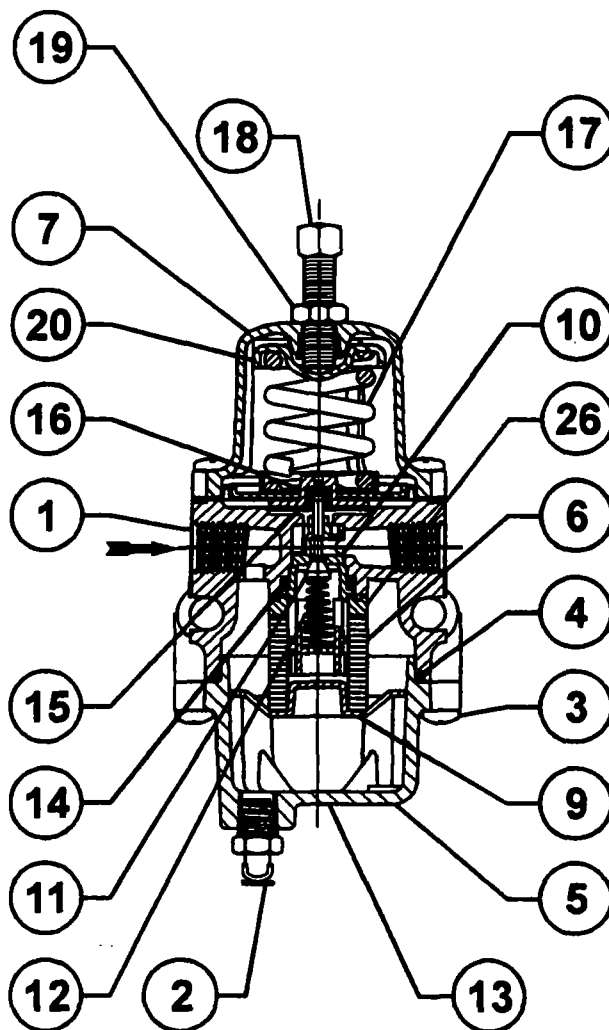


Figure 2. 67CF Series Assembly Drawings

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For information, contact Fisher Controls:

Marshalltown, Iowa 50158 USA

28320 Gallardon, France

Sao Paulo 05424 Brazil

Singapore 128461

FISHER

PANEL LEGEND

ITEM	MFR.	MURPHY PART No.	MODEL NO.	DESCRIPTION
1.	MURPHY	50700112	TTDJ-IGN-T	"SELECTRONIC TATTLETALE" ANNUNCIATOR
2.	MURPHY	10700062	SPLFC-136P10	BUILDING AIR TEMPERATURE "SWICHGAGE"
3.	MURPHY	05701559	45PEF-R-60	SUCTION PRESSURE "SWICHGAGE"
4.	MURPHY	05701543	45PEF-R-300	DISCHARGE PRESSURE "SWICHGAGE"
5.	MURPHY	05090122	A25PEF-100-SF15	ENGINE OIL PRESSURE "SWICHGAGE"
6.	MURPHY	05090116	A25PEF-300-SF60	COMPRESSOR OIL PRESSURE "SWICHGAGE"
7.	MURPHY	10701414	A25TEF-250-16-SR210	ENGINE WATER TEMPERATURE "SWICHGAGE"
8.	MURPHY	10090124	A25TEF-300-16-SR220	GAS DISCHARGE TEMPERATURE "SWICHGAGE"
9.	MURPHY	10090123	A25TEF-300-16-SR190	RETURN OIL INLET TEMPERATURE "SWICHGAGE"
10.	MURPHY	05090121	A25DPEF-30-SR15	OIL FILTER DIFFERENTIAL PRESSURE "SWICHGAGE"
11.	MURPHY	05090121	A25DPEF-30-SR15	COALESCING FILTER DIFF. PRESSURE "SWICHGAGE"
12.	MURPHY	05704397	A25VG-30	ENGINE VACUUM "MURPHYGAGE"
13.	TELEMECANIQUE	00007381	ZB2BS54	EMERGENCY SHUTDOWN PUSHBUTTON
14.	TELEMECANIQUE	00007382	ZB2BZ102	CONTACT BLOCK
15.	MURPHY	10090133	A25TEF-160-16-1/2-SR125	SALES GAS TEMPERATURE "SWICHGAGE"
16.	BWB	00009177	"R" PILOT	PRESSURE SENSOR, SET @ 160 psi RISING
17.	BWB	00009176	"R" PILOT	PRESSURE SENSOR, SET @ 155 psi RISING
18.	AMOT	00004852	4229B1C1	PNEUMATIC INDICATOR (2), GREEN/BLACK
19.	-----	-----	-----	NOT USED
20.	VERSA	00006349	VGA-3322-181CC-5116-D048	SOLENOID VALVE
21.	AMOT	00004525	4057DO23H1	VALVE (3)
22.	INGERSOLL	00006295	SMGB-618	PUSHBUTTON
23.	McDANIEL	00004486	KGP-GF	LINE PRESSURE INDICATION GUAGE, 300 psi
24.	MURPHY	50225495	-----	VERTICAL LEGEND HOLDER W/303740.XLS INSERT
25.	VERSA	00005407	BSP-3308-316	PNEUMATIC PILOT VALVE
26.	MURPHY	50225417	-----	ENCLOSURE, ENC-P-H-A302408LP-N3-MR
27.	MURPHY	50225726	-----	STAND, STD-P-30X24X9-CP-REV-MR, MTG HOLES
28.	FISHER	00008449	67CFR-224	REGULATOR, 0-35 PSI
29.	IR	39161002	1N4005	DIODE

