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# INDICATING MODULATING TEMPERATURE CONTROLLER

The LFP is a potentiometer type indicating temperature controller designed for use with proportional positioning motors. It derives its simplicity and efficiency from the Piston-Pak filled systems sensing element. This document outlines the specifications of the LFP and provides installation and operation instructions.



## SPECIFICATIONS INSTALLATION OPERATION

# LFP

**Partlow**

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**QUALITY INSTRUMENTATION DESIGNED & MANUFACTURED IN THE U.S.A.**

### Dynapar, Veeder Root, and Eagle Signal Brands:

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Please disregard all phone numbers and addresses in this manual. The phone numbers and address on this page are the correct phone number and addresses to use for sales, repair, and application support.

## LFP PRODUCT SPECIFICATIONS

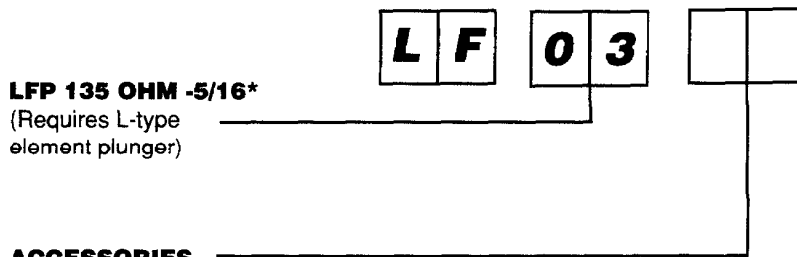
Dimensions	8 5/8" W x 8" H x 4 9/32" D
Surface Mounting	Brackets provided
Flush Mount Cutout	7" W x 7 3/4" H
Coil Resistance	135 ohms standard; 100 or 1000 ohms optional
Coil Length and Throttling Range Available	1/8" - 3.5%, 5/16" - 8%, 5/8" - 16%
Load Error Adjustment	Manual reset for load error compensation
Electrical Rating	Max. volts - 30; Max. watts - 3
Electrical Hookup	Terminal block accessible through top hatch
Conduit Openings	1/2 inch NPS holes on each side of case; drill guide hole spotted in rear of case showing optional rear opening location
Agency Approvals	CSA
Approx. Net Weight*	7 lbs
Approx. Ship. Weight*	10 lbs

\* Weight may vary depending on element length

**Note:**  
**It is strongly recommended that Partlow equipped applications incorporate a high or low limit protective device which will shut down the equipment at a preset temperature condition in order to preclude possible damage to property or product.**

**This document should accompany the instrument to its final installation in order to provide operational and service assistance to the end user.**

## LFP ORDER MATRIX



**LFP 135 OHM -5/16\***  
 (Requires L-type element plunger)

### ACCESSORIES

- 0 None
- 1 201 Weather Resistant (requires inverted dial)
- 2 392 High Limit Setpoint

\* The potentiometer coil kits listed below are available. They are ordered separately and installed by the user.

Description	Order Number
100 Ohm 1/8"	64403504
100 Ohm 5/16"	64403505
135 Ohm 1/8"	64403501

### PISTON-PAK THERMAL SENSING ELEMENT

A Piston-Pak Thermal Sensing Element must be specified for each LFP. Use Partlow Form 3028 "Mechanical Instrumentation Products Cross Reference and Pricing Guide" to configure the matrix number for the sensing element.

# INSTALLATION AND WIRING

## LOCATION

The element head assembly is subject to ambient temperature limitations of -30°F to 125°F (-35°C to 52°C) for low temperature head assemblies, and 32°F to 150°F (0°C to 66°C) for high temperature head assemblies. These temperature limitations must be considered when determining the instrument location. It should be located in an area as free from vibration as possible.

## MOUNTING

The instrument(s) may be surface or flush mounted. For flush mounting proceed as follows: Cut the panel opening to the sizes illustrated in Figure 1. Then drill 1/4 inch clearance holes where indicated in Figure 1 and if desired, tap for number 10 flat head screws.

