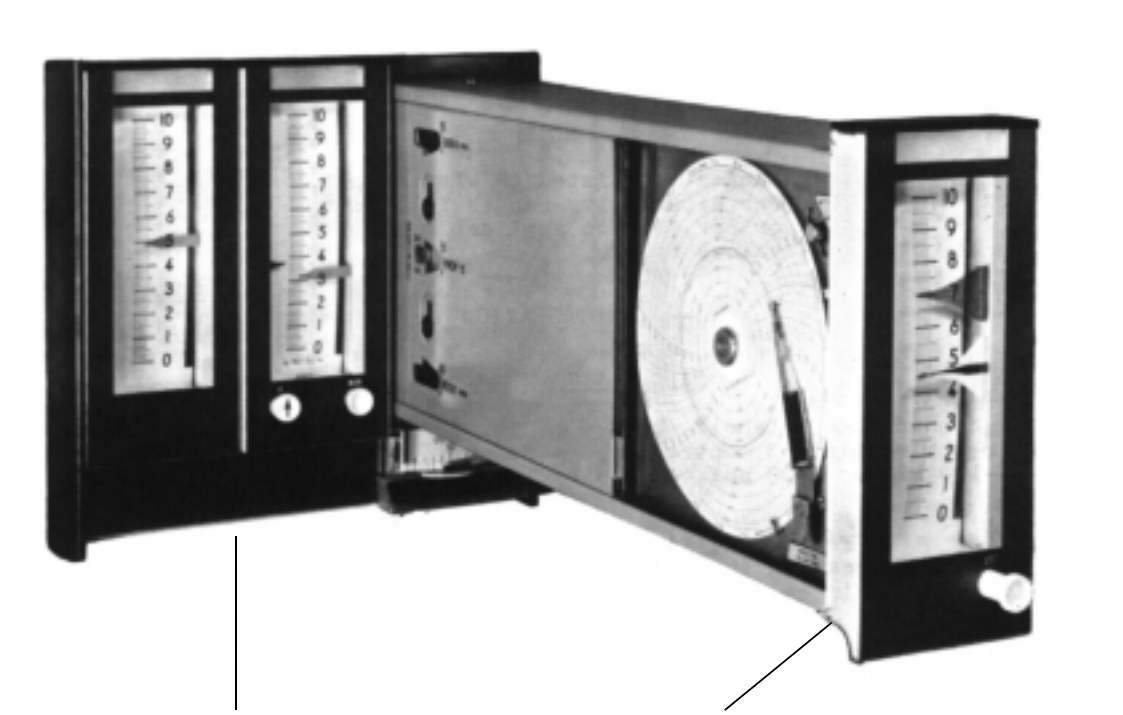
Model 130M Pneumatic Controller

Installation and Operation



Model 130M Controller is a pneumatic, shelf-mounted instrument with a separate manual control unit. These components fit in individual adjacent locations in a shelf, and either or both can be removed without interferring with any of the other instruments.

If either the controller or its manual unit is removed from the shelf, the process can be controlled by the remaining component. Both have jack-plug pneumatic connections with built-in check valves, so that they can be removed from the shelf without disconnecting any piping.

For panel, shelf, and controller installation details, see Instruction MI 017-410 (standard shelf) or MI 017-412 (short shelf). For principle of operation, schematic diagram, and other details, see Technical Information Sheet TI 29-201a.

Standard Specifications

Output Signal:	20-100 kPa or 3-15 psi
Measurement Signal:	20-100 kPa or 3-15 psi
Set-Point Signal:	20-100 kPa or 3-15 psi
Air Supply Pressure:	140-150 kPa (20-22 psi)
Air Consumption	
Manual Operation:	1.0 m^3/h (0.6 ft^3/min)
Automatic Operation:	0.5 m^3/h (0.3 ft^3/min)
Ambient Temperature Limits:	–20 to +65°C (0 to 150°F)
Control Modes	
Model 130M-□2:	Proportional
Model 130M-□3:	Proportional plus Derivative
Model 130M-□4:	Proportional plus Reset
Model 130M-□5:	Proportional plus Reset plus Derivative
Control Model Limits:	Proportional, 5-500% Reset and Derivative actions, 0.01-50 minutes

— NOTE

Ranges are listed in kPa and psi. For alternative ranges in kg/cm^2 or bar, divide applicable kPa values by 100.

