

Installation & Maintenance Instructions.

800 Series Electric Indicating Temperature Controllers and Thermometers.

Type 800, 800S, T800, T800S, 802, 802S, 802P, 802PS, 820E*, 822E.*

*Explosion proof class I, Groups, B,C,D, Class II, Groups B,F + G and Class III.

IM800-REV 1

OPERATION

Temperature variations are sensed by the liquid-filled bulb which hydraulically transmits motion through a capillary and bellows to a rack-pinion mechanism which rotates the indicating pointer and actuates precision snap-acting switch(es). Controller settings are made by turning the adjustment knob(s) causing the cam(s) to reposition the precision snap switch(es) in relation to the thermal sensing system. Thermometer types T800 (with enclosure) and T800S (Skeleton) provide temperature indication only with no control switches.

Part I - INSTALLATION

1. Remove adjustment knob(s) and cover .

CAUTION: Do not knockout any plugs on 800E, T800, 820E, 822E. Knobs held on to adjustment shaft with 5/64" Allen screw. Covers held on with 4 phillips head screws at corners.

2. Mount the Controller

The controller maybe mounted in any position to either a surface or panel (1/4" thick maximum). Located where vibration, shock and ambient temperature fluctuations are minimal. It is recommended that mounting the unit with conduit connection on top be avoided. Explosion-proof types must be mounted on a flat surface. See mounted diagrams, Fig. 1D.

To flush mount: (not applicable to explosion-proof types). Cut out the panel as shown in Fig. 1A. Mount to the panel using the two holes located on the flange of the enclosure.

To panel mount (skeletons): prepare the cut out, drilling the holes for the knob shaft and the mounting holes per Fig. 1C.

To surface mount: (Option M449) Attach 2 mounting ears found in separate package to recessed areas on back side of enclosure by means of 2 self-tapping screws. Mount to surface per Fig. 1B. On dual switch explosion-proof types requiring seal fitting, install the nipple and the sealing fitting prior to surface mounting the controller.

3. Bulb and Capillary Mounting

A. Fully immerse the bulb and 6" of capillary in the control zone. For best control it is generally desirable to place the bulb close to the heating or cooling source in order to sense temperature fluctuations quickly. Be sure to locate the bulb so it will not be exposed to temperature beyond the instrument range limits.

B. Try to place the remaining capillary adjacent to the control head so it will sense the same ambient temperature. (Control is ambient temperature compensated.)

C. Factory calibration, unless specified otherwise, allows for 6" capillary tube in the control zone. If longer lengths are required calibration maybe necessary. Follow the procedures outlined in Part II.

D. "C" style bulbs can be coiled or shaped to fit the installation . Avoid sharp bends and coils tighter than 2" radius. **Do not** bend "B" style bulbs

E. Avoid bending or coiling the capillary tube tighter than 1/2" radius. Exercise caution when making bends near the capillary ends.

F. If a separable well or union connector is used follow separate instructions included with them.

4. Making wiring connections

WARNING: Be sure all live supply circuits are disconnected before wiring to installation. Connect conduit to the case and wire directly to the terminals or leadwires in accordance with national and local electrical codes.

IMPORTANT: Maximum recommended wire size: #14 AWG.

A. Enclosed units-Types 800, 802 and 802P: Connect the electrical conduit to the case securing it with the grounding locknut supplied.

NOTE: Unless control is connected to a metallic conduit, grounding bushing shall be removed from grounding wire. A separate conductor shall be provided from grounding system directly to the non-current carrying metal parts of control (splice to the grounding wire).

Conduit opening is available on the left side as standard. It can be supplied on the right side on request. -See Part III (option M007). Wire through the 7/8" conduit hole directly to the lead-wire provided, color coded as follows; or to the optional terminal block.

	SWT. 1	SWT. 2
Common	Violet	Yellow
Normally Open	Blue	Orange
Normally Closed	Black	Red

See wiring diagrams Fig. 2A and 2B. Optional terminal block wiring is available for single or dual switch controls, Option M100. (See Fig. 2D).

B. Skeleton Units - Types 800S, 802S, 802PS wire directly to the leadwires, in the same manner as above "A".

*For dual switch Types 802 and 802S the #1 switch set point may not be higher than that of the #2 switch.

For dual switch Types 802P and 802PS the set point of the #1 switch may be either high or low with respect to that of the #2 switch.

For dual switch Type 822E the #2 switch set point may not be higher than that of the #1 switch.