## WIRING

The threaded side conduit holes may be utilized for electrical connections should the instrument be surface mounted. An optional rear conduit hole may be drilled for flush mount installation. The hole location is spotted in the rear of the case (see Figure 9, page 7 for location). Make necessary electrical connections using short sections of flexible cable or conduit according to applicable electrical codes, ordinances and regulations regarding the use of conduit etc. Next, access the connection terminal block by unscrewing the two screws on the top and removing the top cover hatch. The terminal block is labeled H, C and L (See Figure 2 below). H and L represent the resistive portion of the coil assembly. H being the end of the coil that would relate to upper or maximum drive, L being the lower end of the coil or minimum drive. C designates the wiper blade in contact with the coil. Make your necessary electrical connections using Figure 2 as a guide.

## PLACING THE THERMAL SENSING ELEMENT

Locate the thermal sensing bulb in the most agitated part of the medium to be measured and completely immerse it. (When U and Y type bulbs are used note separation coupling between bulb and capillary). Be sure to immerse the element up to the coupling for correct temperature indication. Do not bend capillary to less than 1/2 inch radius and never bend it too close to the element bulb or element head. Pencil type bulbs must never be bent as this will affect accuracy. U and Y type bulbs may be bent, but never to less than a two inch radius. Anchor the excess capillary securely to prevent vibration damage. The bulb may be elevated up to 40 feet above the instrument without affecting calibration. For elevations over 40 feet consult with your local Partlow Representative, Distributor or the Factory.

## STUFFING BOX INSTALLATION (IF APPLICABLE)

Overtightening of 21-T-105 steel or stainless steel stuffing boxes can damage the thermal element by restricting the capillary bore. To prevent damage, the stuffing box gland nut should be turned 1/2 to 3/4 of a revolution from a finger-tight position. This is equivalent to a torque of 65 to 100 inch-pounds for steel and 130 to 180 inch-pounds for stainless steel.

Figure 1 - Panel Cutout illustration (in inches)

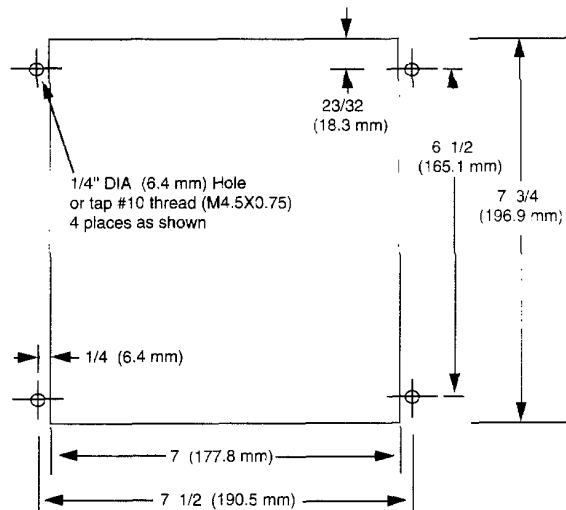
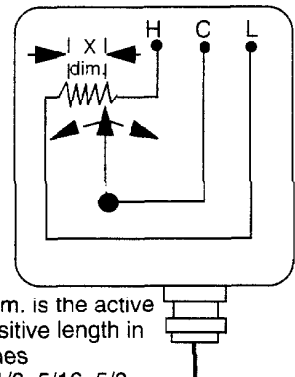


Figure 2 - Control Potentiometer



X dim. is the active sensitive length in inches  
ie. 1/8, 5/16, 5/8  
std 5/16 - 135 ohm

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## **INSTRUMENT OPERATION**

Prior to putting the instrument into service, check it against an accurate test thermometer. As with any precision instrument minor adjustments may be necessary after shipment and installation. If you are unfamiliar with how to perform this check, refer to the CHECKING TEMPERATURE (below) and RE-ZEROING (page 5) section of this document.

The potentiometer coil, which moves with the red set pointer, is positioned at the control point by turning the setting knob on the cover of the instrument. The indicating pointer, which moves upscale or downscale in response to the thermal sensing element, also slides the contact finger along the potentiometer coil within the modulating range. The control is factory-adjusted so that the wiper arm is at mid-point or 50% of coil value when indicating pointer and set pointer are aligned.

Basically, the control potentiometer coil forms half of a Wheatstone Bridge circuit, while the other half of the bridge is formed by similar coil built into the proportional positioning motor. The resistance of the control coil should be matched to the resistance of the motor coil.

