CP-8102

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Electronic Two-Input Temperature or Humidity Controller General Instructions

APPLICATION

Electronic two-input temperature or humidity controller for heating, cooling, humidification or dehumidification in HVAC systems.

SPECIFICATIONS

Features: Self-contained package incorporating an amplifier with two input bridges for TS-8XXX temperature sensors, humidity sensors or remote setpoint adjustor.

Sensors:

Temperature, TS-8XXX one or two; three sensors through a CN-8101.

Humidity, HS-8X01 or HSP-6X81.

Control Action: Direct (D.A.) or reverse (R.A.) selectable by jumper. Factory set D.A.

Authority Ratio Adjustment: 0.5:1 to 25:1, adjustable by dial.

Control Output Voltage: 1 to 15 Vdc, 10 mA maximum. Unit factory calibrated for 7.5 Vdc output with sensor at setpoint temperature.

Power Requirements: 20 Vdc (-1.5, +1), 23 mA.

Power Supply Available: 6.2 Vdc, 7 mA maximum.

Remote Setpoints: Order separately AT-8122, AT-8155 or AT-8158.

Setpoints, Ratio and Throttling Potentiometers: Visible and accessible without removing controller cover.

Controlled Devices*: Maximum of six TAC System 8000.

Environment:

Ambient Temperature Limits,

Shipping and Storage -40 to 160°F (-40 to 71°C).

Operating 40 to 135°F (4.4 to 57°C).

Humidity, 5 to 95% RH, non-condensing.

Locations, NEMA Type 1 indoor only.

Connections: Coded screw terminals.

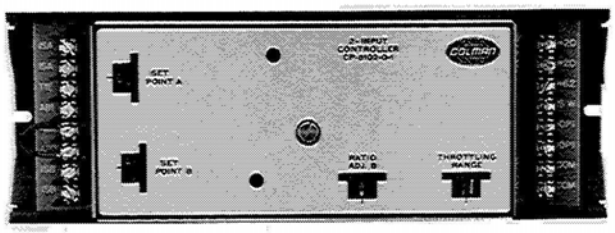
Cover: Aluminum.

Mounting: Unit is provided with plastic track for panel mounting. AD-8912 enclosure can be ordered separately for remote installations.

Dimensions: 4" high x 11" wide x 2-1/2" deep (102 mm x 279 mm x 64 mm).

***TYPICAL CONTROLLED DEVICES**

CC-8100 Series Relays
MP-300-600 Series Actuators
MP-400-600 Series Actuators
MP-5000 Series Actuators
MS-1233 Series Damper Actuators
MS-80000 Series Actuators
SP-40000 Series Step Controllers
VS-9000 Series Valve Assemblies



CP-8102

Table-1 SPECIFICATIONS.

Part Number	Control Dial Range Setpoint "A"	Control** Dial Range Setpoint "B"	Throttling Range for 3 Vdc Output Change
CP-8102	20 to 120°F	20 to 120°F	Adjustable 2 to 10°F by Dial*
CP-8102-116	-6 to 48°C	-6 to 48°C	Adjustable 1 to 6° C by Dial*

* 15, 25, 40 and 60°F by pin selection (use j9 jumper). With the use of AD-8969-901 (order separately) the following T.R.S. can be obtained: 55, 65, 75, 85, 100, 115, 125 and 140°F.

** For reset control, set setpoint "B" at zero reset and setpoint "A" at control point desired with no reset action from sensor "B".

ACCESSORIES

AD-8122	Signal adaptor for dual outputs (two direct acting)
AD-8123	Signal adaptor for dual outputs (one direct, one reverse acting)
AD-8124	Signal adaptor for dual outputs (one reverse, one direct acting)
AD-8912	12" (305 mm) enclosure
AD-8969-201	Offset resistor kit: 5, 10, 15 & 20°F
AD-8969-901	Extended throttling range jumper
ASP-301	Power supply
AT-8122	Remote setpoint adjuster, dual scale 20 to 120°F (-6 to 49°C)
AT-8155	Remote setpoint adjuster, dual scale 50 to 250°F (10 to 121°C)
AT-8158	Remote setpoint adjuster, dual scale 55 to 85°F (13 to 29°C)
AT-8222-101	Setpoint scale for humidity 20% to 100%
AT-8435	Remote setpoint adjuster, dual scale 50 to 450°F (10 to 232°C) for use with TS-8204 only
CN-8101	Multi-purpose bridge
HS-8000 Series	Humidity sensors
HSP-6000 Series	Humidity transmitters
TOOL-201	Calibration kit for TAC System 8000
TS-8000 Series	Temperature sensors