C. Explosion-Proof Types 820E and 822E:

Connect the electrical conduit directly to the die-cast aluminum enclosure via 3/4" NPTF connection. Wire per the job requirements directly to the terminal block. See Fig. 2C. Wiring enclosure includes ground terminal.

5. Switch Settings (Dual Switch Types Only)

The basic enclosed and skeleton dual switch controllers are furnished with a choice of individual or common adjustment of set points as described below.

Separate knob and pointer for each switch (Types 802 and 802S): Turn black knob for switch #1. Set points are shown by individual pointers and may be separated up to 100% of dial range apart, so long as the red pointer is set higher than the green pointer. Single knob and pointer for both switches (Types 802P, 822E, 802PS). Both switches are standardly factory set together within 5% of (the dial range, and turning the knob positions both switch set points simultaneously, maintaining a constant separation between switches.)

6. Replace cover(s) and knob(s), Adjustment

Controller is ready for operation. Turn setting pointer to desired control temperature and start up the process. To suit particular process conditions or for greater controller accuracy it may be desirable to make slight alterations to the set point or indicator reading. See Part II., paragraph 1 below for instructions. Be sure to replace knob gasket(s) when reassembling.

Note:

Indicating Pointer Deflection:

The indicating pointer will read slightly low at bulb temperature above the controller setting. This deflection is normal and repeatable (approximately 0.5% of scale range or single switch models) and is due to the transference of the switching mechanism load to the thermal system. It can be measured by moving the setting pointer from the high to the low end of the scale and observing the resultant indicating pointer deflection.

Part II Controller's Calibration.

NOTE: Prior to making any controller adjustments the cover and adjustment knobs should be removed. When adjustments are completed all applicable parts should be replaced. NOTE the 802 adjustment knob slides off adjustment shaft for all control except the 802. 802 requires 5/64" Allen Wrench. Be sure to replace gasket when re-assembling.

1. In-Process Adjustments

- A. Use an accurate test thermometer such as a thermocouple with its probe mounted directly to the center of the sensing bulb. Before making any adjustments, allow process temperature to stabilize; i.e., successive on-off cycles repeat
- B. Correct any difference by holding compensator with a 5/16" wrench while turning zero adjustment "C" on thermal assembly with a second 5/16" wrench, until the brown indicating pointer reads the same as the test thermometer. Turning in lowers indicated reading.

- C. Compare process temperature with the adjustment "A" and setting the adjustment pointer to the indicating pointer, then retighten the screw.

2. Adjusting Thermometer Types (T800, T800S)

- A. Use the in-Process adjustments to check the control.
- B. Differences between the test instrument and the thermometer can be corrected by turning the zero adjustment "C" (Fig. 3) on the thermal assembly. Turning in lowers indicated reading.

3. Adjusting Single Switch Types (800, 800S, 820E)

- A. Move the adjustment pointer up scale beyond the brown indicating pointer. This permits checking the set point by moving the lever arm upward with a finger or tool simulating thermal assembly movement.
- B. Connect test lights to indicate switch operation or listen for the switch "click".
- C. Loosen adjustment "A" and move the adjustment pointer until it agrees with the indicating pointer. (when the switch "clicks", then retighten the screw.

4. Adjusting Dual Switch Types (802P, 802PS)

- A. If it is desired to adjust the set point of switch #1 below that of switch #2 turn the red set pointer up scale beyond the brown indicating pointer by an amount greater than the desired difference between the switch settings. If it is not possible to do this because the black indicating pointer is registering too high a temperature, the thermal assembly sensing bulb temperature must be lowered in order to accomplish the adjustment.
To adjust the set point of switch #1 above that of switch #2 turn the red set pointer down scale until it agrees with the brown indicating pointer. Both pointers must be below the upper scale limit by an amount greater than the desired difference between the switch settings.
The foregoing step enables the actuating lever to be moved by a finger or tool simulating thermal assembly movement.
- B. Connect test lights to indicate switch operation or listen for the individual switch "clicks".
- C. The set point of switch #1 may be adjusted by up to 50% of the range span above or below the #2 switch set point. Turn adjustment "B" clockwise to raise or counterclockwise to lower the #1 switch set point. The set point of switch #2 will remain aligned to the red adjustment pointer.
- D. Check the results of any adjustments made by manipulating the actuating lever.
- E. If it is necessary to align switch #2 to the red adjustment pointer loosen adjustment "A", set the adjustment pointer as required and tighten adjustment "A".

