

T-5800-3 and T-5800-4 Dual Input Receiver-Controllers Installation and Calibration

The T-5800 Series Receiver-Controllers are designed for use with remote temperature, humidity, or pressure transmitters (connected to the controlled variable "CV" input) to provide precise control of pneumatic devices. The T-5800-3 is a dual input proportional-only receiver-controller with field selectable local or remote set point. The T-5800-4 is also a dual input receiver-controller with field selectable local or remote set point; however, this model provides proportional plus integral (PI) control. In addition, an automatic/manual integral control cutout feature is incorporated into the T-5800-4 design. Utilizing the fan "F" connection, this feature allows the system to start up using proportional-only control thus keeping the system from going out of control on startup, as is inherent to PI (automatic reset) controllers, when the system has been off for some time. Refer to Product Data T-5800 for instrument specifications and additional details.

Installation

The T-5800 Series Receiver-Controllers are designed for surface mounting; refer to Fig. 3 for space requirements and mounting details. All air line connections are made to the units through two snap-on input/output fittings which have barbed fittings for 1/4 in. O.D. polytubing. Both dual input models are furnished with a clear cover, snap-on air connectors, a double .007 in. orifice jumper, an additional set point dial sticker marked with 50 graduations, and a yellow remote indication set point dial sticker.

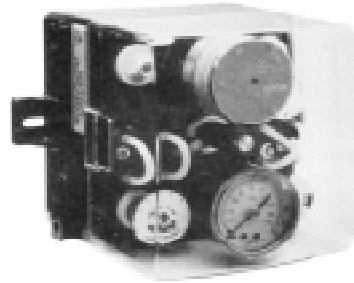


Fig. 1: T-5800-3 Dual Input Proportional Receiver-Controller

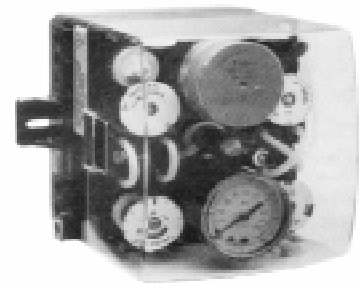


Fig. 2: T-5800-4 Dual Input PI Receiver-Controller

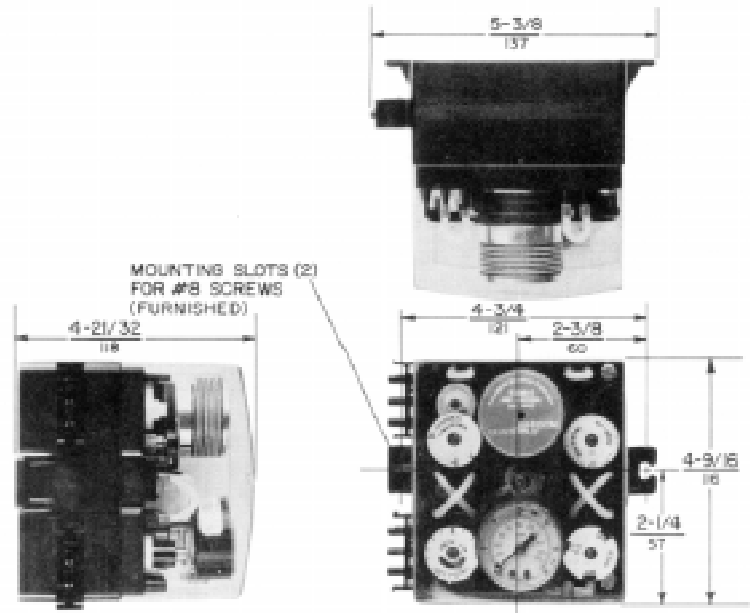


Fig. 3: T-5800 Series Dimensions in./mm and Mounting Details

Cover Removal

The cover can be removed by applying an inward pressure to one of the black tabs of the receiver-controller main body to unlatch it. The cover can also be removed by simply taking hold of the top and bottom sides of the cover and pulling outward.

Oil Indicating Supply Air Filter

Check the oil indicating supply air filter and replace as necessary (A-4000-137 ordered separately). When the filter is dirty, a pressure drop will occur. When filtering oil-contaminated air, the filter will change from white to red in color. If frequent changes are necessary, check the air supply system to determine the cause of dirty or oil-contaminated air.

Positioning the Action and Orifice Jumpers

The T-5800 must be programmed according to the system requirements. Both dual input receiver-controllers are factory set in the direct acting mode with reverse readjustment. The action and readjustment can be changed by interchanging the placement of the tube ends from one lower spigot to the other lower spigot (see Figs. 4, 11, and 15).

Each dual input T-5800 is furnished with a double .007 in. orifice jumper and three yellow spigot caps (see Fig. 5). The orifice jumper provides a restricted source of supply to low volume non-relay type transmitters. For best results, it is recommended that this jumper be used when the low volume transmitter is located within 50 ft. (15m) of the receiver-controller. For all other applications, it is recommended that the spigots be capped and a source of supply be furnished at the transmitter.