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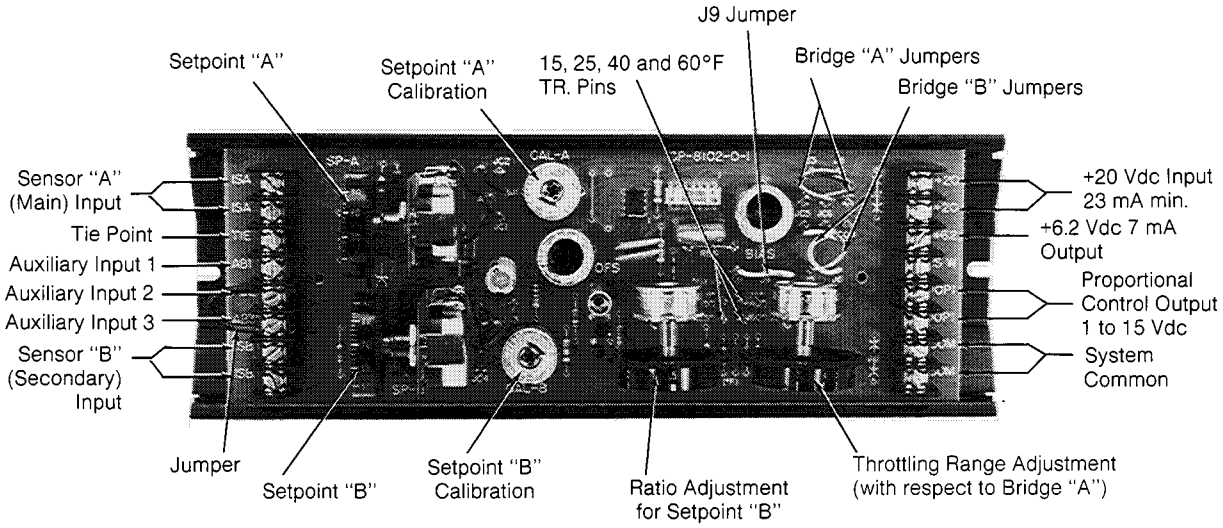


Figure-1 CP-8102.

DEFINITIONS

Mode of Operation: Either direct acting or reverse acting. **Direct Acting (D. A.)** means that an increase in temperature at the sensor(s) causes the voltage output (OP1) to increase. **Reverse Acting (R.A.)** means that an increase in temperature at the sensor(s) causes the voltage output (OP1) to decrease.

Reset Control Action: The direction of reset determines whether input A setpoint is reset upward or downward on a temperature decrease at input B.

Direct Reset (D.R.): A temperature decrease on input B resets input A setpoint downward.

Reverse Reset (R.R.): A temperature decrease on input B resets input A setpoint upward.

CONTROL TERMINAL INPUTS

See Figure 1.

ISA: Any TS-8000 temperature sensor (1000 ohm Balco).

ISB: Any TS-8000 temperature sensor (1000 ohm Balco).

AB1, AB2, AB3: Auxiliary inputs; any remote setpoint adjuster AT-8000 series, HS-8X01 humidity sensor, CN-8101 multipurpose bridge.

CONTROL TERMINAL OUPUT

See Figure 1.

OP1: 1 to 15 Vdc (10 mA maximum). Units factory calibrated for 7.5 Vdc output with sensor at setpoint temperature.

ADJUSTMENTS

See Figure 1.

Temperature Setpoint "A": By dial 20 to 120°F (-6 to 48°C).Remote setpoint adjuster (see Accessories), disable setpoint "A" by moving jumper J1 to JC2.

Temperature Setpoint "B": By dial 20 to 120°F (-6 to 48°C). Remote setpoint adjuster (see Accessories), disable setpoint "B" by moving jumper J2 to JC4.

Setpoint "A" Calibration: By potentiometer.

Setpoint "B" Calibration: By potentiometer. For reset control, set setpoint "B" at value where setpoint "A" will be reset. Adjust setpoint "A" at control point required with no reset from sensor "B".