A detector relay, either incorporated into the proportional motor or operating as a separate unit, detects any imbalance between the two coils of the Wheatstone Bridge circuit. When control temperature changes, moving the control wiper to a new position on the control coil, the proportioning motor wiper moves on its coil in the direction necessary to restore a balanced circuit. The output shaft of the positioning motor, turning in response to the motor wiper and connected through linkage to valves, dampers, etc., regulates fuel flow to maintain temperature.

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## **MAINTAINING YOUR LFP**

### **CHECKING TEMPERATURE**

When checking and verifying your temperature be sure to use a test thermometer of known accuracy. Position the test thermometer sensing bulb or probe adjacent to the thermal sensing bulb from the LFP. Turn the knob and position the set pointer to the desired process temperature. Wait for the temperature to stabilize, then compare the test thermometer reading with that of the LFP (Black indicating pointer). If the two readings do not agree, the LFP should be re-zeroed.

### **POTENTIOMETER REPLACEMENT**

Be sure all electrical power to the instrument is off. Remove the set point knob and front cover from the instrument. Reinstall the setpoint knob and rotate the red set pointer up scale to its maximum setting. Remove the two screws which retain the dial face to the instrument (**Note: there are small paper washers behind the screws, be careful not to misplace them**). Gently apply pressure to the black pointer assembly and move it fully upscale. Remove the dial plate at this time. Allow the black pointer to come back to its original location. Rotate the setpoint knob to allow the red set pointer to come to mid scale. Loosen the two screws located below the coil assembly. Use care to retain the nut and washer located behind the mounting bracket. Remove each of the screws and related wire terminals. Be certain to keep the wire location for later reinstallation. Unscrew the slotted head bolt from the center of the coil assembly. Be careful not to misplace the paper washer used to insulate the coil ends from the mounting bracket. Remove the coil and install the new coil. Be certain to replace the insulating washer when installing the holding screw. Reconnect the screws through the coil wire through the slots under the coil assembly. Fasten the proper wire terminals from beneath with the washer and screws removed earlier. Check to make certain the wiper blade is making proper contact with the coil assembly. Rotate the set point upscale to the maximum. Bring the black pointer upscale also using gentle pressure to the bracket. Reinstall the dial face. Fasten it into place. Return the set pointer to the desired setting. Re-apply power and allow the system to stabilize. Pointer alignment may be needed. If so, refer to POINTER ALIGNMENT section (page 5). Once adjusted, remove the knob, reinstall the cover and setpoint knob.

**RE-ZEROING YOUR LFP**

Be sure that the process temperature is stable. Remove the instrument knob and cover. Loosen the set screw S (Figure 3, below) and using the wrench provided turn shaft J until the black indicating pointer reading agrees with the test thermometer reading. Lengthening shaft J (counterclockwise) raises the black indicating pointer reading, shortening shaft J (clockwise) lowers the reading. Tighten the set screw S. Check the adjustment by allowing the temperature to stabilize and compare the readings. Repeat these steps if necessary.

**POINTER ALIGNMENT**

Equilibrium condition is reached at a different percentage of heat available with each application. Therefore, the black indicating pointer may indicate slightly higher or lower than the set pointer. It must be compensated in order to achieve the control temperature required. To bring indicating pointer into alignment with set pointer, turn adjusting screw A (Figure 4, below) until corrected. After each screw adjustment allow adequate time for the indicating pointer to settle out. Repeat this procedure until properly aligned.

**BRAKE TIGHTENING**

Periodically the setting shaft brake may require tightening. If the brake is too loose, the overtravel movement of the black indicating pointer will tend to drag the red set pointer upscale from its set position. To tighten the brake, turn the adjustment screw U clockwise (Figure 5, below). Do not over-tighten.

**PISTON-PAK THERMAL SENSING ELEMENT IDENTIFICATION**

An element designation number is stamped on the bottom of the element head. This is a coded description of the element specifications and should be used whenever a replacement element is ordered. The number appearing on the side of the element head (Figure 6, page 6) is the element age code, which may be required in establishing warranty.