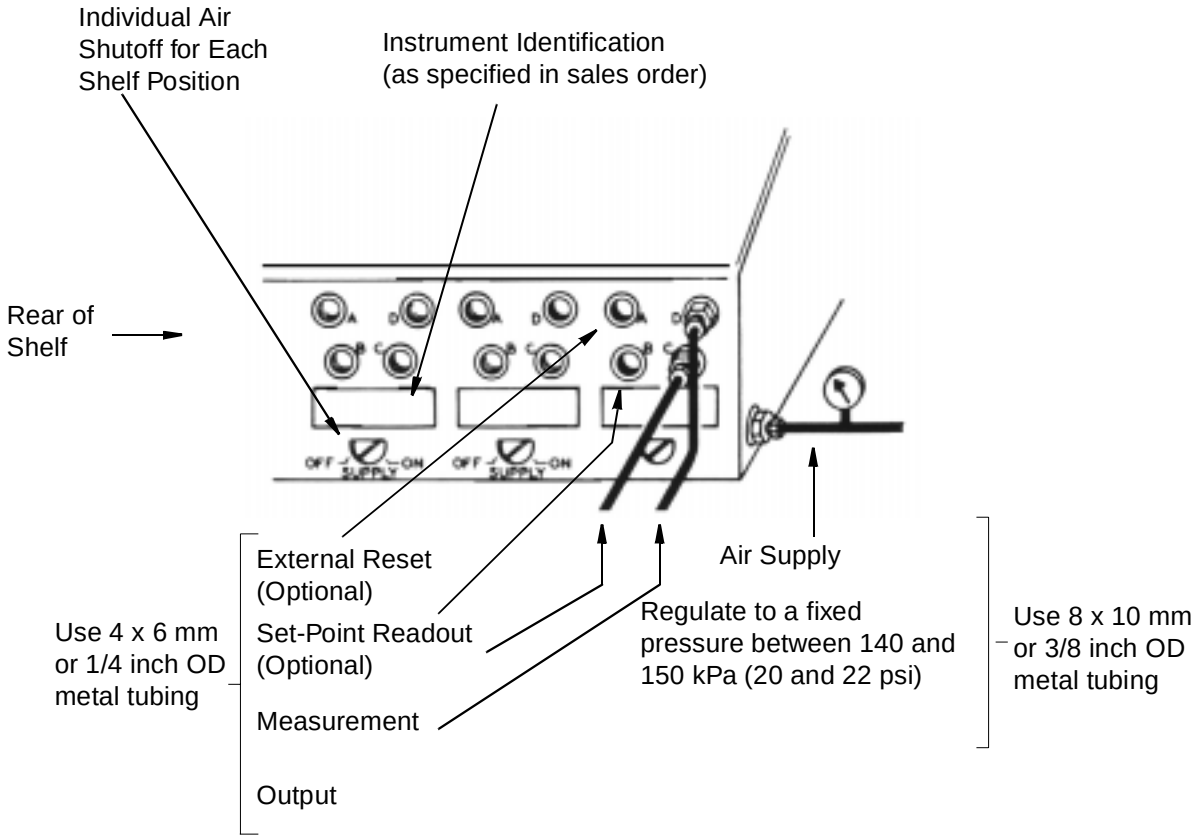
Installation

Piping to Rear of Shelf

All connections at shelf are 1/4 NPT. Tie in signal lines to connections at correct location of controller, as identified on rear of shelf. All signals are 20-100 kPa or 3-15 psi.

— NOTE

Illustrated is rear of Model 102 shelf. With Model 101 (short) shelf, connections at rear have same identifications, but locations are different; for locations, see label above connections.



Optional Connections

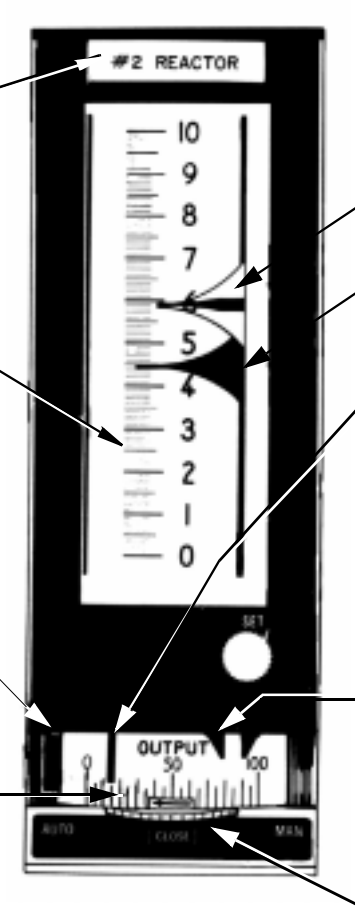
An optional reset connection (connection “A” in illustration above) and/or set-point readout connection (connection “B”) is provided when specified in sales order.

Wiring to Rear of Shelf

If controller has optional recorder, alarm lights, or alarm actuator, wiring to rear of shelf is required. See Instruction MI 017-475 for recorder details and MI 017-470 for alarm details.

Operation

Components on Front of Instruments



Instrument Identification
Marked as specified in sales order. With optional alarm lights, nameplate is back-lighted when alarm goes on.

Set-Point Measurement Dial
Dial is graduated as specified in sales order.

Transfer Switch
To switch between automatic and manual control (see details on Page 4).

Final Operator Direction Label
Arrow indicates direction to turn wheel to **close** final operator.
(Arrow can be positioned to face either direction.)