Throttling Range: By dial 2 to 10°F (1 to 6°C). By pin selection 15, 25, 40 and 60°F (8, 14, 22 and 33°C). Remove J9 jumper from JC9 and attach to required throttling range pin. By extended throttling range adjuster AD-8969-901 (order separately) 55, 65, 75, 85, 100, 115, 125 and 140°F (31, 36, 42, 47, 56, 64, 69 and 78°C). The throttling range is the sum of the T.R. pins connected.

Authority Ratio Adjustment: By dial 0.5 to 25:1. Ratio is the number of degrees change at sensor "B" required to reset setpoint "A" 1°. Example: 25:1 means a 25°F (14°C) change at sensor "B" will reset setpoint "A" 1°F (0.5°C).

Table-2 JUMPER CONNECTIONS.

Controller Function	Jumper Connections Required	
	Bridge "A"	Bridge "B"
Direct Acting*	J4 to JC6 J3 to JC5	J5 to JC5 J6 to JC6
Reverse Acting	J4 to JC5 J3 to JC6	J5 to JC6 J6 to JC5
Internal Setpoint Active*	J1 to JC1	J2 to JC3
Internal Setpoint Inactive for Remote Setpoint	J1 to JC2	J2 to JC4
Disable Bridge "B" for Single Sensor Input	Remove Jumper from AB2 to AB3	

*As supplied from factory.

To Obtain Reverse Reset: Both bridges should have the same action. example: Both direct acting or both reverse acting.

To Obtain Direct Reset: Bridges should have different action. Example: One direct and one reverse acting.

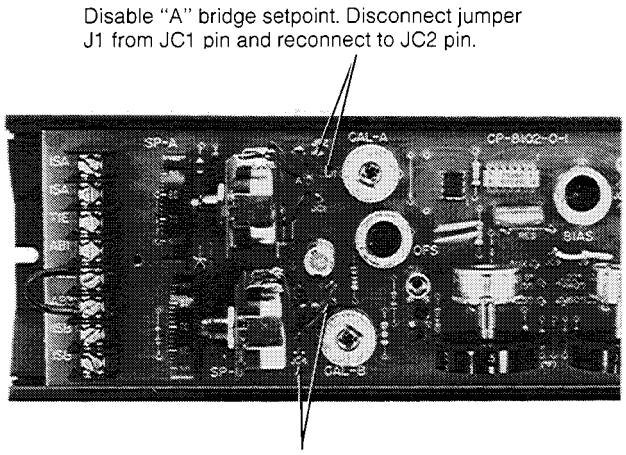


Figure-2 Disabling Setpoint "A" and/or Setpoint "B".

PRE-INSTALLATION

Open the carton and visually inspect the device for part number and obvious defects before proceeding with the installation.

Note: Mounting screws are not provided.

INSTALLATION

Device may be mounted in any position in an inside location near the controlled equipment using the two slots in the track. AD-8912 enclosures can be ordered separately for remote installations.

Caution: Avoid locations where excessive vibration, moisture, corrosive fumes or vapors are present, or where high radio frequency or electromagnetic interference generating devices are near. NEMA Type 1 housings are intended for indoor use primarily to provide a degree of protection against contact with the enclosed equipment.

GENERAL WIRING INFORMATION

Make all connections according to job wiring diagrams and in compliance with national and local codes.

Two separate No. 18 twisted pair wires [six turns per foot (0.3 m), Class II, low voltage] are suitable for up to 1000 feet (300 m) for the sensor leads. See Table 3 for longer runs.

Caution: Never run line voltage in the same conduit with unshielded sensing element leads. Use copper conductors only.

Shielded cable (Belden No. 8422 or equivalent) must be used when it is necessary to install sensor or controller wiring in the same conduit with power wiring, or when it is known that high RFI/EMI generating devices are near. Terminate the shield at the controller only on the COM (-) terminal.

Caution: Never connect the shielding or common to earth ground.