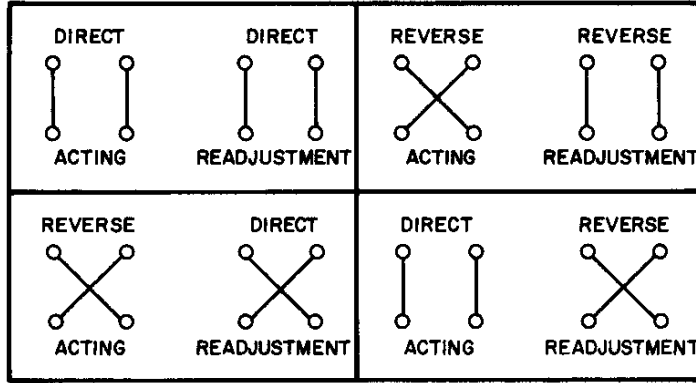


Fig. 4: T-5800 Receiver-Controller Action and Readjustment Modes

FOR LOW VOLUME NON-RELAY TRANSMITTERS WITHIN 50 ft. OF RECEIVER-CONTROLLER

FOR ALL OTHER APPLICATIONS, FURNISH SOURCE OF SUPPLY AT TRANSMITTER

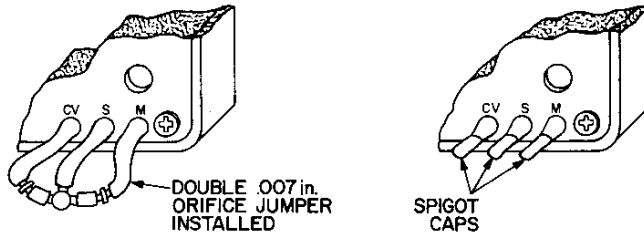


Fig. 5: Orifice Jumper Located on Lower Right Corner of T-5800

Precalibration Setup

Using the graph on Form 561, prepare a readjustment schedule (similar to the example in Fig. 6) with respect to job requirements, action, range of readjustment, transmitter spans, and pressures. Use the graph and transmitter span vs. output comparison chart

to illustrate the pressure relationship of master "M" input vs. controlled variable "CV" input. Locate the two end points of the control schedule and connect with a straight line.

The receiver-controller ratio is determined by the following formula:

$$\text{Ratio} = \frac{\text{Sensitivity of the Controlled Variable "CV" Transmitter (See Table)} \times \text{Change in Controlled Variable "CV" } (\Delta \text{ Temp, Pressure, or RH})}{\text{Sensitivity of the Master "M" Transmitter (See Table)} \times \text{Change in Master "M" } (\Delta \text{ Temp, Pressure, or RH})}$$

Ratio = $\frac{.06 \times (200-80)}{.06 \times (60-0)}$

Ratio = $\frac{.06 \times 120}{.06 \times 60}$

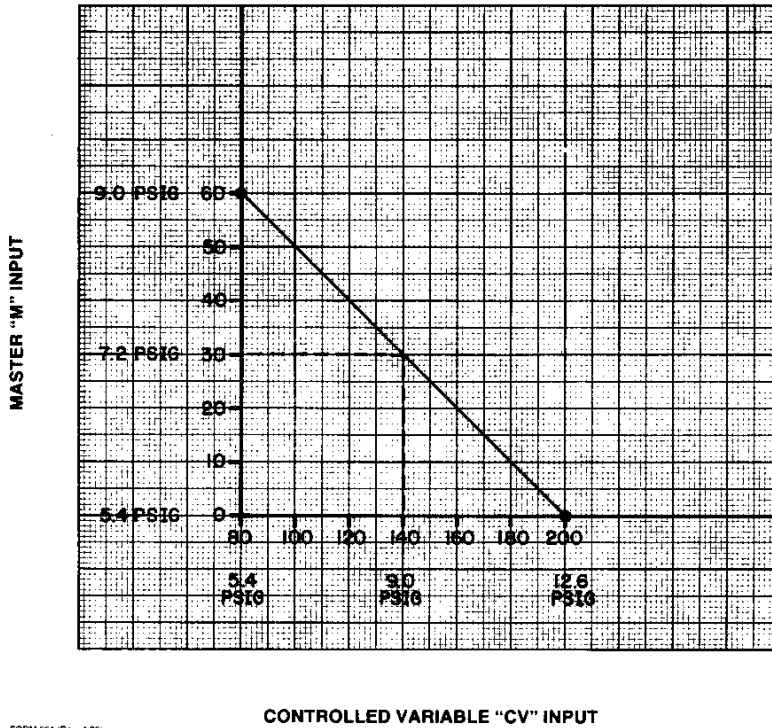
Ratio = $\frac{7.2}{3.6}$

Ratio = 2.0

Transmitter Span	Transmitter Sensitivity
25	.48 PSI/N*
50	.24 PSI/N*
100	.12 PSI/N*
200	.06 PSI/N*

*N = Temp, Pressure, or RH

EXAMPLE



FORM 561 (Rev. 4/86)

Printed in U.S.A.

Job	Sample Job
Street	123 Main Street
City	Anytown, PA
Date	4/10/86
Control Diag. No.	12345
System or Unit No.	Boiler

Controlling Transmitter or Sensor	
Location Hot Water Supply	
Span 200	Limits 40 to 240
Working Range 80 to 200°F	

Master Transmitter or Sensor	
Location O.A. TEMP.	
Span 200	Limits -40 to 160
Working Range 0 to 60°F	
Ratio or Aux. Auth. 2:1	

Master	CV
0°F	200°F
60°F	80°F

Fig. 6: Master "M" Input vs Controlled Variable "CV" Input

Set point Selection - Local or Remote

Local: The arrow on the set point dial represents approximately a 9 PSIG (63 kPa) set point pressure. The dial sticker is designed so that the actual set point can be written directly on its surface using a common pencil.