Set-Point Index

Measurement Pointer

Output Pointer

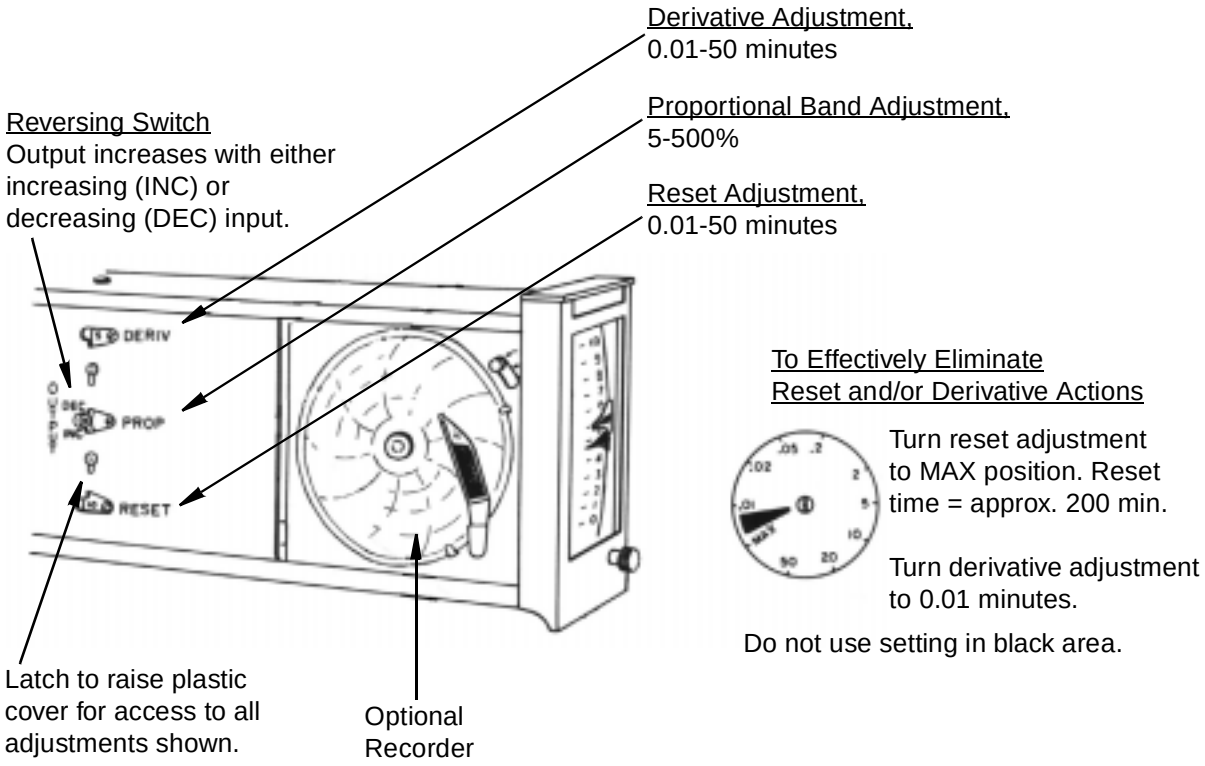
Set-Point Adjustment Knob
Knob can be locked in place with optional set screw on side.

Memory Pointers
Pointers are adjustable so that a desired output or a desired output range is indicated.

Manual Output Adjustment Wheel

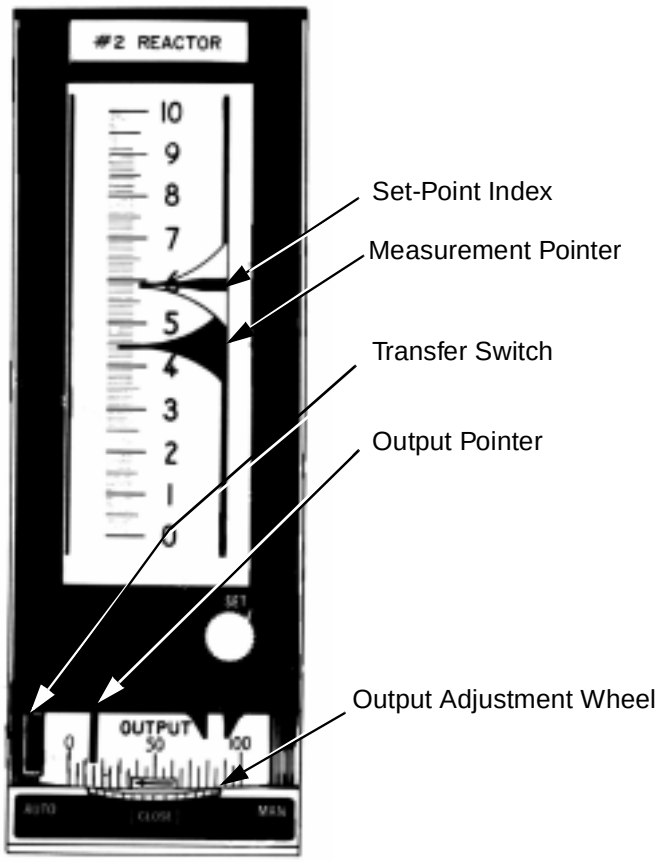
Components at Instrument Control Panel

To expose control panel, withdraw controller part way (see page 7).



Transfer Switch

The transfer switch provides for switching between automatic and manual control without upsetting the process. The switch can be moved freely between AUTO and MAN without special precautions (except controllers without reset circuit; see 3rd paragraph below).



Operation with Transfer Switch in MAN

In MAN, when output adjustment wheel is rotated, output will change. Direction that wheel is turned will cause output pointer to move in same direction (left to decrease output, etc.).

Arrow located above wheel is direction to turn wheel to close control valve, as specified in sales order.

When transfer switch is moved to AUTO, measurement will approach the set point at reset rate. (For controllers without reset, align set-point index with measurement pointer before transferring, to prevent process upset.)

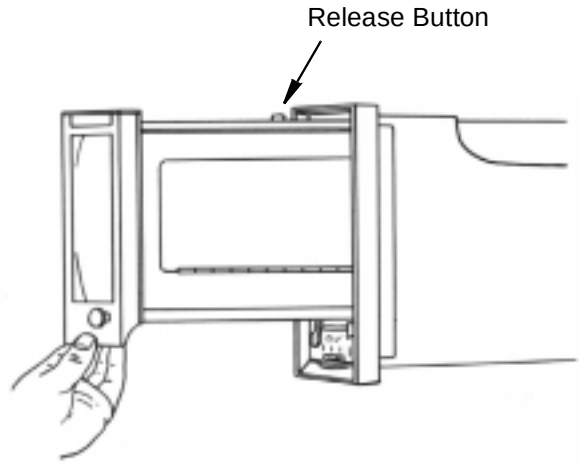
Operation with Transfer Switch in AUTO

In AUTO, process is automatically controlled at reading of set-point index.