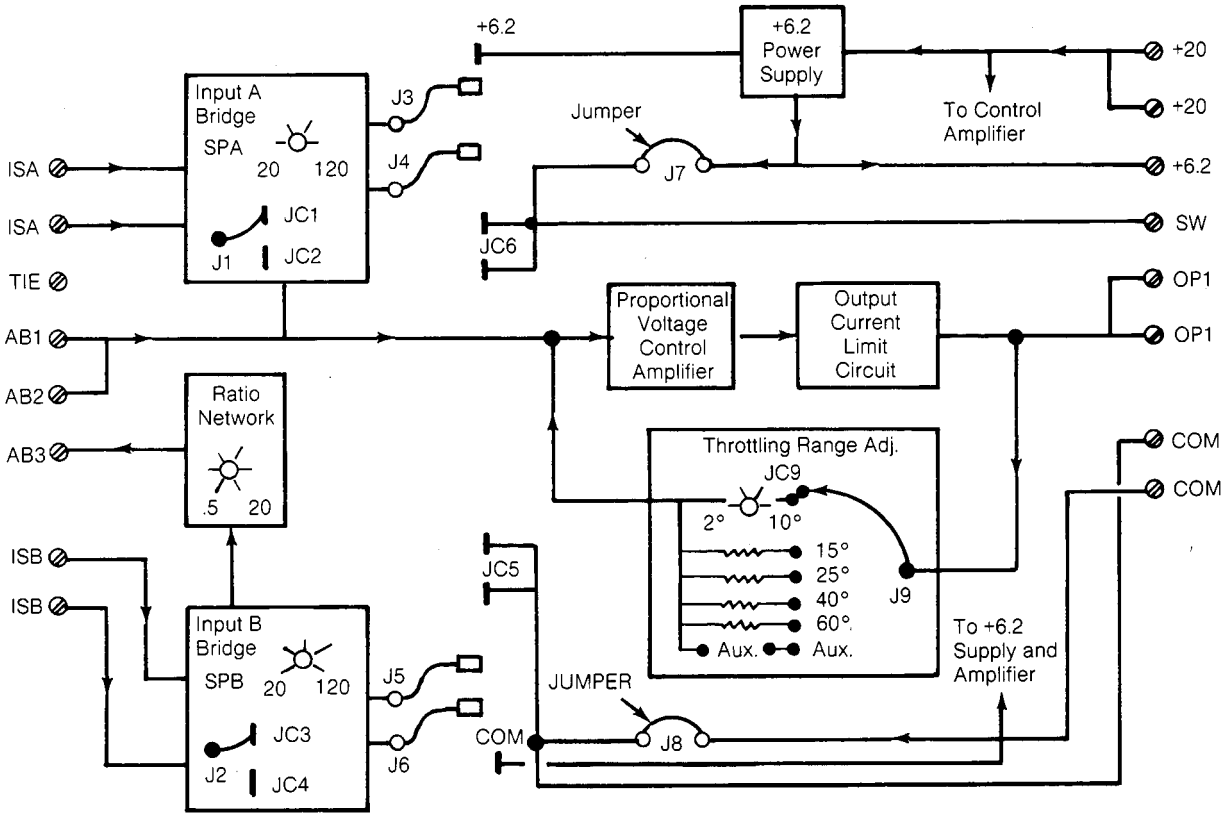


Figure-3 CP-8102 Controller Block Diagram.

Table-3 WIRING LENGTHS.

Wire Gauge	Length of Run in Feet (1 ft. approx. 0.3 m)						
	"HS" Sensor to CP-8102	"TS" Sensor to CP-8102	CN-8101, AT-81X4, TS-8601 to CP-8102	"HSP" Transmitter to CP-8102	TSP-8101 to CP-8102	CP-8102 to Controlled Device	CP-8102 to Adaptor*
22	125	-	-	-	Should be in same panel as controller.	-	-
18	300	1000	1000	250		1000	1000
16	-	2250	-	-		2250	2250
14	-	4000	-	-		4000	4000

General Rules for Wiring CP-8102 to Controlled Device(s)

1. Never connect red lead (or +20 terminal) of any controlled device which has a regulated power supply to the red lead (or +20 terminal) of any other controlled device (see Figure 5).
2. Controlled devices (MP-52XX) with unfiltered and unregulated power supplies must be filtered. CP-8102 will provide filtering for a maximum of two MP-52XX by connecting the two red leads together at the controller's +20 terminal (see Figure 6).
3. Controlled devices with filtered and unregulated supplies: Up to six controlled devices with the red leads (+20 terminals) can be connected together. Number of units paralleled depends on the current (mAdc) requirements of the controller or adaptor.

Table-4 CONTROLLED DEVICE POWER SUPPLY CHARACTERISTICS.