Note: When local set point adjustment is used, the set point "SP" connection must be open to atmosphere.

Remote: Rotate the set point dial fully counterclockwise until it hits its mechanical stop. Affix

the yellow dial sticker to indicate remote set point adjustment mode (see Fig 7). Connect the tubing from the remote set point adjustment device to the set point "SP" connection of the snap-on input/output connector. A low volume restricted source of supply air (less than .005 in. orifice) is automatically furnished; therefore, use 75% of the overall line length that is recommended for a .005 in. orifice.

FC and PRV Test Points

The FC and PRV test points and their associated adjustments are for **FACTORY USE ONLY**.

Supply Air Interruptions

Both dual input receiver-controllers have within their circuitry a master balance regulator which requires that the supply air remain on at all times. In addition, T-5800-4 has an automatic/manual integral control cutout feature which also requires that the supply air remain on at all times.

Calibration

General Instructions

Calibration and readjustment of the T-5800 Receiver-Controller should only be done by a qualified Johnson Controls

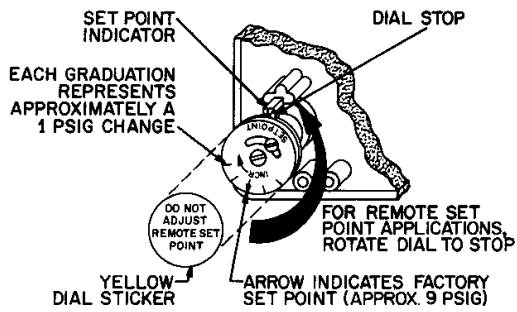


Fig. 7: Remote Set Point Mode



Fig. 8: X-200-173 Calibration Kit



Fig. 9: X-200-140 Test Probe with X-200-180 Series Transmission Gauge and F-500-42 Adapter

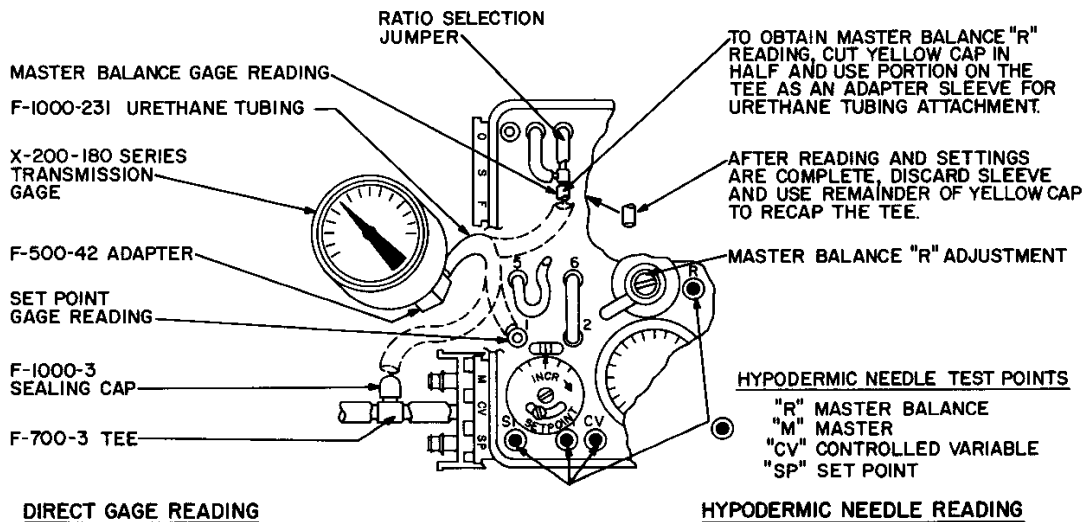
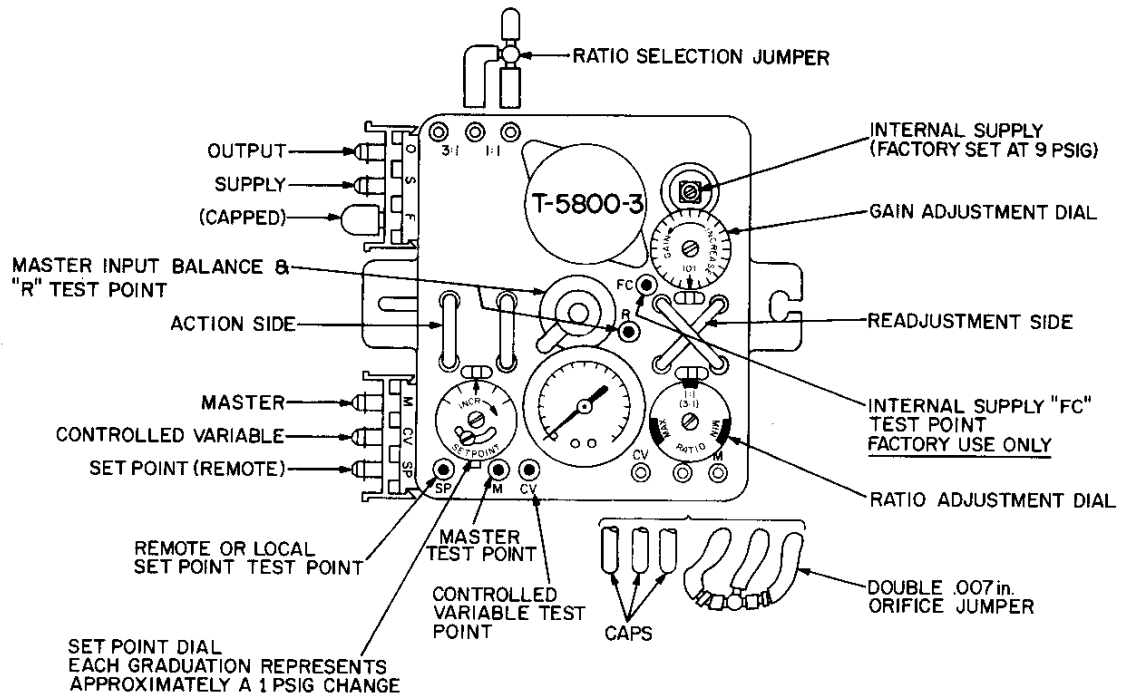