5. Adjusting Dual Switch Types (802,802S)

- A. Connect test lights to indicate switch operation or listen for the individual switch "clicks".
- B. The separation between switches is the difference between the high and low set points. The set points are determined by setting individual adjustment pointers and may be separated up to 100% of the scale range apart.
- C. To align either switch to the adjustment pointer the corresponding adjustment "A" must be loosened and the adjustment pointer set to the indicator pointer, then tighten adjustment "A".

NOTE: Switch #1, green pointer, cannot be set to operate at a higher setting than switch #2, red pointer.

6. Adjusting Dual Switch Explosion-Proof Type (822E)

- A. Remove the explosion-proof die-cast cover to permit access to the switches.
- B. Move the adjustment pointer up scale beyond the indicating pointer by an amount greater than the desired difference between the switch settings by moving the actuating lever upward with a finger or tool simulating thermal assembly movement.
- C. Connect test lights to indicate switch operation or listen for the individual switch "clicks".
- D. The set point of switch #1 is determined by the red adjustment pointer. The set point of switch #2 may be adjusted by up to 25% of the range span below the switch #1 set point by turning adjustment "D" in (right hand thread). See Fig. 4. The set point of switch #2 should not be above that of switch #1.
- E. To align switch #1 to the adjustment pointer, loosen adjustment "A" and set the adjustment pointer to the scale, then retightened adjustment "A".

7. Correction for Capillary Immersion

If the length of capillary immersed in the process differs from the amount immersed in the factory calibration bath, a calibration shift will occur. The error may be corrected as follows:

- A. Move set pointer to highest temperature setting.
- B. Note indicating scale reading with the head and sensor at room temperature.
- C. Loosen the two thermal assembly mounting screws.
- D. Reposition the housing index against the calibrations on the instrument case (or skeleton casting) at a rate of 1 division line per capillary length listed below. Move to the left if capillary is to be added to the process, or to the right if capillary is removed from the process.

Model No.	Range	Capillary Length/Division*
1	-180 to 120 F	2 Ft.
2	-125 to 350 F	1 1/2 Ft.
3	-125 to 500 F	1 Ft.
4	-40 to 120 F	4 Ft.
5	-40 to 180 F	3 Ft.
6	-0 to 250 F	2 1/2 Ft.
7	-0 to 400 F	2 Ft.
8	50 to 650 T	2 Ft.
M9	50 to 100 F	2 1/2 Ft.

*Added to or taken away from the process

- E. Tighten the two thermal assembly mounting screws.
- F. Note change indicated scale reading (if any).
- G. Turn Zero adjustment "C" to bring indicating pointer reading back to the original reading noted in step 1. Turning in lowers indicated reading.

NOTE: The thermal assembly can be returned to its original position by aligning its flange with the line scribed on the instrument case.

PART III-SPECIFICATIONS

- Enclosure material: Lexan,® except 820E and 822E, aluminum. A grounding wire will be supplied with all lexan enclosure units.
- Terminal Block option for 800 & 802 (M100).
- 3/4" conduit optional optional for 802 (M901).
- Surface mounting hardware option (M449)
- Secondary Conduit (M007) includes 6235-139 plug button. Apply an even coat of methylene chloride or other epoxy adhesive to affix the plug button into the unused conduit opening to maintain integrity of the enclosure. Ground terminal in 820E and 822E wiring enclosure.

PART IV-Replacement Parts

(See Figs. 3 and 4)

Components available for replacement are the thermal assembly and the switches. Replace as follows:

Thermal Assembly Replacement

- 1. Thermal assemblies are "pre-calibrated" at the factory and can easily be interchanged with the old one. Instructions are included with each replacement assembly. See Part II Para. 1 or 2 for zero adjustment.
- 2. Should the thermal assembly be removed temporarily for any reason, it should be replaced so that the edge of its flange corresponds with the line scribed on the instrument case.

Replacement of Switches-Enclosed Types (Except explosion proof)

(The leadwire's configuration, though rather slack from the switch bank assembly to the wire clamp, is necessary for proper controller operations. This configuration should be duplicated when replacing a switch).

- 1. Turn the adjustment to the upper range limit. This will permit access to all (3) scale mounting screws.
- 2. Remove the scale and unscrew the screw holding pivot post mounting bracket. Be sure to save the (2) spacers under the bracket. (Dual switch types only).
- 3. Remove the tension spring from switch bank assembly.
- 4. The switch bank assembly can now be removed from the pivot post.

(Dual Switch Types)

- A. Disassemble switch #1 extension spring. This will permit access to whichever switch needs replacement.
- B. Insert new switches and leadwires on switch bank assemblies.
- C. Re-assemble switch #1 extension spring and re-install entire assembly onto pivot post.