Filtered & Regulated	Filtered & Unregulated	Unfiltered & Unregulated
CC-8101 CC-8102 CC-8103 CC-8111 Series CC-8118 Series CC-8218 Series CC-8161 Series CP-8261 Series CP-8301 Series* CP-8425 Series CP-8502 Series CP-8511 Series CP-8513 Series PP-8121 PP-8516	MP-5XX MP-54XX MS-1233 MS-8XXXX Actuators	MP-52XX Actuators

* Except CP-8301-101 which does not have a power supply.

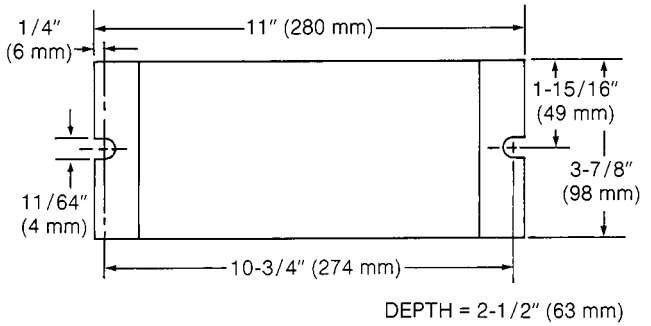


Figure-4 Mounting Dimensions.

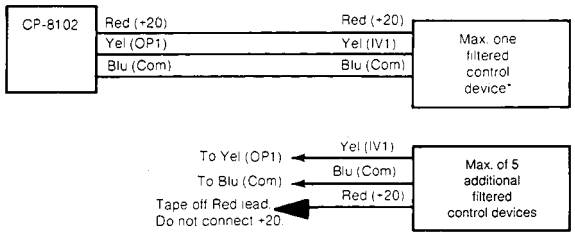


Figure-5 Controlled Devices All Filtered.

FIELD CHECKOUT

Units are factory calibrated and tested and should not require field checkout. If required, proceed as follows (see Figure 1):

Note: The following procedures can be used for either reverse or direct acting connected CP-8102 controllers.

1. Initial Conditions for CP-8102:
   a. Jumper between AB2 and AB3 disconnected.
   b. 20 Vdc +1 -1.5 Vdc (23 mA) applied to the +20 and common terminals. This power is normally supplied by the controlled device.
2. Connect a 20,000 ohm/volt DC VOM meter between the OP1 (+) terminal and COM (-) terminal of the CP-8102. Use a 20 Vdc or less range.
3. Disconnect the temperature sensing element "A" from the ISA terminals of the CP-8102. Short ISA terminals together and VOM reading should be 1 Vdc or less if bridge "A" is direct acting and more than 15 Vdc if bridge "A" is reverse acting.

4. Open ISA terminals and VOM reading should be greater than 15 Vdc if bridge “A” is direct acting and less than 1 Vdc if bridge “A” is reverse acting.
5. The CP-8102 is a good unit if it passes tests in steps 3 and 4. Replace the unit if tests 3 and 4 are not met.

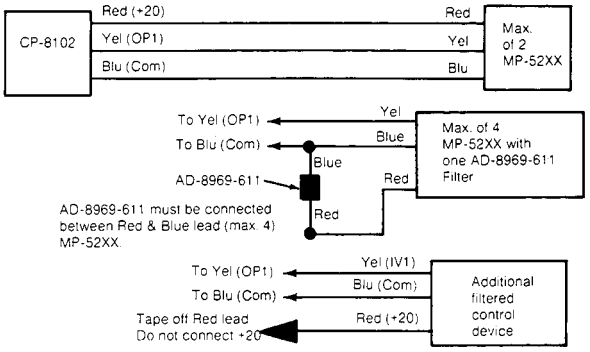


Figure-6 At Least One of the Controlled Devices in MP-52XX (Unfiltered).

FIELD CALIBRATION PROCEDURES FOR CONTROLLERS WITH ONE AND TWO INPUTS

See Figures 7 and 9.

The following procedures can be used for either reverse or direct acting connected CP-8102 controllers.

The CP-8102 is factory calibrated and shipped with both inputs connected for direct acting output.