Fig. 10: Methods for Checking Pressure Readings



**Fig. 11: T-5800-3 Adjustment Points
(Proportional-Only Model)**

representative equipped with the proper tools. An X-200-173 Calibration Kit (see Fig. 8, ordered separately) is available for making adjustments and pressure checks on the T-5800. This kit provides all of the necessary gages, regulators, and connectors for a more convenient and quicker calibration procedure.

An X-200-140 Hypodermic Needle Test probe and appropriate gage (see Fig. 9, ordered separately) is also available for troubleshooting, test point readings, or final set point adjustments under actual job conditions. **Note: Figure 10 illustrates an alternative method of checking pressure readings on the T-5800 where use of a hypodermic needle test probe is prohibited.**

Calibrating the T-5800-3 (See Fig. 11)

With the supply air ON, balance the receiver-controller by setting the following:

- Adjust the local set point dial or the remote adjuster (manual or automatic) to produce 9 PSIG (63 kPa) using the appropriate method and gage as described above.
- Turn the gain dial clockwise so that the word "INCREASE" imprinted on the dial is centered with the dial reference point.
- Install the ratio selection jumper in the correct position (see Fig. 11). If the calculated ratio is less than or equal to 2.5:1, (as is the case with the example where the calculated ratio is 2:1), the jumper should be

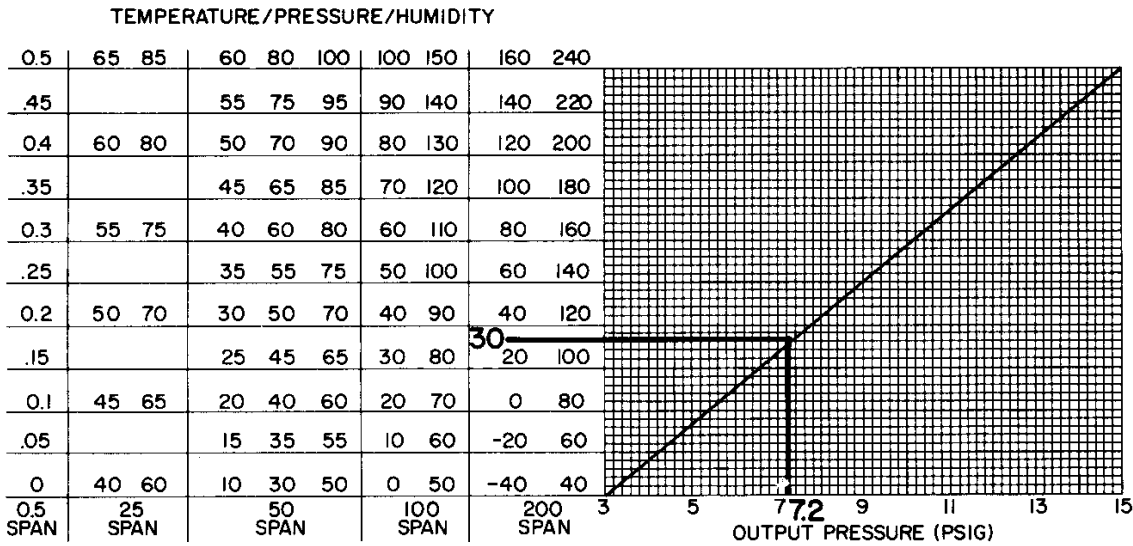
installed in the 1:1 position. If the calculated ratio is greater than 2.5:1, the jumper should be installed in the 3:1 position.

- Turn the ratio dial so that "1:1 (3:1)" imprinted on the dial lines up with the dial reference point.

Receiver-Controller Preset (See Example Fig. 6)

Utilize one of the pressure checking methods described previously to obtain a master "M" input pressure reading, a master balance "R" pressure reading, and a controlled variable "CV" input pressure reading.

1. Apply a master "M" input pressure equal to the midpoint of the desired working range (Example: 30°F on a 0 to 60°F working range or 7.2 PSIG as highlighted in Fig. 12).