**ORDERING/SPECIFYING THE PISTON-PAK SENSING ELEMENT**

The sensing element is ordered separately from the LFP and requires its own matrix number. To determine the correct sensing element configuration for your instrument(s) and application see Partlow Form 3028 "Mechanical Instrumentation Products Cross Reference and Pricing Guide".

Figure 3 - Re-Zeroing

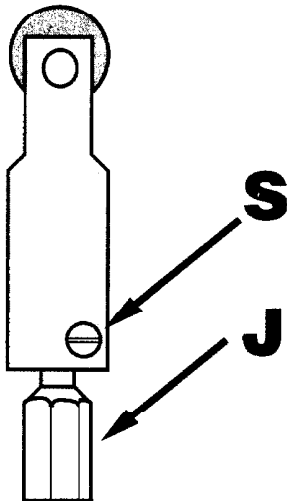
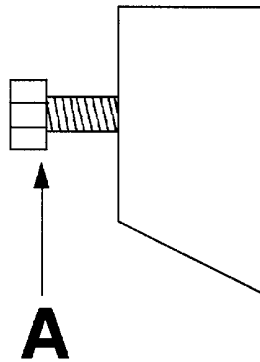
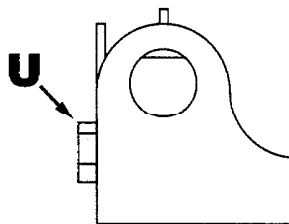


Figure 4 - Pointer Alignment



Switch 5 - Brake Tightening



**ELEMENT REPLACEMENT**

To change a thermal sensing element, start by removing screws D (Figure 7) and withdrawing the element from the instrument body. Then remove the element bulb from the medium. Install the new element and replace screws D. Insert the new element bulb into the medium being measured.

*Note: After the element has been replaced, check the temperature setting, re-zeroing may be necessary. If so, see the CHECKING TEMPERATURE section.*

**Caution: The mechanism inside the instrument and particularly the inside of the thermal element housing, should never be oiled. However, if the instrument interior is subject to corrosion or gunking conditions, the linkage should be sprayed periodically with corrosion inhibiting CRC2-26, 3-36, or 5-56. Use only CRC2-26, 3-36, or 5-56 as other lubricants may cause buildup and internal parts to stick. CRC2-26 may be purchased from Partlow in a 15 oz. container (part #63600401). CRC5-56 can be purchased at most any hardware or automotive store.**

Figure 6 - Sensing Element ID

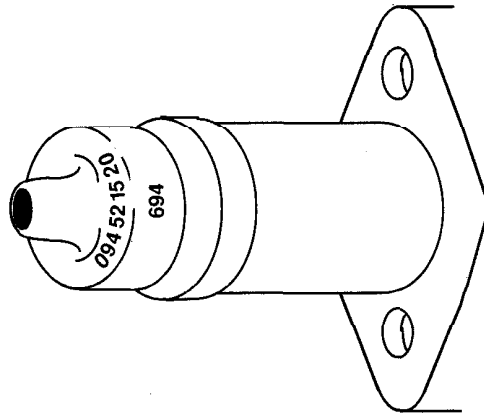
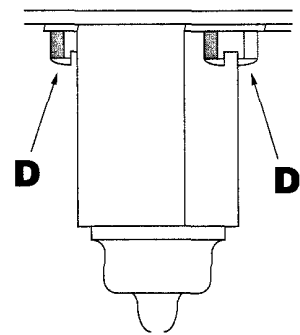


Figure 7 - Replacing Element



**LFP CONTROLS WITH HIGH LIMIT SWITCH AND SET POINTER (ACC. 392)**

For LFP controls containing a high limit switch whose actuation point changes with the movement of the set pointer (Acc. 392), switch hookup and switch adjustment is accomplished as follows:

**SWITCH HOOK UP**

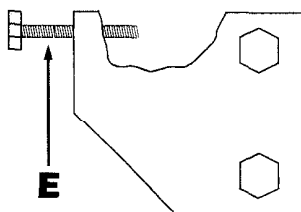
Note the Hi-Limit terminal block connections designated H1, C1, and L1. The terminals represent the normally-open, common and normally closed sides of the switch (with bulb temperature below the setting of the switch). Make connections accordingly.