(Single Switch Types)

- A. Remove the cover from the switch.
- B. Insert new switch and leadwires back into switch cover.
- C. Re-assemble switch assembly to pivot post.
- 5. Re-assemble switch bank assembly tension spring.
- 6. Install the (2) spacers and secure the pivot post mounting brackets.
- 7. Replace the scale, making sure that the scale mounting holes are properly fitted around the cast-in guides hidden by the screws
- 8. Re-calibrate the set points following the procedures in Part II, paragraph 2 or 3 as applicable.

***Note:** Terminal block option has integral spade connections on the shortened lead wires. Remove leadwires from terminal block. When replacing new switches be sure to follow the color coding wiring diagrams on page six.

Replacement of Switches (Explosion-Proof Types) (Single Switch Type)

1. Remove die-cast aluminum cover and remove 2 terminal block mounting screws.
2. Remove (2) switch mounting screws, the switch and the insulator.
3. Remove leadwires from switch and transfer to new switch.
4. Install insulator with new switch and mount in control.
5. Install terminal block and adjust temperature setting per Part II.

(Dual Switch Type)

1. Remove die-cast aluminum cover, unscrew and remove terminal block and insulator, letting terminal block hang.
2. Unscrew terminal block supports and remove (2) switch mounting screws, washers and wire guard.
3. Lift out dual switch bank and actuating lever assembly.
4. Disconnect (6) wires at switch terminals.
5. Assemble new switches and insulators to the switch bank assembly.
6. Connect wires at the switch terminals.
7. Install switch bank assembly, terminal block supports, insulators, wire guard and terminal block in controller.
8. Adjust temperature setting per Part II.

Recommended practices in selecting, specifying and installing temperature controls

United Electric Controls Company recommends careful consideration of the following factors when specifying and installing UE Temperature Controls. Before installing a control, the Installation and Maintenance Instructions provided must be read and understood.

- Maximum temperature limits stated in literature and on nameplates must never exceeded, even by surges in the systems. Occasional operation of unit up to maximum temperature is acceptable on a limited basis (e.g. start-up, testing). Continuous operations should be restricted to the designated adjustable range.
- The adjustable range must be selected so that incorrect, inadvertent or malicious settings at any range point cannot result in an unsafe system condition.
- Install unit where shock, vibration and temperature fluctuations are minimal. Orient unit so that moisture is prevented from entering the enclosure via the conduit.
- Units must not be altered or modified after shipment. Consult UE if modification is necessary.
- Provide for preventative maintenance and periodic testing—particularly in critical applications. Factory set units should be tested on all applications prior to start-up.
- Do not mount unit in ambient temperature exceeding published limits.
- Install a back-up control for critical applications where a control failure could endanger life, limb or property. A hi or low limit control is recommended for applications where a runaway condition could result.
- Electrical ratings stated in literature and on nameplate must not be exceeded—overload on a switch can cause failure on the first cycle. Wire units according to local and national electrical codes, using wire sizes recommended in installation sheets.
- Use only factory authorized replacement parts and procedures.
- For remote models, capillary lengths beyond 10 feet can increase chance for error, and may require recalibration of set point and indication.
- Observe warning signs of possible failure, such as drift in set point. Check control immediately.