METRIC CONVERSION FACTORS

(°F - 32) / 1.8 = °C
 PSIG x 7 = kPa
 in. WG x 249 = Pa

Fig. 12: Transmitter Span vs Output Pressure

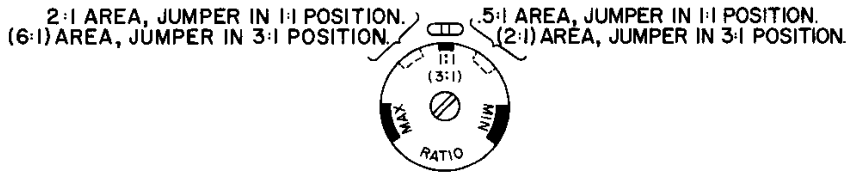


Fig. 13: Ratio Dial Reference Points

2. Rotate the master balance screw (see Fig. 10) located in the center of the receiver-controller (clockwise to increase or counterclockwise to decrease) to produce a 9 PSIG (63 kPa) gage reading at the master balance "R" reference. Doing so will shift the working range (internally) to a more linear portion of the ratio circuit.

3. Vary the master input from minimum to maximum over its working range (Example: 0 to 60°F or 5.4 to 9 PSIG per Fig. 6). **Note: The master "M" INPUT is limited to not less than 2 PSIG nor greater than 17 PSIG. Note the pressure readings at the master balance "R" reference corresponding to these minimum and maximum points.**

If the minimum master balance "R" pressure noted above is greater than or

equal to 5 PSIG and the maximum master balance "R" pressure is less than 19 PSIG (with a 20 PSIG supply), no further adjustments are required. If the minimum master balance "R" pressure is less than 5 PSIG, rotate the master balance screw (clockwise to increase) so that the minimum pressure is greater than 5 PSIG and the maximum does not exceed 19 PSIG.

4. After removing the pressure checking method from the master balance "R" reference, it is suggested that the master balance screw be sealed (using a small dab of fingernail polish).
5. Return the master "M" input pressure to the midpoint of the desired working range (Example: 30°F or 7.2 PSIG on a 0 to 60°F working range per Fig. 6).
6. Apply a controlled variable "CV" input pressure to the value corresponding to the value 7.2 PSIG master "M" input setting (Example: 140°F or 9 PSIG per Fig. 6).
7. Rotate the ratio dial (see Fig. 13) to a position which most closely represents the required ratio setting (Example: 2:1, outer scale on dial and jumper in 1:1 position).
8. Adjust the local set point dial or the remote adjuster (manual or automatic) to produce an output pressure on the controller gage equal to the midpoint of the spring range of the controlled device.

Ratio and Set Point Checkout

1. Apply the minimum master "M" input pressure value (Example: 0°F or 5.4 PSIG per Fig. 6).
2. Apply the corresponding controlled variable "CV" input pressure value (Example: 200°F or 12.6 PSIG per Fig 6).
3. Ratio Dial Adjustment:

Note: Never adjust the ratio dial when the master "M" Input pressure is at the midpoint of its working range (Example: 30°F on a 0 to 60°F range or 7.2 PSIG per Fig. 12). No output signal change

will occur because the internal ratio circuitry is in a balanced condition, and any previous ratio dial setting (if not marked) will be lost.

Adjust the ratio dial to cause the receiver-controller output to be at a pressure value which would produce the required controlled variable "CV" input (Example: Direct acting T-5800-3, N.O. heating valve with a 3 to 7 PSIG spring range; output should be below the midpoint of the spring range of the valve which would produce the required 200°F).

4. Apply the maximum master "M" input pressure value (Example: 60°F or 9 PSIG per Fig. 6).
5. Apply the corresponding controlled variable "CV" input pressure value (Example: 80°F or 5.4 PSIG per Fig. 6).
6. Set Point dial Adjustment:
Adjust the set point dial to cause the output pressure to be at the opposite end of the spring range of the controlled device (Example: Direct Acting T-5800-3, N.O. heating valve with a 3 to 7 PSIG spring range; output should be above the midpoint of the spring range of the valve which would produce the required 80°F).
7. Rotate the gain dial so that "10:1" imprinted on the dial lines up with the dial reference point.
8. The T-5800-3 is calibrated and ready for system operation.

Gain Adjustment (See Fig. 14)

Adjusting the gain dial **will not** affect the controller set point;

however, the **output pressure** may change when the gain dial is adjusted. Increasing the gain will narrow the throttling range (decrease offset), allowing the control point to be closer to the set point. Decreasing the gain will widen the throttling range, forcing the control point away from the set point.