When transfer switch is moved to MAN, output will remain at last value of output before switching, until output adjustment wheel is rotated.

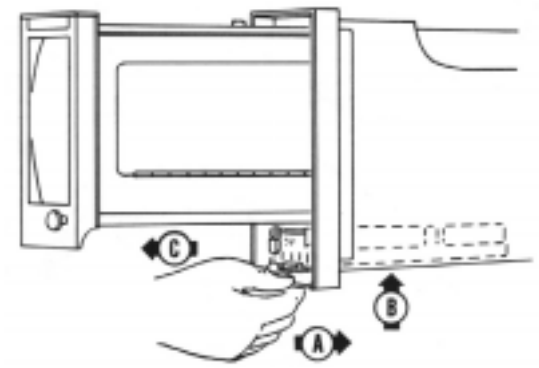
To Remove Controller

Withdraw controller approx. 35 cm (14 in) from shelf. While holding down release button on top, slide controller out of shelf.



To Remove Manual Control Unit

1. Remove controller about 20 cm (8 in) from shelf (see illustration above).
2. While pushing in on manual unit (to release catch), lift up, and then slide out unit.

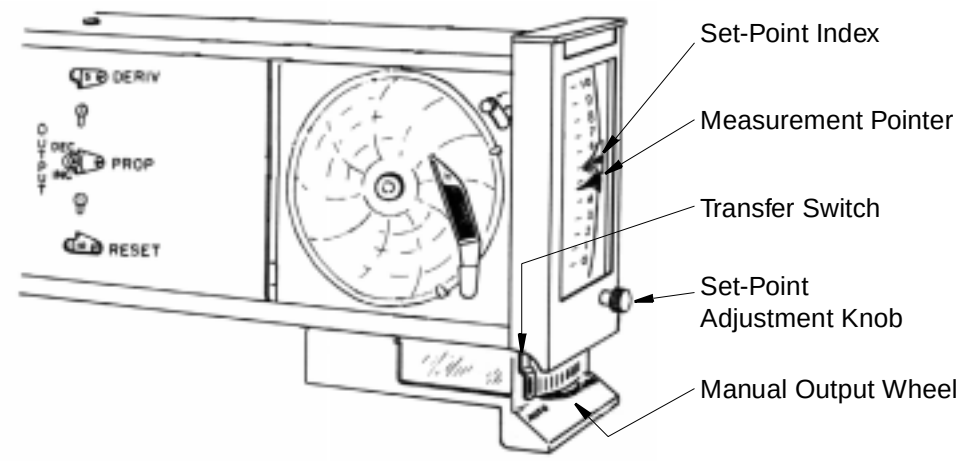


Putting Into Operation

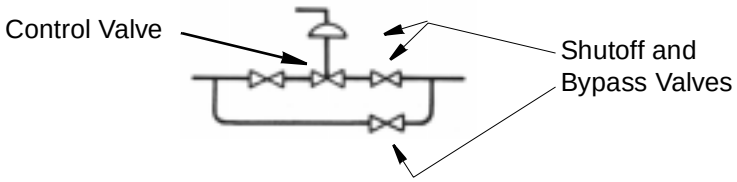
1. Check that all instruments in control loop are properly installed and operating.
2. Adjust reversing switch for desired control action: with increasing input, output will either increase (INC) or decrease (DEC).
3. Turn DERIVATIVE adjustment (if present) to 0.01 or to safe low value.

   Turn PROPORTIONAL BAND to maximum or safe high value.

   Turn RESET adjustment (if present) to MAX or to safe high value.



4. Open shutoff values and close bypass valve.



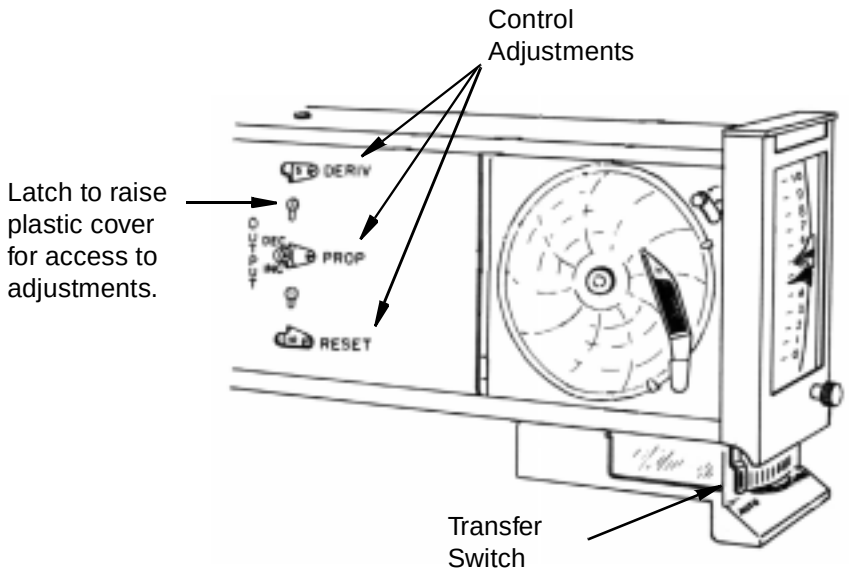
5. Start up on manual control as follows:
   a. Move transfer switch to MAN.
   b. Turn set-point knob so that set-point index is at desired set (control) point.
   c. Turn on controller air supply at rear of shelf. (Pressure must be at a fixed value between 140-150 kPa or 20-22 psi.) Blow out filter.
   d. Adjust output with manual output wheel so that measurement pointer is held as close as possible to set-point index.