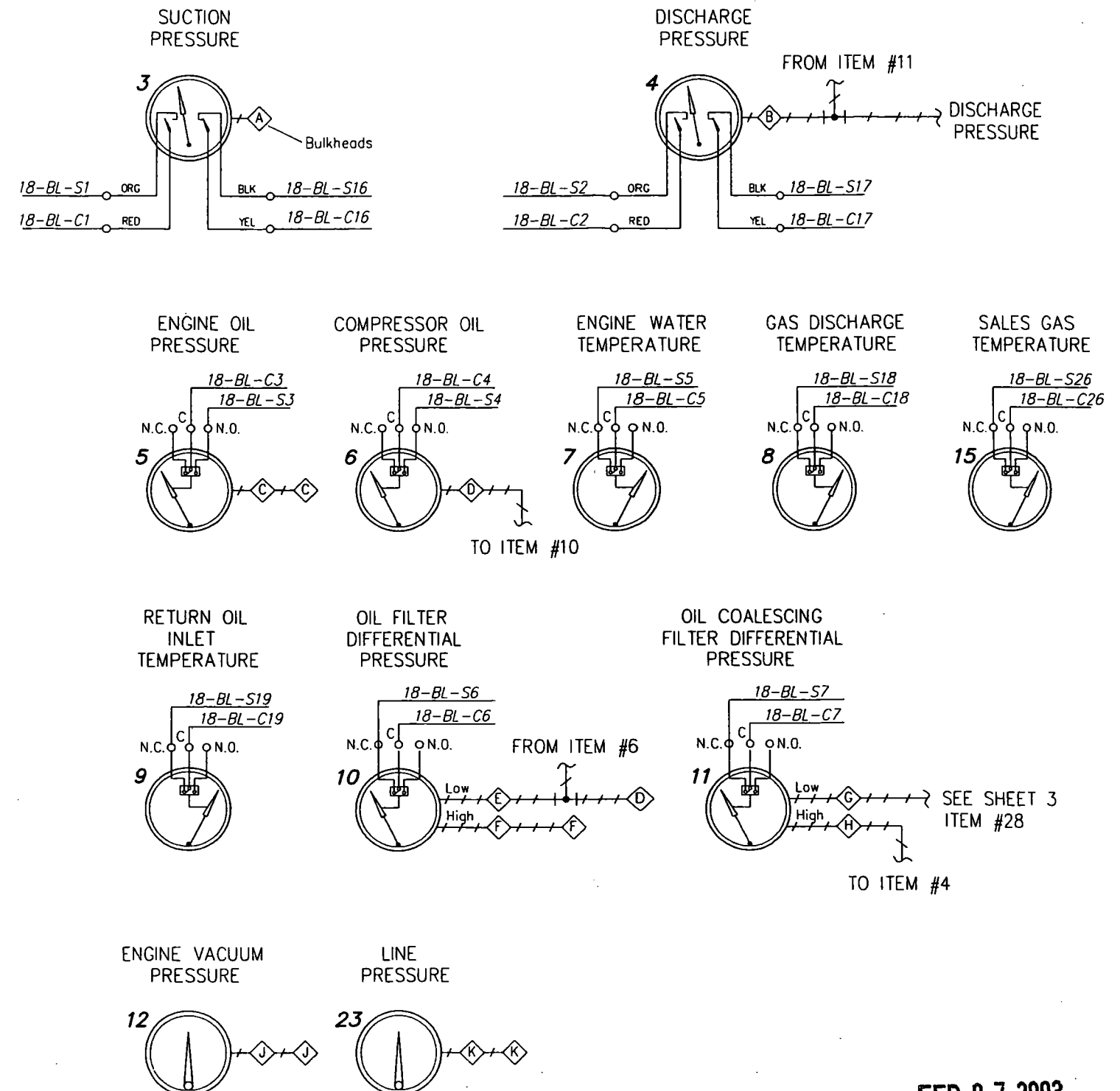
NOTES:

- FACTORY WIRING: _____
CUSTOMER WIRING: _____
END USER WIRING: _____
TUBING: +-----+
- TUBING: 1/4 x .035 316 STAINLESS STEEL (WELDED)/FLEX
FITTINGS: SWAGelok STAINLESS STEEL
- LAST WIRE NUMBER USED: 18-GY-53
- "18-BL-25" REPRESENTS "WIRE GAUGE-WIRE COLOR-WIRE NUMBER"
- ROUTE SENSOR LEADS SEPARATE FROM ALL OTHER WIRING.
- MAXIMUM LENGTH OF SENSOR LEADS IS 500 FEET.
- CAUTION: DISCONNECT ALL SENSOR LEADS BEFORE WELDING.**
- THIS PANEL IS SUITABLE FOR USE IN CLASS I, DIV. 2, GROUP D HAZARDOUS LOCATIONS.
- GROUND SYMBOLS WILL BE SHOWN PER THE FOLLOWING:
EARTH/POWER CHASSIS/NON-INCENDIVE DC COM/CLOSE LOOP