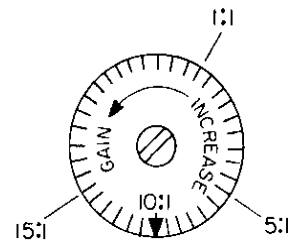


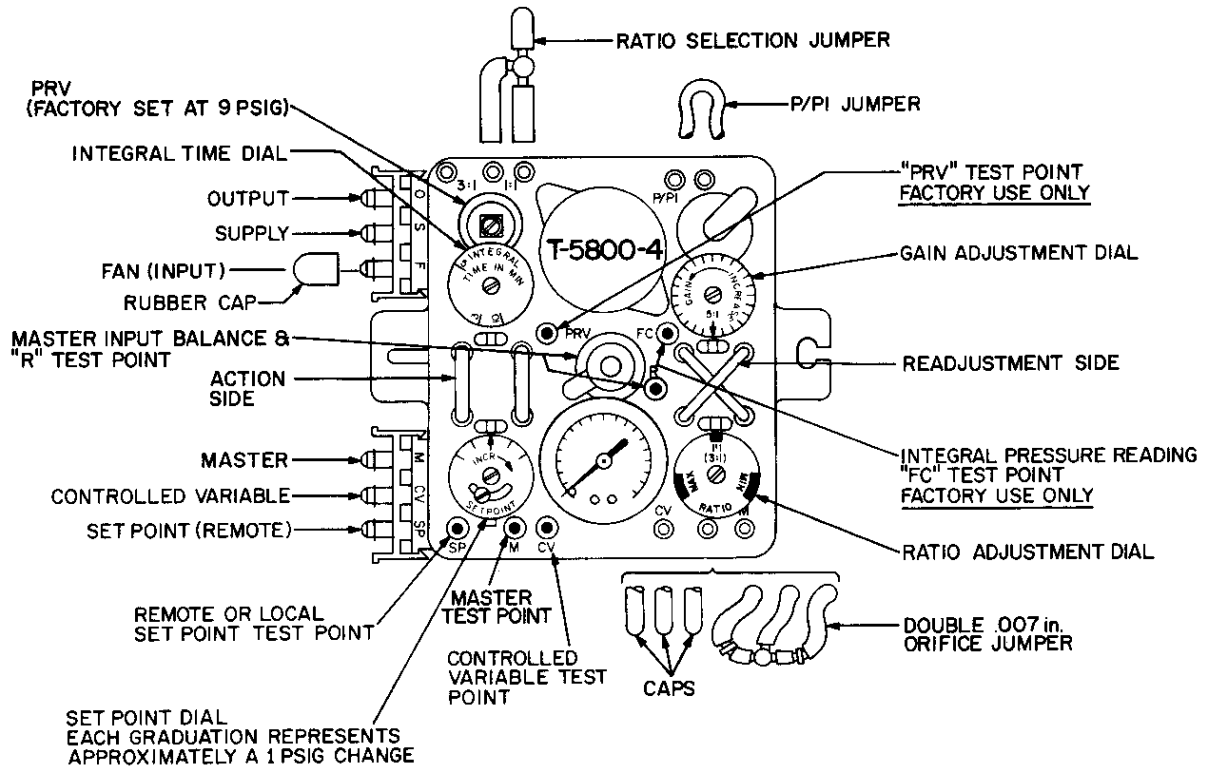
Fig. 14: T-5800-3 Gain Dial Reference Points

Normally, having the gain arrow set at the pointer represents a reasonable gain adjustment which would provide stability. Increase the gain setting by small increments until the system becomes unstable and begins to cycle. Decrease the gain setting slightly to remove the cycling effect. Doing so will provide maximum controllability with a minimum of offset.

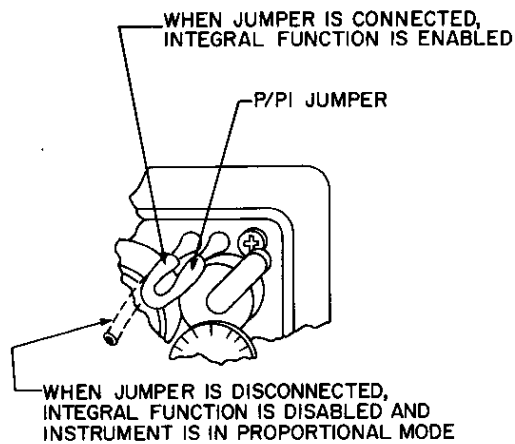
Calibrating the T-5800-4 (see Fig. 15)

When connecting the T-5800-4 Receiver-Controller to an operating system, the fan "F" connection should either have the "system in operation" function signal (minimum of 12 PSIG) attached (example: fan on-off or water circulation pump on-off), or the connection must be capped.

Pulling the P/PI jumper (see Fig. 16) off of its spigot causes the receiver-controller to operate as proportional-only controller (no integral function). The jumper must be connected



**Fig. 15: T-5800-4 Adjustment Points
(Proportional Plus Integral Model)**



**Fig. 16: P/PI Jumper Located on
Upper Right Corner of T-5800-4**

in order for the system to have normal proportional plus integral control.

The T-5800-4 has an automatic/manual integral control cutout feature when the fan "F" connection is used. This feature keeps the system from going out of control on startup (after it's been off for some time) by allowing the system to start up using proportional-only control. If it is determined that there is not a need for the cutout feature, cap the unused fan "F" connection. Doing so will allow normal proportional plus integral control of the system at all times, provided that the P/PI jumper is connected.