      Avoid making frequent or excessive changes as this may delay balancing out of process.
6. After measurement has stabilized, measurement pointer will be in line with set-point index. Move transfer switch to AUTO. Process is now on automatic control.
7. Adjust PROPORTIONAL BAND, RESET, and DERIVATIVE controls (if present) for best process operation (see page 9).
8. To return to manual control, move transfer switch to MAN. Output will remain at last value until manual control wheel is turned.

Elimination of Outside Disturbances

If, on manual control, the measurement shows cycling, pulsations, or erratic performance, while the final operator is unchanged, this trouble obviously is not due to the controller. For best control performance, such outside disturbances must be eliminated or reduced to a minimum before placing the instrument on automatic control.

Control Adjustments



NOTE

Before making these adjustments, instrument must be operating in manual control.

Proportional Controller (Model 130M-□2)

1. With transfer switch in MAN, set PROPORTIONAL BAND at maximum or at safe high value.
2. Move transfer switch to AUTO, and make change in set point. Observe process and output responses.
3. If cycling does not occur, adjust PROPORTIONAL BAND to half of previous value.
4. Repeat Steps 2 and 3 until cycling is observed. Then increase PROPORTIONAL BAND to twice its value.

Proportional Plus Derivative Controller (Model 130M-□3)

1. Turn DERIVATIVE to 0.01 or to safe low value.
2. Adjust PROPORTIONAL BAND as described in “Proportional Controller” above.
3. Adjust DERIVATIVE using same procedure as Proportional Band, except doubling each setting instead of halving it.

Proportional Plus Reset Controller (Model 130M-□4)

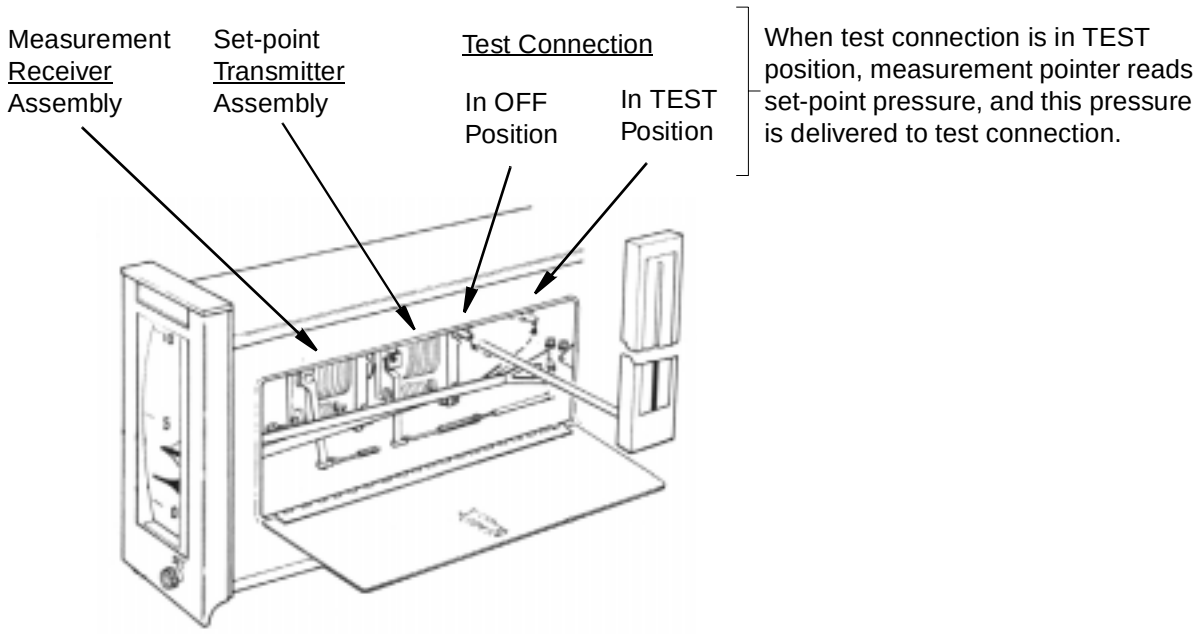
1. Turn RESET to MAX or to safe high value.
2. Adjust PROPORTIONAL BAND as described in “Proportional Controller” above.
3. Adjust RESET using same procedure as Proportional Band.

Proportional Plus Reset Plus Derivative Controller (Model 130M-□5)

1. Turn RESET to MAX or to safe high value.
2. Turn DERIVATIVE to 0.01 or to safe low value.
3. Adjust PROPORTIONAL BAND as described in “Proportional Controller” on page 9.
4. Adjust DERIVATIVE using same procedure as Proportional Band, except doubling each setting instead of halving it.
5. Adjust RESET to final setting of Derivative in Step 4, above.

Calibration Checks

The transmitter and receiver assemblies can be calibrated either to the SI (20 to 100 kPa) or to the English (3 to 15 psi) signal pressure range. The two ranges are not exactly equivalent; therefore, the entire system must be calibrated in the same units.



1. Withdraw controller part way and open access door on right side.

   If left side panel and optional recorder (if present) are removed, adjustments will be more accessible.