FIG. 1

FIG. 1A FLUSH MOUNTING

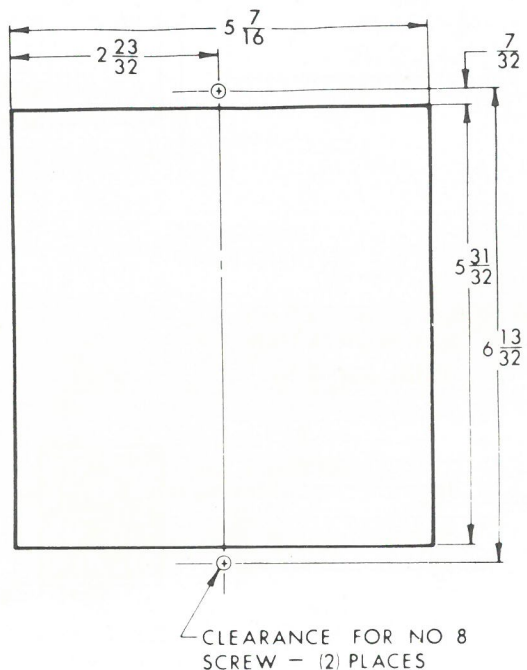


FIG. 1B SURFACE MOUNTING

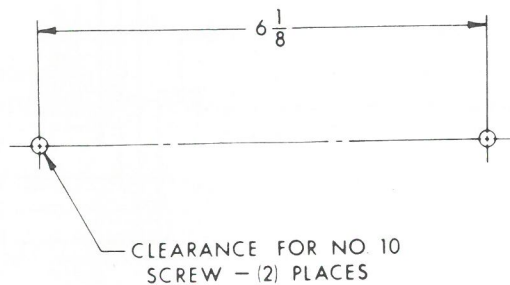


FIG. 1D EXPLOSION - PROOF MOUNTING

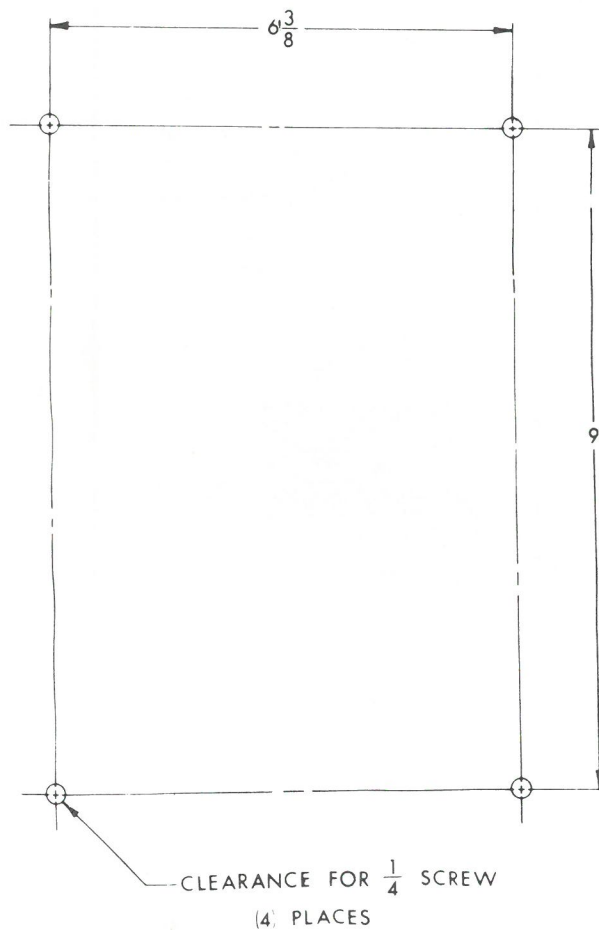


FIG. 1C PANEL MOUNTING (SKELETON)