With the supply air ON, balance the receiver-controller by setting the following:

- Pull the P/PI jumper off of its spigot so that the receiver-controller will operate as a proportional-only controller (no integral function).
- Adjust the local set point dial or the remote adjuster (manual or automatic) to produce 9 PSIG (63 kPa) using the appropriate method and gage as described previously.
- Install the ratio selection jumper in the correct position (see Fig. 15). If the calculated ratio is less than or equal to 2.5:1 (as is the case with the example where the calculated ratio is 2:1), the jumper should be installed in the 1:1 position. If the calculated ratio is greater than 2.5:1, the jumper should be installed in the 3:1 position.
- Turn the ratio dial so that "1:1 (3:1)" imprinted on the dial lines up with the dial reference point.

Receiver-Controller Preset (See Example Fig. 6)

Utilize one of the pressure checking methods described

previously to obtain a master "M" input pressure reading, a master balance "R" pressure reading, and a controlled variable "CV" input pressure reading.

1. Apply a master "M" input pressure equal to the midpoint of the desired working range (Example: 30°F on a 0 to 60°F working range or 7.2 PSIG as highlighted in Fig. 12).
2. Rotate the master balance screw (see Fig. 10) located in the center of the receiver-controller (clockwise to increase or counterclockwise to decrease) to produce a 9 PSIG (63 kPa) gage reading at the master balance "R" reference. Doing so will shift the working range (internally) to a more linear portion of the ratio circuit.
3. Vary the master input from minimum to maximum over its working range (Example: 0 to 60°F or 5.4 to 9 PSIG per Fig. 6). **Note: The master "M" INPUT is limited to not less than 2 PSIG nor greater than 17 PSIG.** Note the pressure readings at the master balance "R" reference corresponding to these minimum and maximum points.

If the minimum master balance "R" pressure noted above is greater than or equal to 5 PSIG and the maximum master balance "R" pressure is less than 19 PSIG (with a 20 PSIG supply), no further adjustments are required. If the minimum master balance "R" pressure is less than 5 PSIG, rotate the master balance screw (clockwise to increase) so that the minimum pressure is greater than 5 PSIG and the maximum does not exceed 19 PSIG.

4. After removing the pressure checking method from the master balance "R" reference, it is suggested that the master balance screw be sealed (using) a

small dab of fingernail polish).

5. Return the master "M" input pressure to the midpoint of the desired working range (Example: 30°F or 7.2 PSIG on a 0 to 60°F working range per Fig. 6).
6. Apply a controlled variable "CV" input pressure to the value corresponding to the 7.2 PSIG master "M" input setting (Example: 140°F or 9 PSIG per Fig. 6).
7. Rotate the ratio dial (see Fig. 13) to a position which most closely represents the required ratio setting (Example: 2:1, outer scale on dial and jumper in 1:1 position).
8. Adjust the local set point dial or the remote adjuster (manual or automatic) to produce an output pressure on the controller gage equal to the midpoint of the spring range of the controlled device.

Ratio and Set Point Checkout

1. Apply the minimum master "M" input pressure value (Example: 0°F or 5.4 PSIG per Fig. 6).
2. Apply the corresponding controlled variable "CV" input pressure value (Example: 200°F or 12.6 PSIG per Fig. 6).
3. Ratio Dial Adjustment:

Note: Never adjust the ratio dial when the master "M" input pressure is at the midpoint of its working range (Example: 30°F on a 0 to 60°F range or 7.2 PSIG per Fig. 12). No output signal change will occur because the internal ratio circuitry is in a balanced condition, and any previous ratio dial setting (if not marked) will be lost.

Adjust the ratio dial to cause the receiver-controller output to be at the midpoint

of the actual spring range of the controlled device.

4. Apply the maximum master "M" input pressure value (Example: 60°F or 9 PSIG per Fig. 6).
5. Apply the corresponding controlled variable "CV" input pressure value (Example: 80°F or 5.4 PSIG per Fig. 6).
6. Set Point Dial Adjustment:
Adjust the set point dial to cause the output pressure to be at the midpoint of the actual spring range of the controlled device.
7. Start up the system to be controlled. After a reasonable period of time, the receiver-controller should be in control (as a proportional-only controller) WITHIN the throttling range of the controlled device.
8. Proceed to the Gain Adjustment section.

Gain Adjustment (See Fig. 17)

Note: All gain adjustments must be made with the P/PI jumper still removed from the spigot.

Adjusting the gain dial **will not** affect the controller set point; however, the **output pressure** may change when the gain dial is adjusted. Increasing the gain will narrow the throttling range (decrease offset), allowing the control point to be closer to the set point. Decreasing the gain will widen the throttling range, forcing the control point away from the set point.

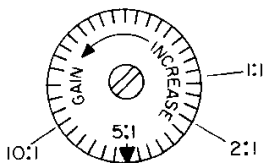


Fig. 17: T-5800-4 Gain Dial Reference Points

Normally, having the gain arrow set at the pointer represents a reasonable gain adjustment which would provide stability.

Increase the gain setting by small increments until the system becomes unstable and begins to cycle. Decrease the gain setting slightly to remove the cycling effect and mark this position on the dial. Rotate the dial fully clockwise until it hits its mechanical stop, then counterclockwise to the midpoint between the stop and the marked position. Doing so will provide a suitable gain to allow the introduction of the integral function.

After the system stabilizes again, reconnect the P/PI jumper to return the integral function to the receiver-controller. After a reasonable period of time, the control point should stabilize at the set point value and no further adjustments will be required. If the control point does not stabilize at the set point value or if excessive cycling occurs, proceed to the Integral Time Adjustment section.