   To remove panel, loosen screw at rear, and slide out panel. To remove recorder, remove the 2 screws on pointer movement bracket, loosen the 2 screws on front of top plate, and disconnect link. By lifting up on top plate, you can ease the recorder out.
2. Attach 0-140 kPa or 0-20 psi manometer (or test gauge) to controller test connection. Use 3/32 inch ID rubber (for flexibility) tubing at test connection.
3. Move test connection to right to TEST position.

4. With controller air supply turned on at rear of shelf, turn set-point knob so that set-point index is at 0, 50, and 100% of scale. Note manometer reading at each setting.

   Readings on manometer should be 20, 60, and 100 kPa (or 3, 9, and 15 psi) respectively. (Ignore measurement pointer readings at this time.)

   If manometer readings are not within required accuracy, calibrate set-point transmitter assembly, as described below.

5. After set-point transmitter assembly has been calibrated, repeat Step 4, this time noting how closely measurement pointer agrees with set-point index.

   If measurement pointer readings are not within required accuracy, calibrate measurement receiver assembly as described on page 13.

Shop Calibration

A spare shelf assembly or a calibrating fixture (Part C0138SN, obtainable from The Foxboro Company) is recommended. Connect a 140 kPa or 20 psi air supply to rear of shelf or to “S” connection on fixture.

If shelf or fixture is not available, air supply must be connected to rear of controller. Use 1/4 inch OD Polyflo tubing (or equivalent). See illustration on page 16 for cross referencing of connections at rear of shelf and rear of controller.

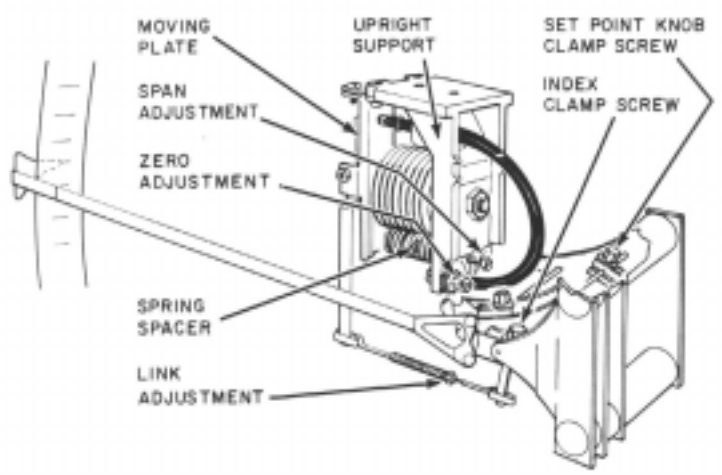
Calibration - Set-point Transmitter Assembly

Squaring Up of Linkage for Complete Calibration

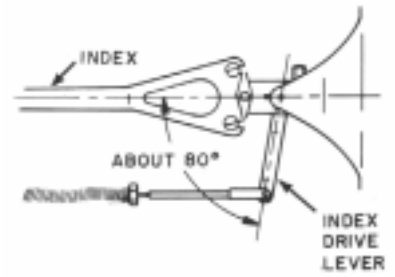
If parts have been replaced, or for some other reason a complete recalibration is necessary, square up linkage before actual calibration.

If set-point index does not have full scale travel, note amount of error and turn set-point knob to move index to 50% of scale. Loosen set-point knob clamp screw and slip index on its shaft by amount of error +2%, in direction to get full scale travel. Tighten clamp screw. Repeat during calibration if necessary.

1. With calibrating equipment set up as shown on page 10, rotate span adjustment screw so that about four turns of spring are visible between upright support and spring spacer.
2. Turn set-point knob so that manometer reading is 60 kPa or 9 psi.
3. Rotate zero adjustment screw so that moving plate and upright support are parallel (about 32 mm or 1 1/4 inch apart). Hold output at 60 kPa or 9 psi by adjusting set-point knob.
4. Turn set-point knob so that set-point index is at midscale.



5. Loosen index clamp screw and slip index on its shaft so that angel between index and index drive lever is about 80°. Retighten clamp screw.
6. Turn set-point knob so that index is at midscale.
7. Adjust length of link so that output is 60 kPa or 9 psi.



Calibration Procedure

When viewing zero and span adjustments as shown in illustration, turn adjustments clockwise to decrease output.

1. With calibrating equipment set up as shown on page 10, turn set-point knob so that set-point index is at 0% of scale.
2. Rotate zero adjustment screw so that output reading on manometer is 20 kPa or 3 psi.
3. Turn set-point knob so that set-point index is at 100% of scale.
4. Output should be 100 kPa or 15 psi. If it is not, use span adjustment to move output about halfway toward correct value.
5. Repeat Steps 1 through 4 until outputs for 0% and 100% of scale are correct.
6. Turn set-point knob so that set-point index is at midscale. If output is not 60 kPa or 9 psi, adjust length of link as follows:

   Adjust length so that output pressure changes by 10 times amount of error, in direction of error. For example, if output reads 8.8 psi, adjust link so that output reads 6.8 psi.