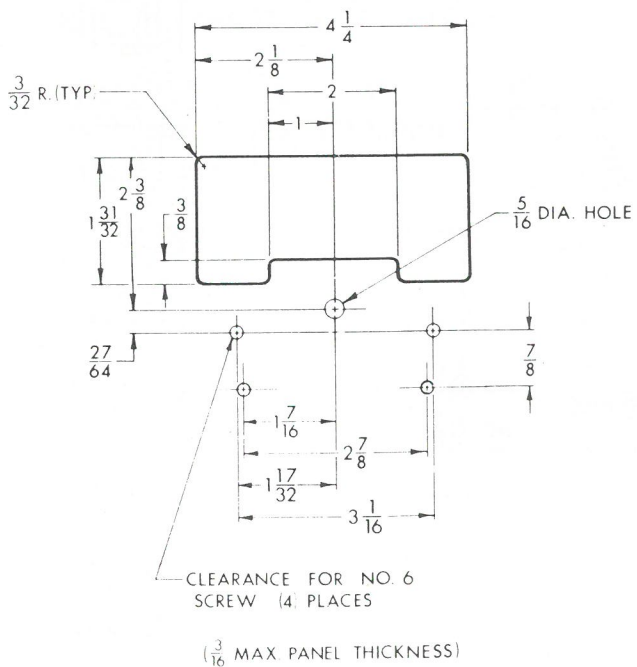


FIG. 2 WIRING DIAGRAMS

FIG. 2A
DUAL SWITCH

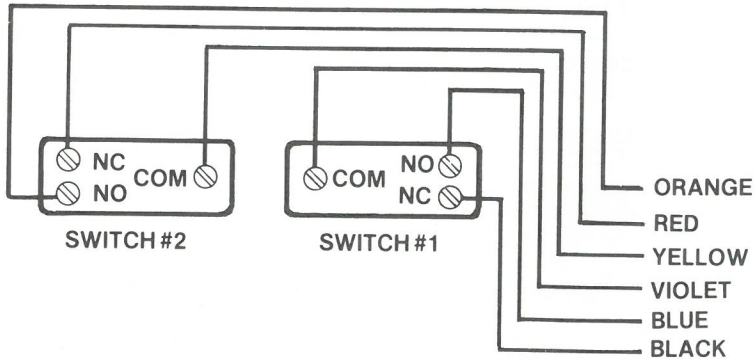


FIG 2B
SINGLE SWITCH

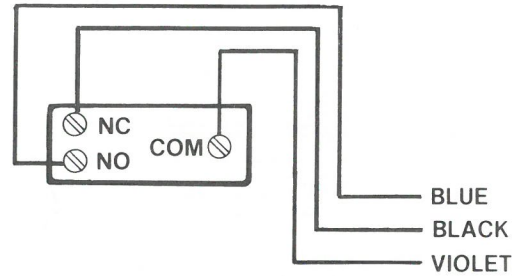


FIG. 2D
WIRING FOR SERIES 800, 802
with Terminal Block Option
(DUAL SWITCH)

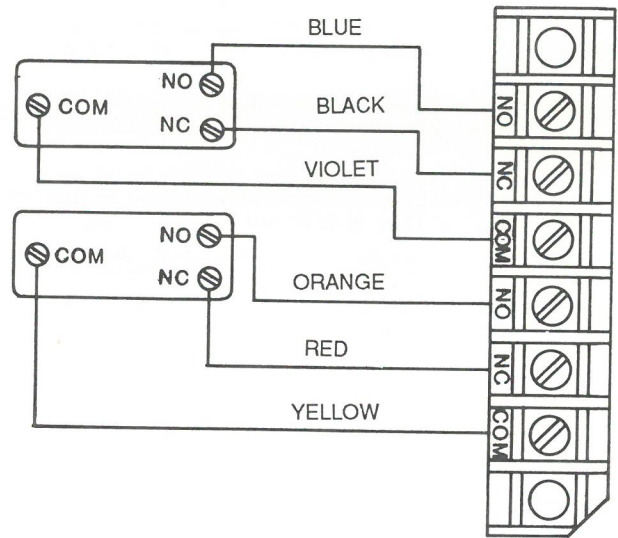
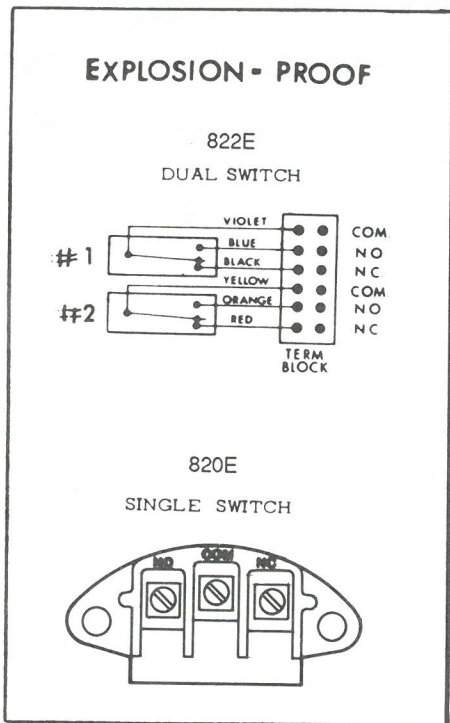


FIG 2C



(SINGLE SWITCH)