**SWITCH ADJUSTMENT**

Potentiometer Coil Length	Setting Limitation from High End of Potentiometer Coil
1/8"	+ 8 1/2 % to - 6 1/2 % of element range
5/16"	+ 6 % to - 6 1/2 % of element range
5/8"	+ 1 1/2 % to - 6 1/2 % of element range

If the switch is not operating at the desired temperature-set pointer relationship (due to switch replacement, etc.), the switch operating temperature can be adjusted by turning screw E (Figure 8, at left). Turning screw E clockwise lowers the high limit setting, withdrawing screw E (counterclockwise) raises the switch setting. Turn screw E until the switch actuates at the desired temperature.

Figure 8 - Switch Adjustment



# DIMENSIONAL DRAWING

Figure 9 - Dimensional Drawing

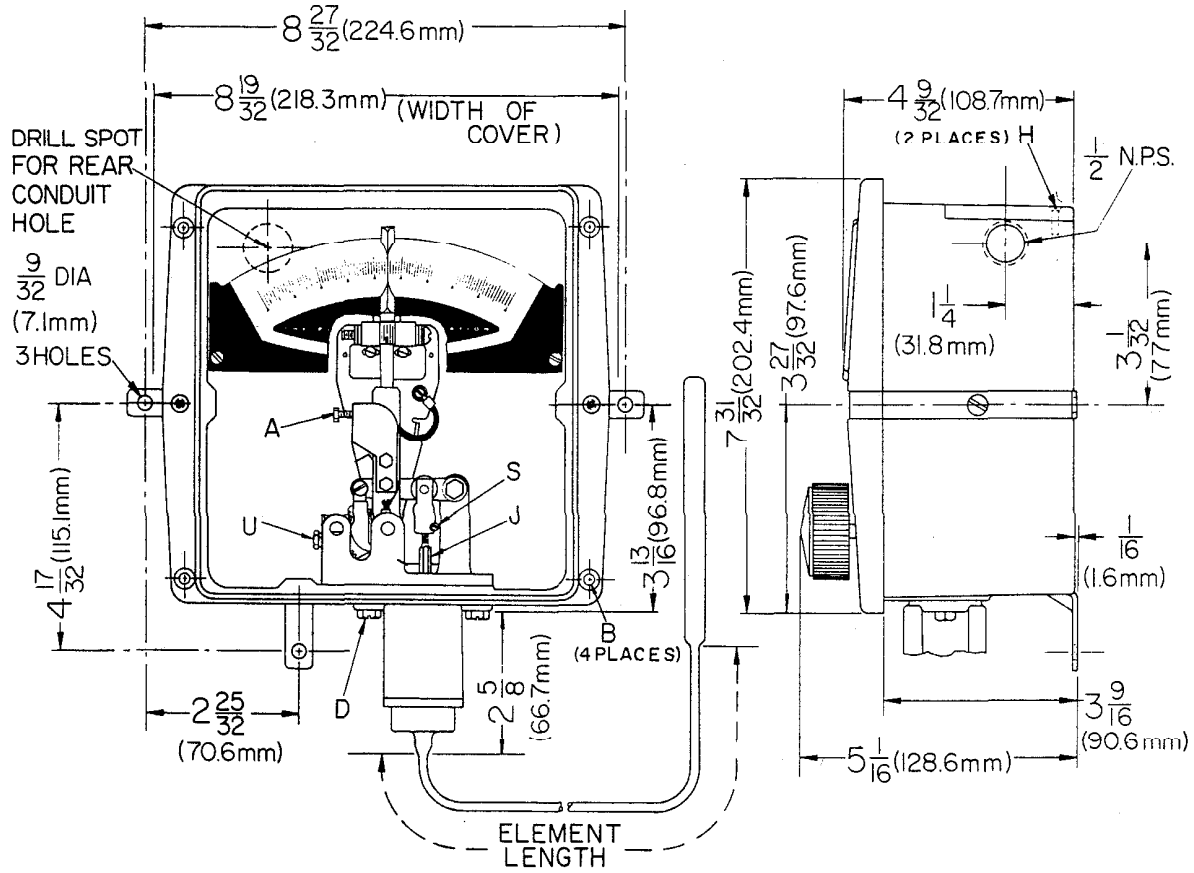
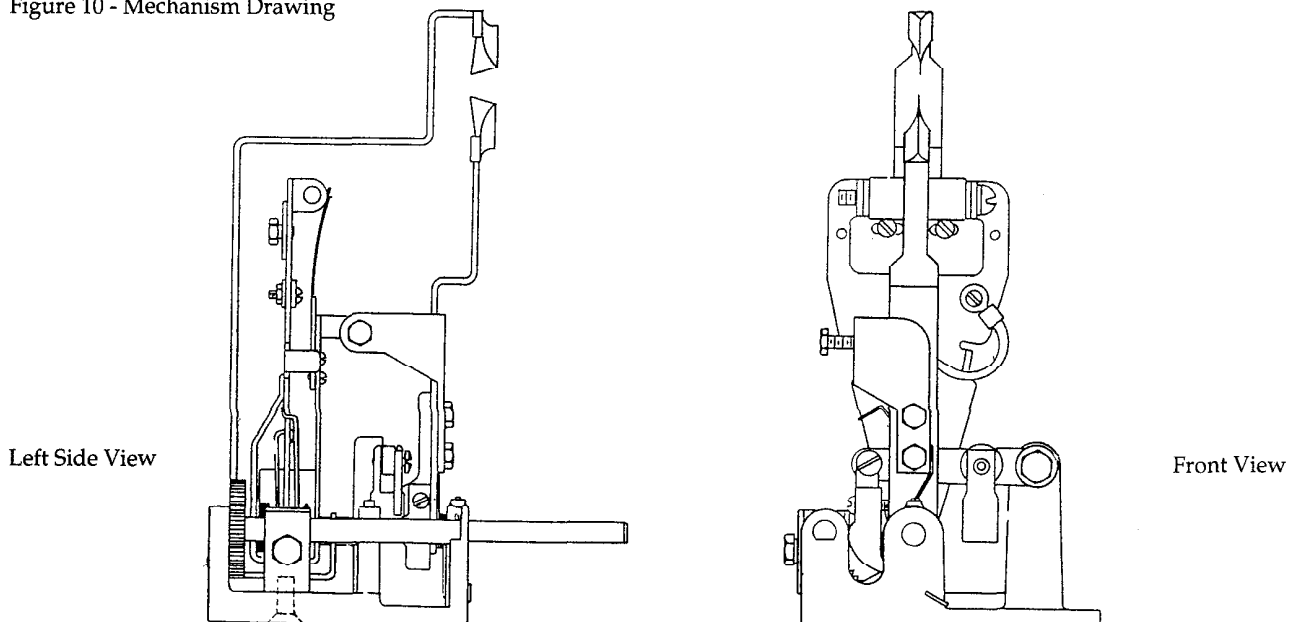