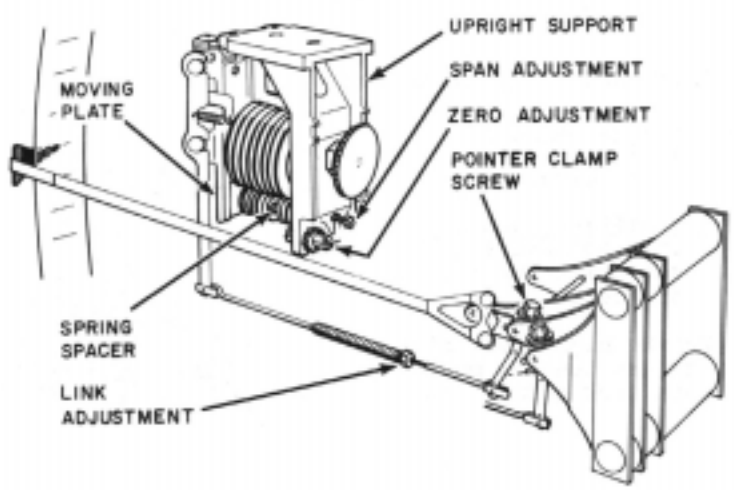
7. Loosen set-point knob clamp screw and move index drive lever (see above diagram) so that output is approx. 60 kPa or 9 psi. Retighten screw.
8. Loosen index clamp screw and slip set-point index on its shaft to midscale. Retighten screw.
9. Repeat Steps 1 through 8 until readings are correct for 0, 50, and 100% of scale.
10. Check calibration of measurement receiver assembly (Step 5, page 10).

Calibration - Measurement Receiver Assembly

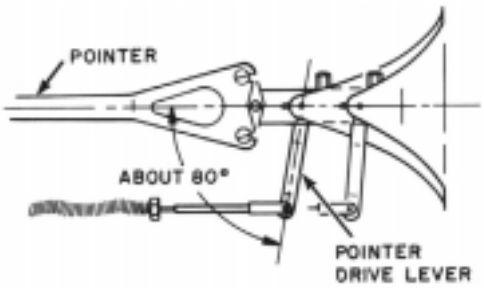
Squaring Up of Linkage for Complete Calibration

If parts have been replaced, or for some other reason a complete recalibration is necessary, square up the linkage before the actual calibration.

1. With calibrating equipment set up as shown on page 10, turn set-point knob so that manometer reading is 60 kPa or 9 psi. (If transmitter assembly is in calibration, set-point index will be at midscale.)
2. Rotate span adjustment screw so that about four turns of spring are visible between upright support and spring spacer.
3. Rotate zero adjustment screw so that moving plate and upright support are parallel (about 32 mm or 1 1/4 inch apart).



4. Loosen pointer clamp screw and slip pointer on its shaft so that angle between pointer and pointer drive lever is about 80°. Retighten clamp screw.
5. Adjust length of link to move pointer to midscale.



Calibration Procedure

When viewing zero and span adjustments as shown in illustration above, turn adjustments clockwise to increase pointer readings.

If controller is equipped with optional recorder, it is recommended that recorder link be disconnected before calibration (see Instruction MI 017-475 for recorder details).

1. With calibrating equipment set up as shown on page 10, turn set-point knob so that manometer reading is 20 kPa or 3 psi.
2. Use zero adjustment to set measurement pointer at 0% of scale.
3. Turn set-point knob so that manometer reading is 100 kPa or 15 psi.
4. Measurement pointer should be at 100% of scale. If it is not, use span adjustment to move pointer about halfway toward 100% of scale.
5. Repeat Steps 1 through 4 until pointer reads correctly when 20 and 100 kPa (or 3 and 15 psi) are applied to element.
6. Turn set-point knob so that manometer reading is 60 kPa or 9 psi. If measurement pointer does not read 50% of scale, adjust length of link as follows: adjust length to move pointer 10 times amount of error in direction of error. For example, if pointer is at 49% of scale, adjust link so that pointer moves to 39% of scale.
7. Loosen pointer clamp screw and slip measurement pointer on its shaft to midscale. Retighten clamp screw.
8. Repeat Steps 1 through 7 until measurement pointer reads correctly when 20, 60, and 100 kPa (or 3, 9, and 15 psi) are applied to element.

Adjustment of Stops

Illustrated is receiver assembly; transmitter assembly is similar.

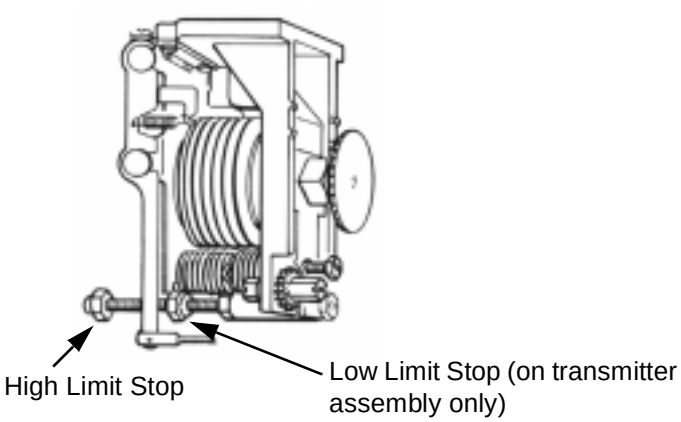
High Limit Stop Adjustment

1. Receiver Assembly
   Apply 100 kPa or 15 psi to receiver element.

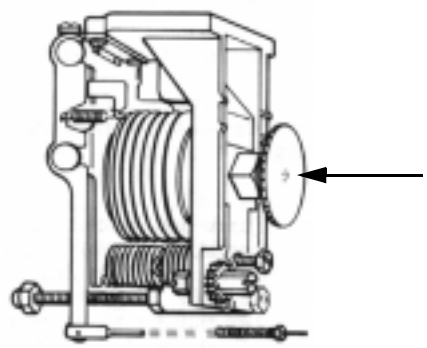
   Transmitter Assembly
   Turn set-point knob so that set-point index is at 100% of scale.
2. Rotate high limit stop until it just touches moving plate, then back off 1/4 turn.