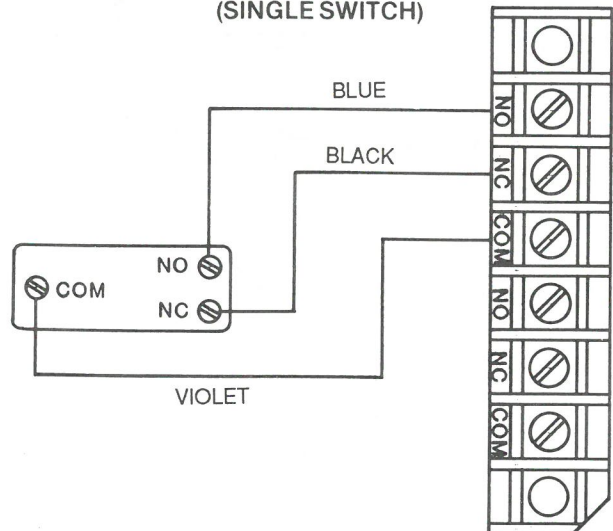
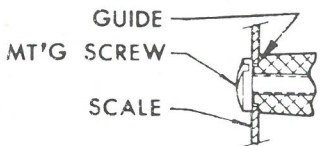
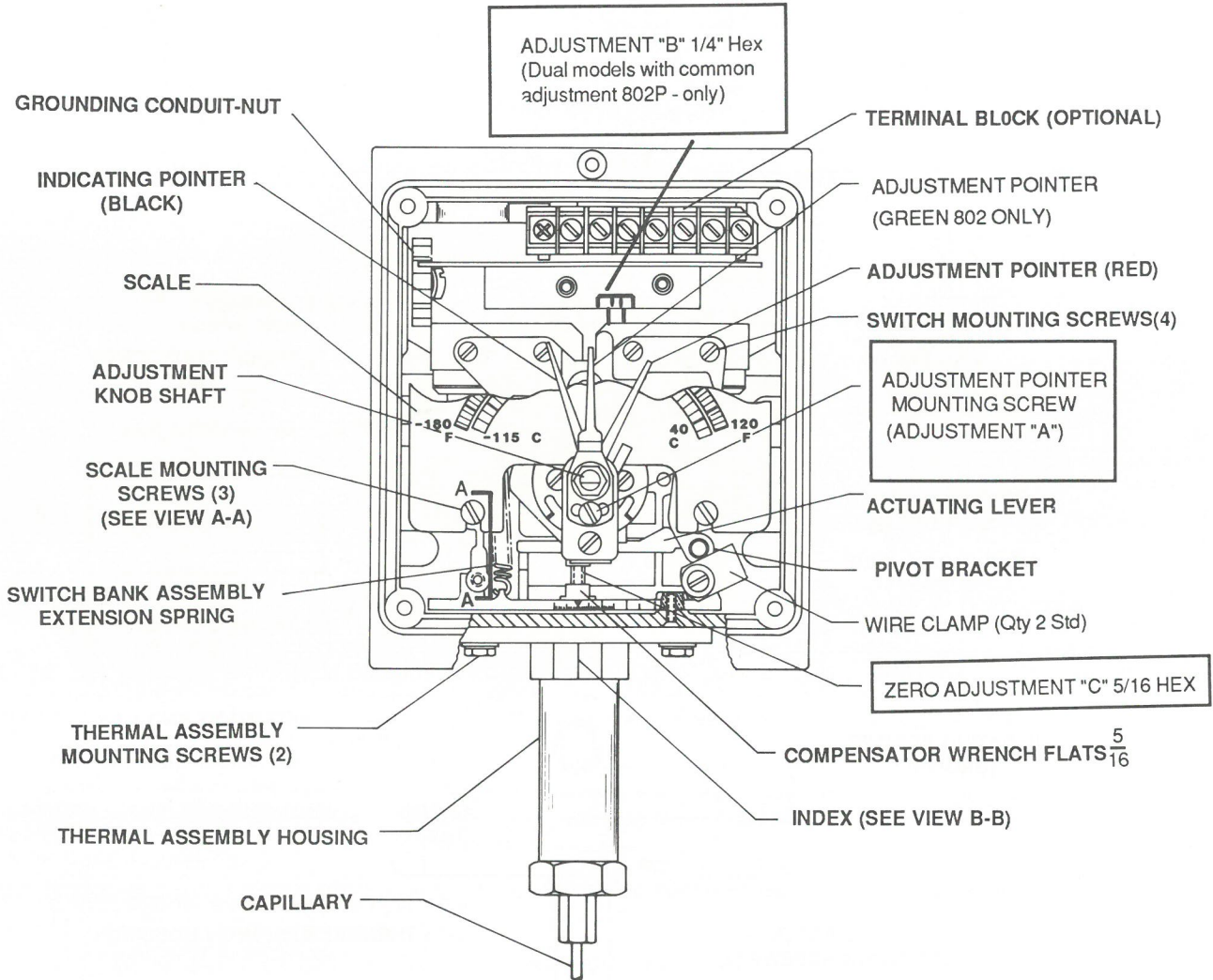


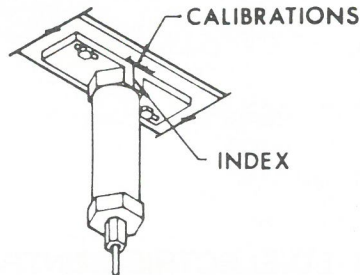
FIG. 3

GENERAL LAYOUT (LEADWIRES OMITTED FOR CLARITY)

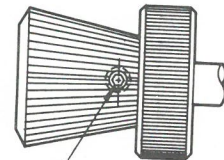
"Composit dual switch version is shown" below. In the single switch version Type 800 only one snap-acting switch is used. In the thermometer version Types T800, and T800s the switch(es), adjustment knobs, pointer and associated parts are missing.