⊥

⏏

↓
- UNLESS OTHERWISE NOTED ALL DEVICES ARE SHOWN IN THE SHELF POSITION.
- ALL WIRING TO BE 18 GA. UNLESS OTHERWISE NOTED.
- EACH OF THE FIRST 16 INPUTS CAN BE CONFIGURED FOR CLASS A, B1, B2, OR C AND FOR SHUTDOWN OR ALARM. SPARE SHUTDOWNS WILL BE DEFAULTED TO CLASS "A".
- INPUT #29 IS SELECTABLE CLASS "A" OR FOR EMERGENCY STOP (OVERRIDES TEST TIMER)
INPUT #30 IS SELECTABLE REMOTE RESET OR CLASS "A"
INPUT #31 IS REMOTE LOCKOUT OR CLASS "A"
(INHIBITS CLASS "B1" & "B2" LOCKOUT TIMERS)
INPUT #32 TYPICALLY USED FOR EMERGENCY STOP (OVERRIDES TEST TIMER)
DISPLAY #50 IS OVERSPEED (INTERNAL, ON "T" MODEL ONLY)
DISPLAY #51 IS UNDERSPEED/LOSS OF IGNITION (ON "T" MODEL ONLY)
DISPLAY #52 IS MANUAL STOP (INTERNAL)
- SENSOR INPUTS ARE PASSIVE SWITCHES. REMOVE FACTORY INSTALLED JUMPER FOR NORMALLY CLOSED SWITCHES.
- NORMALLY OPEN SENSORS ARE RETURNED TO GROUND TO ACTIVATE ANNUNCIATOR.
- FOR ADDITIONAL INFORMATION REFER TO INSTALLATION BULLETIN.



FEB 07 2003

DRAWN BY LINDA				 CONTROL SYSTEMS & SERVICES - ROSENBERG, TX	
CHK'D BY 1-2-03					
DATE 10-03-02				FOR WATERFLOOD SERVICE & SALES	
SCALE NONE				LEGEND & WIRING DIAGRAM	
SHEET 1 OF 3				YOUR NO. REF NO. 50-30-2668	
REV. DESCRIPTION ECR No. DATE CHK'D BY				DWG. NO. 50-30-3740 REV. B	
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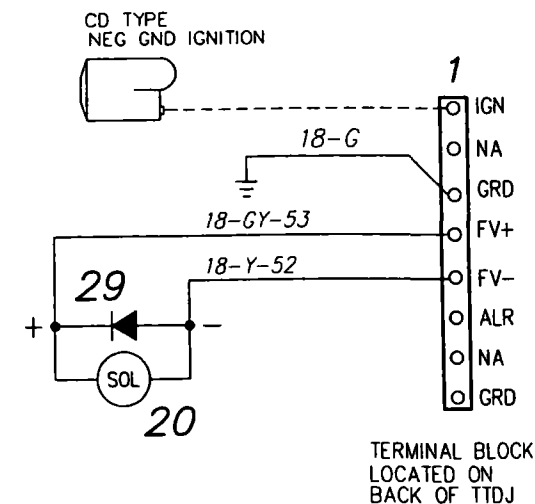
INDICATOR READOUTS 303740.xls

CLASS DISPLAY DESCRIPTION

B1	01	LOW SUCTION PRESSURE	01	18-BL-S1 18-BL-C1	3
B1	02	LOW DISCHARGE PRESSURE	02	18-BL-S2 18-BL-C2	4
B1	03	LOW ENGINE OIL PRESSURE	03	18-BL-S3 18-BL-C3	5
B1	04	LOW COMPRESSOR OIL PRESSURE	04	18-BL-S4 18-BL-C4	6
B1	05	ENGINE WATER TEMPERATURE	05	18-BL-S5 18-BL-C5	7
B1	06	OIL FILTER DIFFERENTIAL PRESSURE	06	18-BL-S6 18-BL-C6	10
B1	07	HIGH OIL COALESCING FILTER DIFF PRESSURE	07	18-BL-S7 18-BL-C7	11
B1	08	LOW COALESCING LEVEL	08		
	09	SPARE	09		
	10	SPARE	10		
	11	SPARE	11		
	12	SPARE	12		
	13	SPARE	13		
	14	SPARE	14		
	15	SPARE	15		
A	16	HIGH SUCTION PRESSURE	16	18-BL-S16 18-BL-C16	3
A	17	HIGH DISCHARGE PRESSURE	17	18-BL-S17 18-BL-C17	4
A	18	HIGH GAS DISCHARGE TEMPERATURE	18	18-BL-S18 18-BL-C18	8
A	19	HIGH RETURN OIL INLET TEMPERATURE	19	18-BL-S19 18-BL-C19	9
A	20	LOW ENGINE COOLANT LEVEL	20		
A	21	LOW ENGINE OIL LEVEL	21		
A	22	ENGINE/COMPRESSOR VIBRATION	22		
A	23	HIGH SCRUBBER LIQUID LEVEL	23		
A	24	HIGH FUEL GAS FILTER LIQUID LEVEL	24		
A	25	LOW BUILDING AIR TEMPERATURE	25	18-BL-25 18-G	2
A	26	HIGH SALES GAS TEMPERATURE	26	18-BL-S26 18-BL-C26	15
A	27	COOLER VIBRATION	27		
A	28	SPARE	28		
A	29	EMERGENCY STOP (OUTSIDE)	29		
A	30	SPARE	30		
A	31	SPARE	31		
A	32	EMERGENCY STOP (INSIDE)	32	18-BL-S32 18-BL-C32	13,14
A	50	ENGINE OVERSPEED (INTERNAL)	1		
B1	51	UNDERSPEED/LOSS OF IGNITION (INTERNAL)			
A	52	MANUAL STOP (INTERNAL)			