Figure 10 - Mechanism Drawing



# EXPLODED ILLUSTRATION AND PARTS LIST

**1. Mechanism Assembly**

Includes: Potentiometer, Wiring and Terminal Block with Mounting Screws, Push Rod

**2. Main Lever Assembly**

Includes: Main lever with Push Rod Cap, Push Rod, Set Screw

**3. Potentiometer**

Includes: Potentiometer Insulating Washers and Installation Hardware

10071811

64412001

- 644035 01 (135-1/8)
- 02 (135 5/16)
- 03 (135-5/8)
- 04 (100-1/8)
- 05 (100-5/16)
- 06 (5000-5/8)

**4. Case Assembly**

Includes: Top Plate with Screws, Terminal Block Barrier, Mounting Brackets with Screws

64412101

**5. Cover Assembly**

Includes: Cover, Glass, Cover Screws

64412201

**6. Knob Assembly**

Includes: Knob with Set Screw

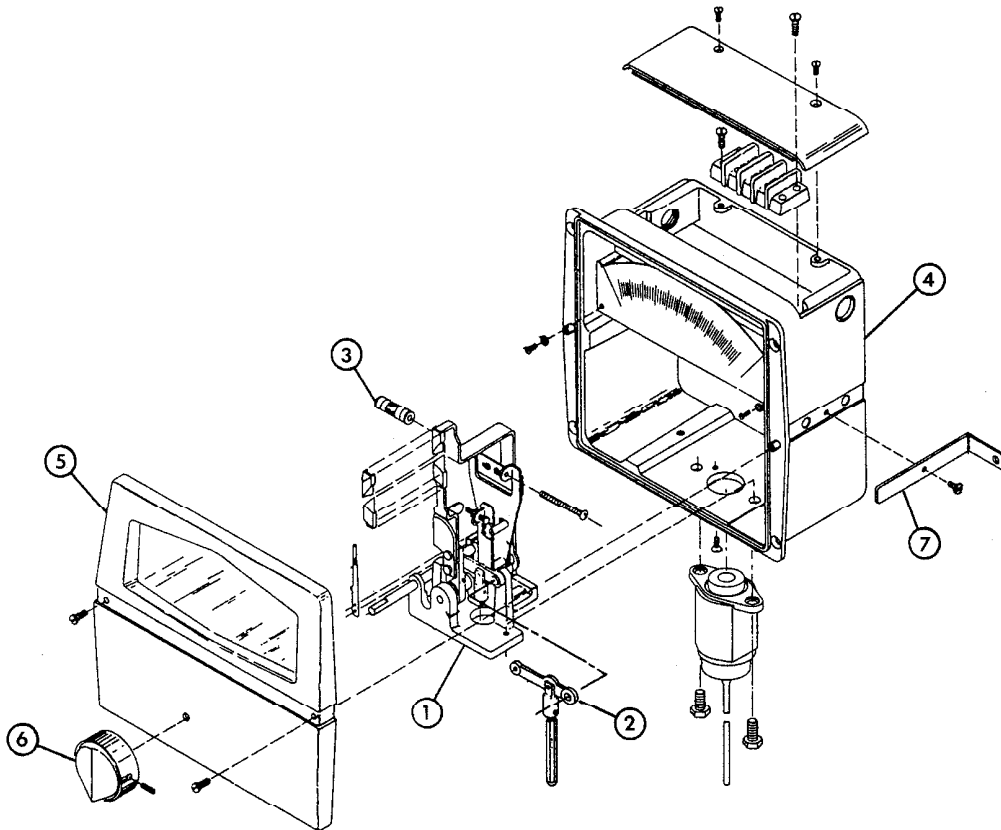
10041301

**7. Mounting Brackets**

64402003

**8. Standard Hardware Kit (not shown)**

Includes:  
 Cover Screws (2)  
 Dial Screws (2)  
 Terminal Block Mounting Screws (3)  
 Mechanism Holding Screw (1)  
 Mounting Bracket Screws (3)  
 Push Rod Set Screw (1)  
 Top Plate Screws (2)  
 Ground Screw (1)



# WARRANTY

These products are sold by The Partlow Corporation ("Partlow") under the warranties set forth in the following paragraph. Such warranties are extended only with respect to a purchase of these products, as new merchandise, directly from Partlow or from a Partlow distributor, representative or reseller, and are extended only to the first buyer there of who purchases them other than for the purpose of resale.

These products are warranted to be free from functional defects in materials and workmanship at the time the products leave the Partlow factory, and to conform at that same time to the specifications set forth in the relevant Partlow instrumentation sheet, sheets, manual or manuals for such products.

Partlow's sole and exclusive obligation and buyer's sole and exclusive remedy under the above warranties is limited to repairing or replacing, at Partlow's option free of charge, the products which are reported in writing to Partlow at its main office - The Partlow-West Company, 2 Campion Road, New Hartford, New York 13413 or FAX MAIL 1-315-797-0403 and which if so advised by Partlow, are returned with a statement of the observed deficiency to the designated facility during normal business hours, transportation charges prepaid and which upon examination by Partlow are found not to comply with the above warranties. PARTLOW SHALL NOT BE LIABLE FOR ANY INCIDENTAL DAMAGES, CONSEQUENTIAL DAMAGES, SPECIAL DAMAGES, OR ANY OTHER DAMAGES, COSTS OR EXPENSES, EXCEPTING ONLY THE COST OR EXPENSE OF REPAIR OR REPLACEMENT AS ABOVE DESCRIBED.

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