Integral Time Adjustment (See Figs. 17 & 18)

Adjusting the integral time dial will not affect the controller set point. If the system response toward the set point is too slow, **decrease** the integral time and/or **increase** the gain dial settings by small increment each. If cycling occurs, **increase** the integral time and/or **decrease** the gain dial settings by small increments each. Using the appropriate pressure checking method described previously, note the exact set point pressure value. Upset the system by rotating the set point dial to force the controlled device to an open position. Wait a sufficient period of time to cause controlled variable deviation, then return the set

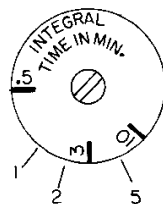


Fig. 18: T-5800-4 Integral Time Dial Reference Points

point dial to its original position producing the noted pressure. If the system response is not as desired, adjust the integral time and gain dials as prescribed above to obtain the desired system response.

System Startup Response

The following procedure is for determining whether an additional time delay is required for proper system startup.

WARNING: Before stopping a system, be sure that a change in output pressure will not upset the system and cause damage.

A. Receiver-controllers Using Fan "F" Connection

When the system becomes stable, stop the system and allow enough time to pass until the controlled variable deviates from the set point. (Remember when the system is off, the receiver-controller returns to proportional-only control. This feature eliminates integral windup during off periods.) Restart the system and observe to see how well it comes into control. When the system is started and the fan signal is increased to maximum (20 PSIG), the proportional-only controller returns to proportional plus integral control to cause the control point to equal the set point. If the system response is not as desired, determine whether the cause is an improper time delay (see T-5800-100 Time Delay section) or an incorrect integral time setting (repeat Integral Time Adjustment procedure above).

B. Receiver-Controllers Having Fan "F" Connection Capped (System ON 100% of the Time)

When the system becomes stable, stop the system and disconnect the P/PI jumper. Allow enough time to pass until the controlled variable deviates from the set point. Restart the system, reconnect the P/PI jumper, and observe to see how well the system comes into control. If the system response is not as desired, repeat the Integral Time Adjustment procedure above.

Note: If the system is shut down (power failure, cleaning, repair, etc.), the P/PI jumper must be disconnected and left vented for a period of time equal to the integral time dial setting. Start up the system and reconnect the P/PI jumper when the system becomes stable.

proportional control function settles out. To eliminate this problem, a T-5800-100 Time Delay (ordered separately) must be added to the fan "F" connection (see Fig 19). This device will delay the pressure increase to the fan "F" connection of the receiver-controller, allowing more time for the system to achieve stable proportional control before the integral control function is initiated.

T-5800-100 Time Delay (When Fan "F" Connection is Used)

After system startup, if the system response is too slow, the integral control function will act on the signal before the

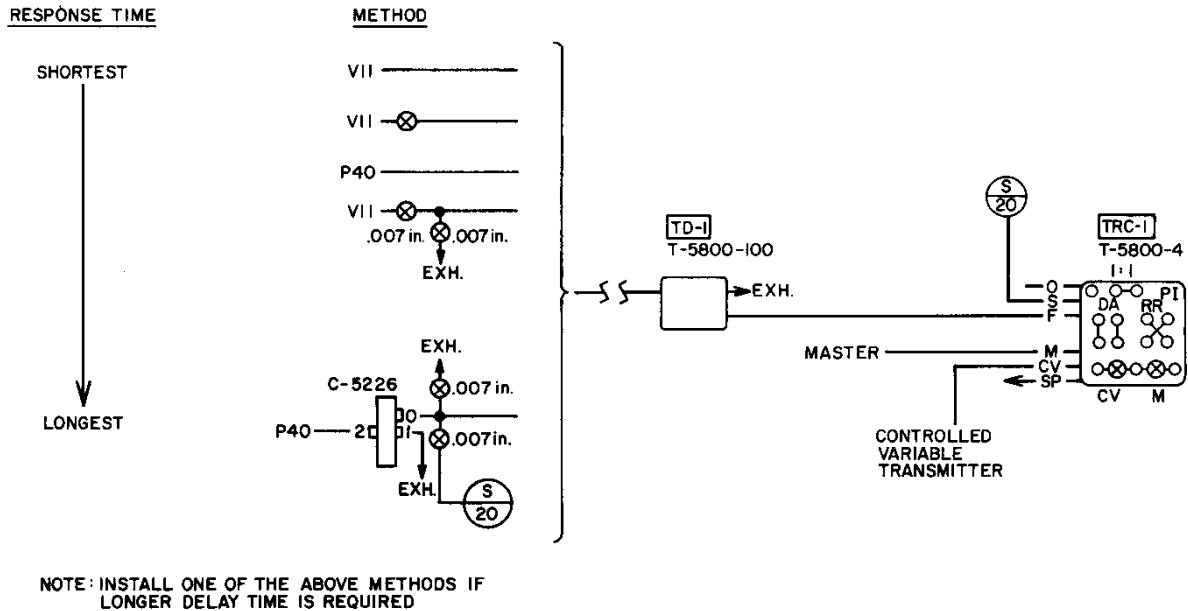


Fig. 19: T-5800-100 Time Delay Connected to Fan Input of T-5800-4

Notes



Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53202

Printed in U.S.A.