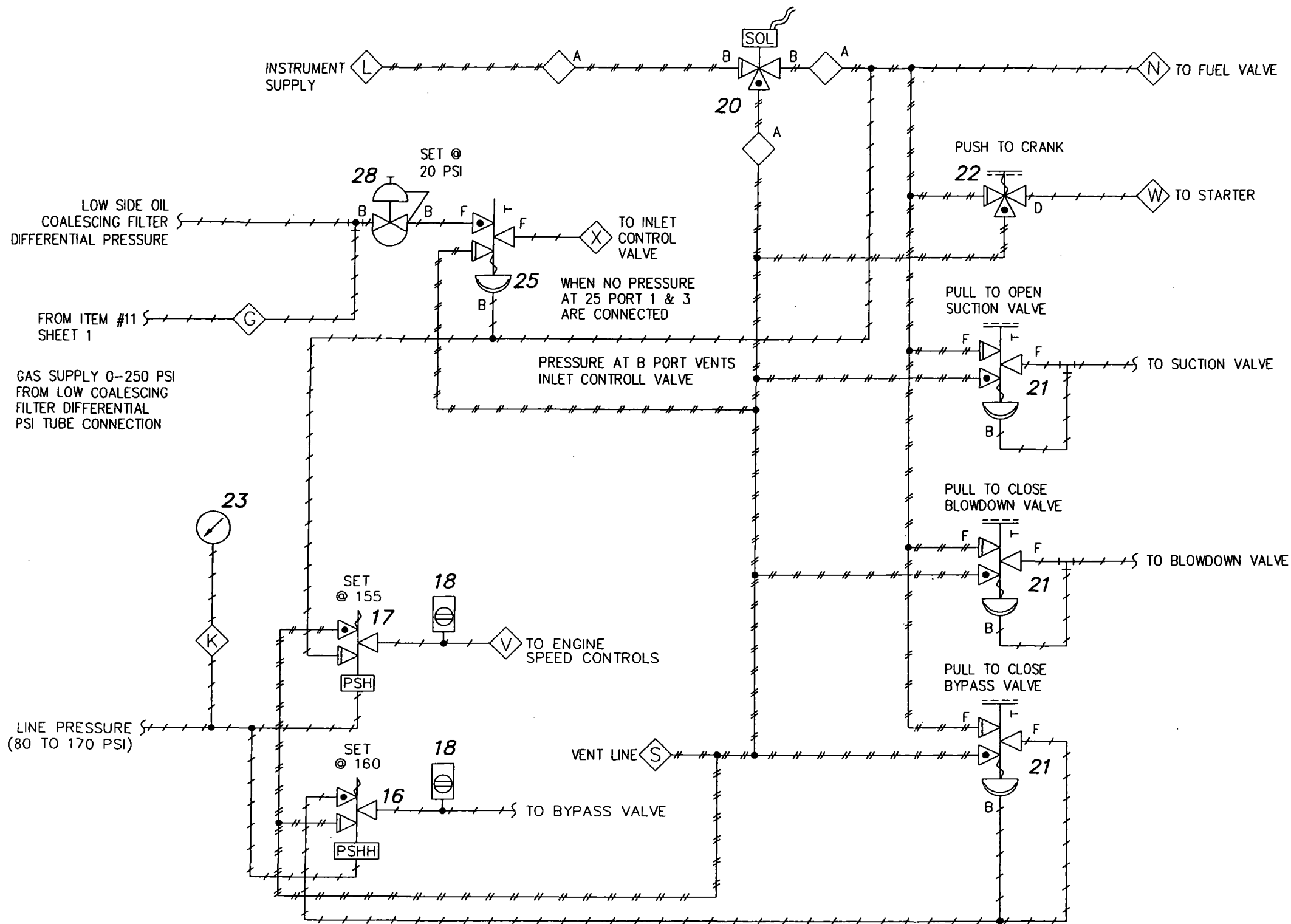
1
TERMINAL BLOCK LOCATED
ON BACK OF TTDJ

ESD IS DESIGNED FOR ANNUNCIATION
OF SHUTDOWN ONLY. ACTUAL SHUTDOWN
SHOULD BE ACCOMPLISHED BY CUSTOMER'S
SHUTDOWN DEVICE MOUNTED LOCALLY.