Low Limit Stop Adjustment (Transmitter Assembly Only)

1. Turn set-point knob so that set-point index is at 0% of scale.
2. Rotate low limit stop until it just touches moving plate, then back off 1/4 turn.



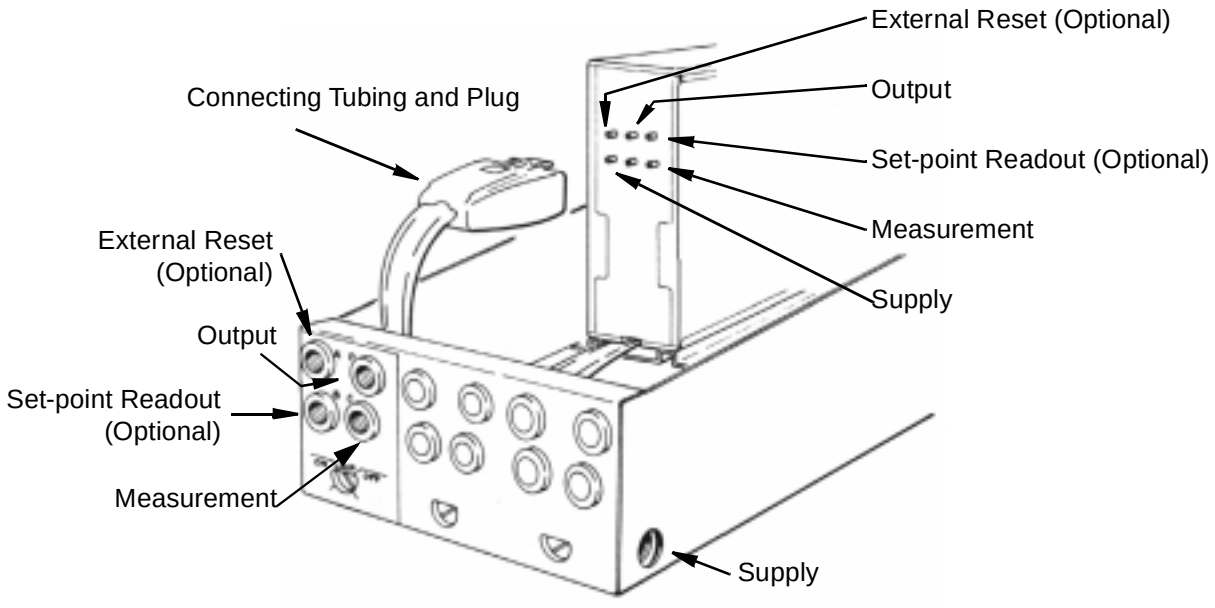
Damping Adjustment (Receiver Assemblies Only)



To adjust, remove all damping by turning screw fully counter-clockwise. Then slowly turn screw clockwise until pulsations of pointer are barely visible. Use minimum amount of damping.

Pneumatic Connection Identifications

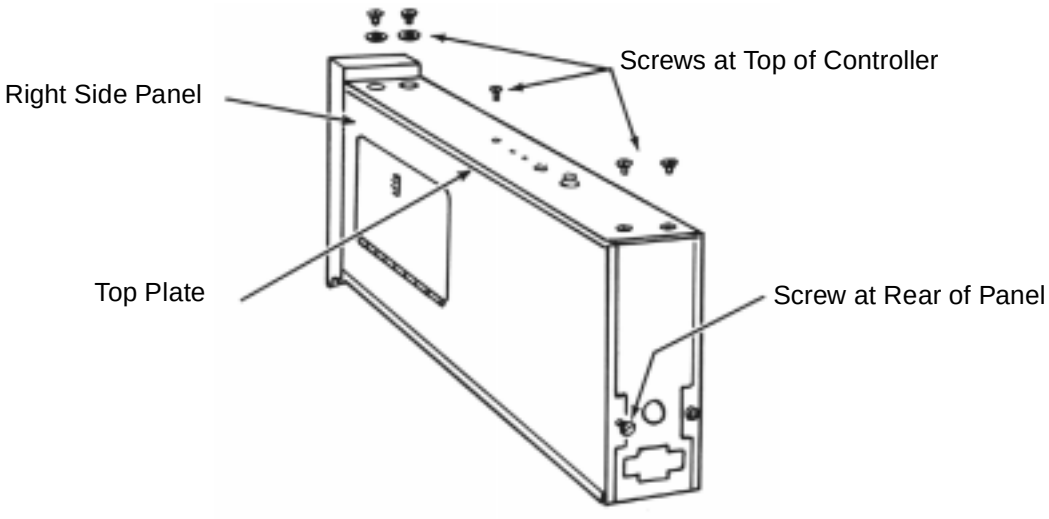
The illustration below identifies the user connections at the rear of the shelf and the corresponding tubing connections at the rear of the controller.



To Remove Right Side Panel

Normally there should be no need to remove the right side panel. However, the replacement of certain parts (pneumatic circuit board, batch switch, and so forth) does require the removal of this panel.

1. Remove five screws from plate on top of controller.
2. Remove screw at rear of panel (left screw facing rear of controller).
3. While holding up top plate, lift out side panel. Do not try to slide out panel.
4. When reinstalling panel, note that it fits into grooves in both top and bottom plates.



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