VIEW A-A
3 PLACES



VIEW B-B

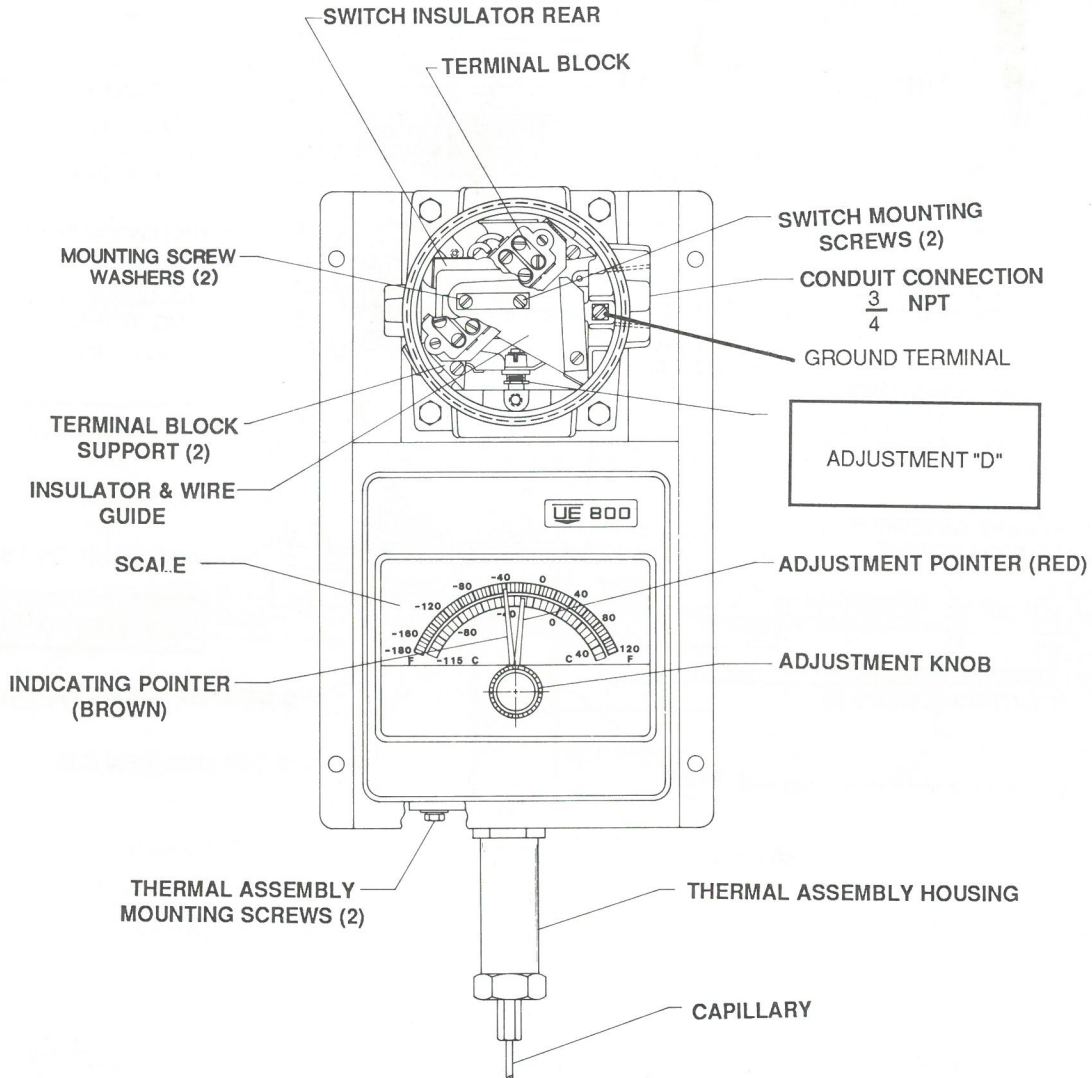


APPROX. WEIGHT:

- TYPE 800S - 2LBS 7 1/2 OZ.
- TYPE 802 - 3LBS 10 1/2 OZ.
- TYPE 820E - 8LBS 11 1/2 OZ.

FIG. 4 EXPLOSION PROOF LAYOUT

Explosion-proof enclosure cover removed. Internal pointer adjustments in Figure 3 same on explosion-proof types. Adjustment knobs and cover can be removed to permit access.



UNITED ELECTRIC CONTROLS CO.

85 School Street
Watertown, MA 02172
Telephone: 1-617/926/1000
Fax: 1-617/906/2568
Telex: 92-2445