FEB 07 2003

				DRAWN BY LINDA		 CONTROL SYSTEMS & SERVICES - ROSENBERG, TX FOR WATERFLOOD SERVICE & SALES WIRING DIAGRAM
				CHK'D BY 1-2-03		
				APP'D BY 12/03		
				DATE 10-03-02		
B	NO CHANGES TO THIS SHEET	03-H001	1-2-03	SCALE NONE		YOUR NO. REF NO. 50-30-2668 DWC. NO. 50-30-3740 REV. B
A	AS BUILT		10-21-02	SHEET 2 OF 3		
REV.	DESCRIPTION	ECR No.	DATE	CHK'D BY		
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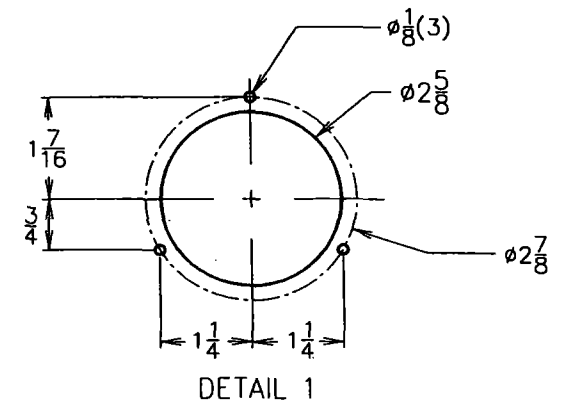
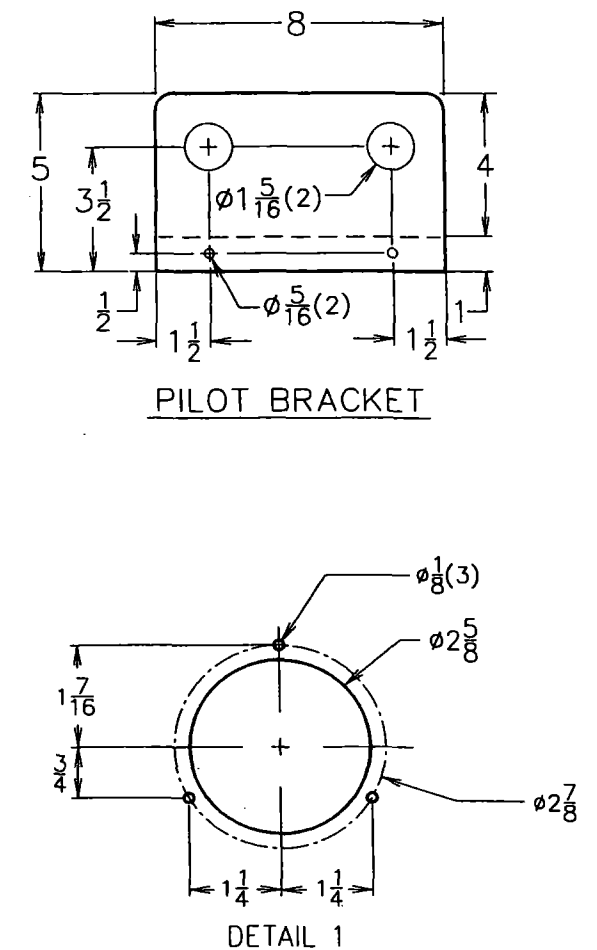
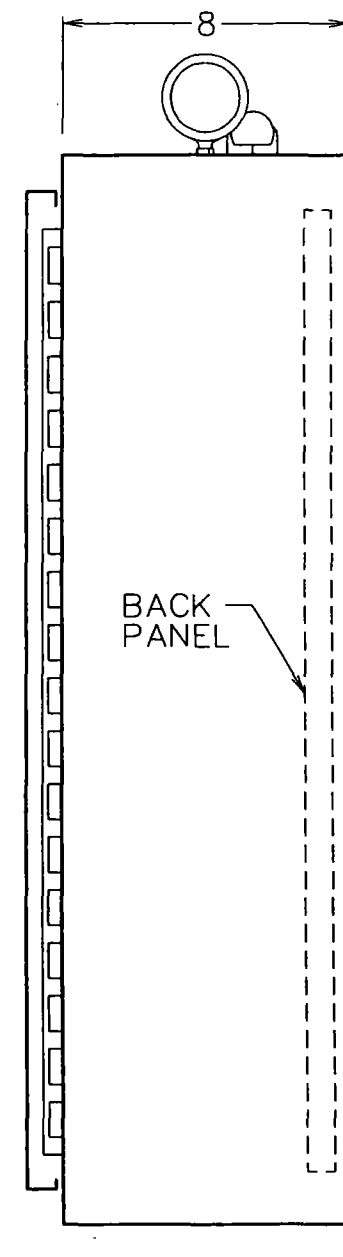
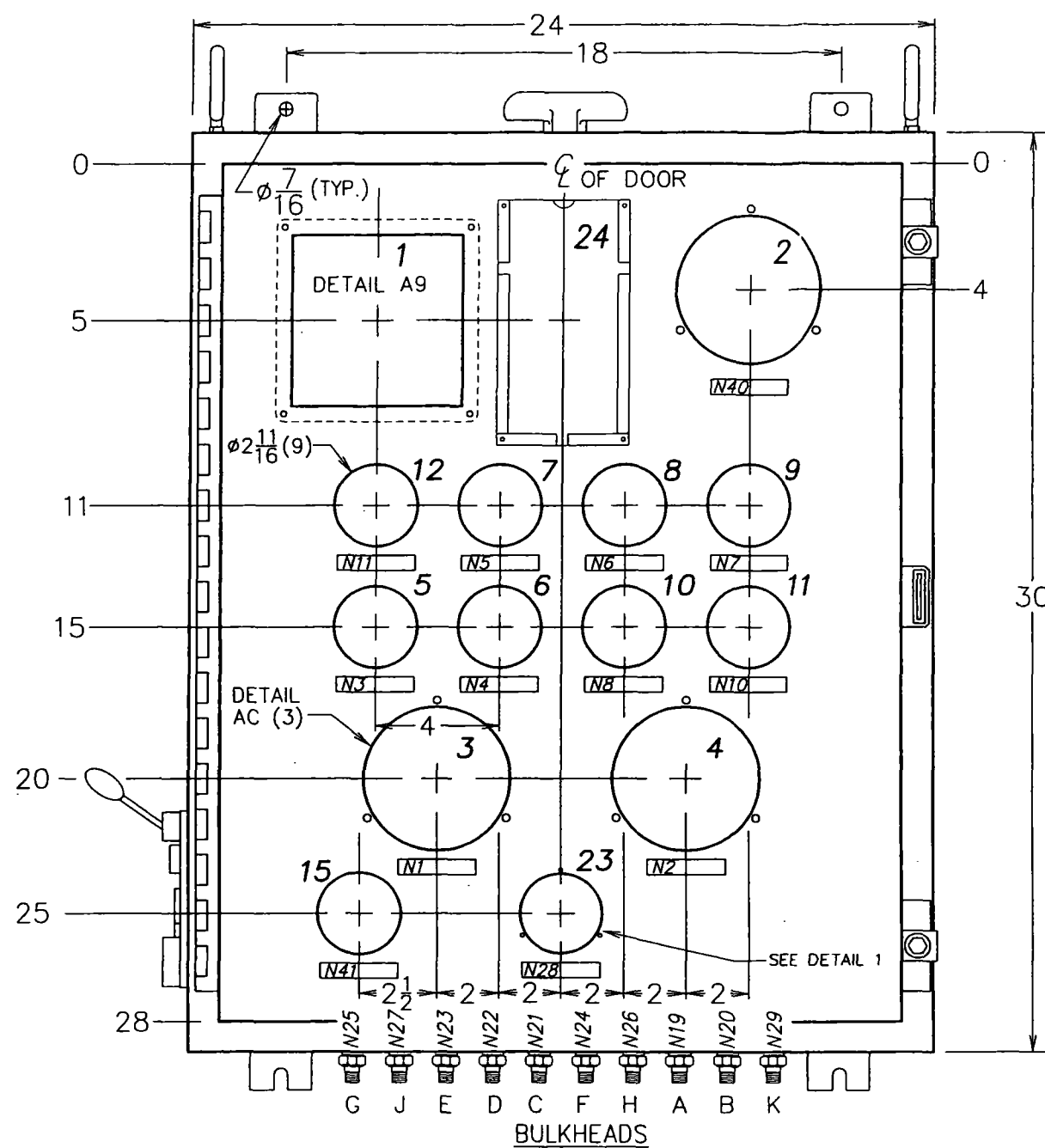
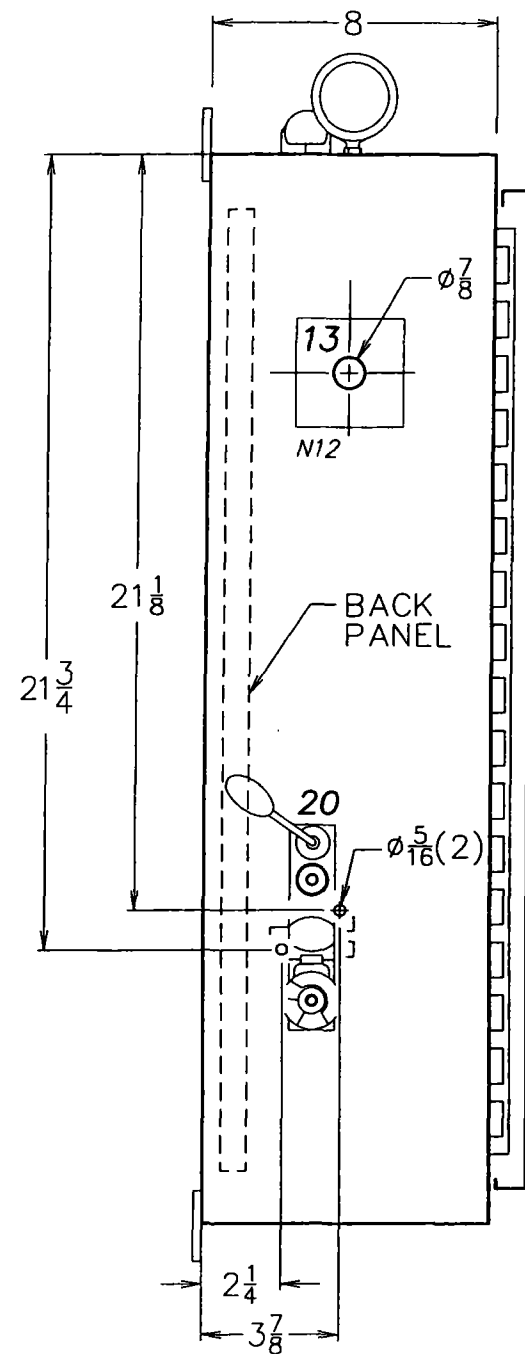


TUBING SCHEDULE

----- 1/4" DIA.
 ----- 3/8" DIA.

FEB 07 2003


DRAWN BY LINDA				 CONTROL SYSTEMS & SERVICES - ROSENBERG, TX	
CHK'D BY 1-2-03					
DATE 10-03-02					
SCALE NONE					
B	DELETED ITEM 19 FISHER 67CFR-226	03-H001	1-2-03	FOR WATERFLOOD SERVICE & SALES	
A	AS BUILT		10-21-02	PNEUMATIC DIAGRAM	
REV.	DESCRIPTION	ECR No.	DATE	CHK'D BY	SHEET 3 OF 3
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YOUR NO.				REF NO. 50-30-266B	
DWG. NO. 50-30-3740				REV. B	

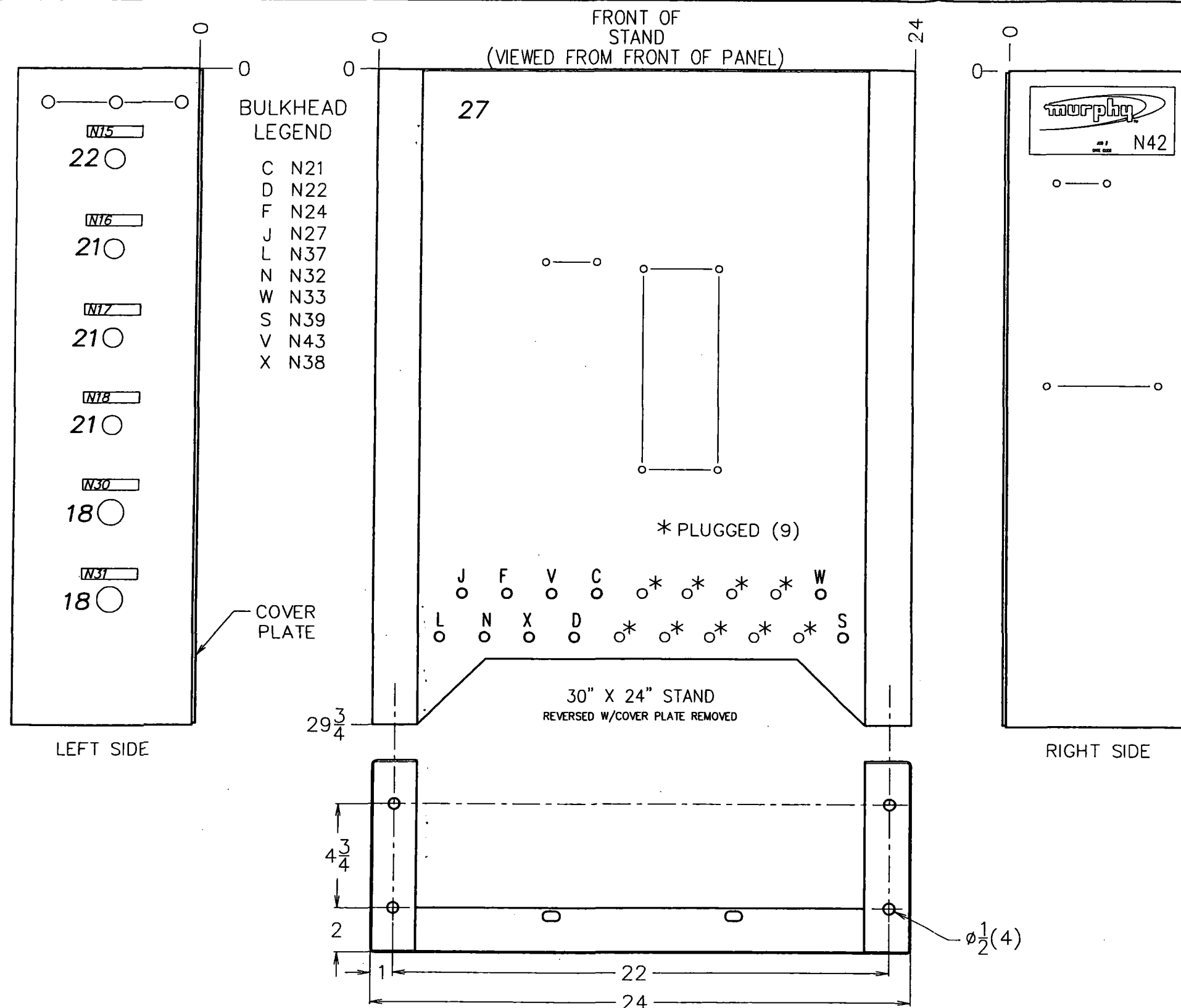


FEB 10 2003

ENCLOSURE: HOFFMAN A-243008LP(OR EQUAL)
BACKPLATE: HOFFMAN A-30P24(OR EQUAL)

ITEM NUMBERS CORRESPOND TO PANEL LEGEND
ON DRAWING NO. 50-30-3740

					DRAWN BY <i>Kcl</i> LINDA	 CONTROL SYSTEMS & SERVICES - ROSENBERG, TX
					CHK'D BY <i>2-10-03 Kyle</i>	
					APP'D BY <i>5/16/02 [Signature]</i>	
					DATE 10-03-02	
B	ENGR. CHANGE - MOVED ITEM 2; ADDED BRACKET DETAIL		10-30-02	<i>[Signature]</i>	SCALE 3/16	
A	AS BUILT		10-21-02			
REV.	DESCRIPTION	EOR #	DATE	CHK'D BY	SHEET 1 OF 2	FOR WATERFLOOD SERVICE & SALES PANEL LAYOUT
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INDIVIDUAL NAMEPLATE SCHEDULE				
QTY.	TAG #	LETTERS/TAG	DESCRIPTION	PART #
1	N1	W/B	SUCTION > PRESSURE	50225266
1	N2	W/B	DISCHARGE > PRESSURE	50225266
1	N3	W/B	LOW ENGINE > OIL PRESSURE	50225266
1	N4	W/B	LOW COMPRESSOR > OIL PRESSURE	50225266
1	N5	W/B	ENGINE WATER > TEMPERATURE	50225266
1	N6	W/B	GAS DISCHARGE > TEMPERATURE	50225266
1	N7	W/B	RETURN OIL INLET > TEMPERATURE	50225266
1	N8	W/B	OIL FILTER DIFF > PRESSURE	50225266
1	N10	W/B	OIL COALESCING FILTER > DIFF. PRESSURE	50225266
1	N11	W/B	ENGINE > VACUUM	50225266
1	N12	R/W	EMERGENCY STOP	50225436
1	N15	W/B	PUSH TO CRANK	50225266
1	N16	W/B	PULL TO OPEN > SUCTION VALVE	50225266
1	N17	W/B	PULL TO CLOSE > BLOWDOWN VALVE	50225266
1	N18	W/B	PULL TO CLOSE > BYPASS VALVE	50225266
1	N19	W/B	SUCTION > PRESSURE	50225307
1	N20	W/B	DISCHARGE > PRESSURE	50225307
2	N21	W/B	ENGINE OIL > PRESSURE	50225307
2	N22	W/B	COMP OIL > PRESSURE	50225307
1	N23	W/B	LOW OIL > FILTER	50225307
2	N24	W/B	HIGH OIL > FILTER	50225307
1	N25	W/B	LOW OIL > COAL FILTER	50225307
1	N26	W/B	HIGH OIL > COAL FILTER	50225307
2	N27	W/B	ENGINE > VACUUM	50225307
1	N28	W/B	LINE > PRESSURE	50225266
1	N29	W/B	LINE > PRESSURE	50225307
1	N30	W/B	ENGINE SPEED > CONTROL	50225266
1	N31	W/B	BYPASS > VALVE	50225266
1	N32	W/B	FUEL > VALVE	50225307
1	N33	W/B	STARTER	50225307
1	N37	W/B	INSTRUMENT > SUPPLY	50225307
1	N38	W/B	INLET > VALVE	50225307
1	N39	W/B	VENT	50225307
1	N40	W/B	BUILDING AIR > TEMPERATURE	50225266
1	N41	W/B	SALES GAS > TEMPERATURE	50225266
1	N42	W/B	LARGE SERIAL NUMBER TAG	50225435
1	N43	W/B	ENGINE SPEED > CONTROL	50225307

FEB 07 2003

ITEM NUMBERS CORRESPOND TO PANEL LEGEND
ON DRAWING NO. 50-30-3740

DRAWN BY <i>Linda</i> LINDA CHK'D BY <i>10/3/02 Kyle</i> APP'D BY <i>[Signature]</i> DATE 10-03-02				CONTROL SYSTEMS & SERVICES - ROSENBERG, TX	
B NO CHANGES THIS SHEET A AS BUILT REV. DESCRIPTION ECR # DATE CHK'D. BY SHEET 2 OF 2				FOR WATERFLOOD SERVICE & SALES STAND LAYOUT YOUR NO. OUR NO. 50-30-2668 DWG. NO. 50-29-3740 REV. B	

MATERIAL
 FINISH
 PAINT
 TEXTURED RED
 UNLESS OTHERWISE NOTED
 DIMENSIONS ARE IN INCHES
 .xx ±0.030 ANGLES ±2°
 .xxx ±0.010 ✓ 125
 FRACTIONS ±1/16

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