Normally, the CP-8102 (connected for either direct or reverse acting) requires no field calibration but if a field calibration check or recalibration becomes necessary, then proceed as follows:

1. Initial Conditions for CP-8102:
   a. Setpoint “A” set for: 70°F.
   b. Setpoint “B” set for: 70°F
   c. Ratio adjustment set for: 1:1.
   d. Throttling range adjustment set for: 3°F.
   e. Jumper between AB2 and AB3 disconnected.
   f. 20 Vdc (23 mA) applied to the +20 and common terminals. This power is normally supplied by the controlled device.
2. Connect a 20,000 ohm/volt DC VOM meter between the OP1 (+) terminal and COM (-) terminal of the CP-8102. Use a 20 Vdc or less range.
3. Calibration of “A” input. Use one of the following two methods.
   a. Temperature measurement methods:

      Accurately measure the temperature at the temperature sensing element “A”. Adjust setpoint “A” until the dial reading agrees with the temperature measured. Rotate setpoint “A” calibration potentiometer (located just to the right of setpoint “A” dial) until a VOM reading of 7.5±.2 Vdc is obtained.
   b. Sensing element substitution method:

      Disconnect the temperature sensing element “A” from the ISA terminals of the CP-8102. Reconnect a 1000 ohm ±.1% wire wound resistor (TOOL-203) to the ISA terminals. Adjust setpoint “A” for 70°F. Rotate setpoint “A” calibration potentiometer (located just to the right of setpoint “A” dial) until a VOM reading of 7.5±.2 Vdc is obtained.

Note: Method B above does not calibrate out any errors due to sensing element tolerances or wire lead resistance.

4. Calibration of “A” input complete.

   If “B” input is not being used (jumper between AB2 and AB3 removed) then proceed to step 7 below.
5. Reconnect jumper between AB2 AB3.
6. Calibration of “B” input. Use one of the following two methods.
   a. Temperature measurement method:

      Accurately measure the temperature at the temperature sensing element “B”. Adjust setpoint “B” until the dial reading agrees with the temperature measured. Rotate setpoint “B” calibration potentiometer (located just to the right of setpoint “B” dial) until a VOM reading of 7.5±.2 Vdc is obtained.
   b. Sensing element substitution method:

      Disconnect the temperature sensing element “B” from ISB terminals of the CP-8102. Reconnect a 1000 ohm ±0.1%, wire wound resistor (TOOL-203) to the ISB terminals. Adjust setpoint “B” for 70°F. Rotate setpoint “B” calibration potentiometer (located just to the right of setpoint “A” dial) until a VOM reading of 7.5±0.2 Vdc is obtained.

Note: Method B above does not calibrate out any errors due to sensing element tolerances or wire lead resistance.

7. CP-8102 calibration is complete. Remove all test meters, test resistor, etc. Reconnect all elements, place setpoints, throttling range and ratio adjustments as required for the application.

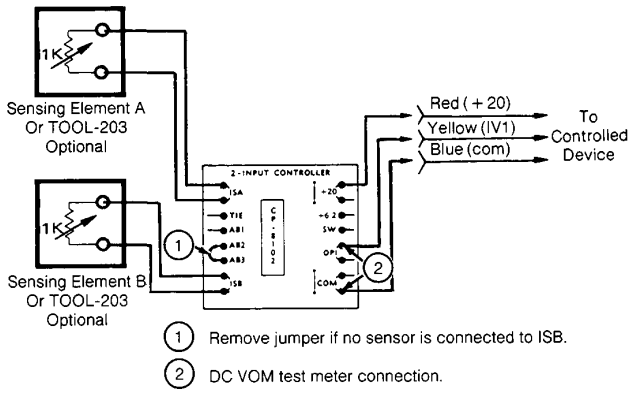


Figure-7 One or Two Sensor Application.

FIELD SERVICE

Units are factory calibrated and tested for direct acting control (D.A.) and reverse reset (R.R.) and should not require service. If required, proceed as follows (see Figure 8):

Power Supply

Apply +20; +1, -1.5 Vdc (23 mA) to the +20 and common terminals. Proper power supply is always required for unit to function properly. The +6.2 (±.3) Vdc should be available from the controller, if required.

Test

Connect a 20,000 ohm/volt DC VOM meter between +20 and common terminals. Controller power supply +20, +1 -1.5 Vdc (indicated by M1 in Figure 8) should be measured. Power supply is normally supplied by controlled device. Check +6.2 (±.3) Vdc power supply of controller with VOM.

Service

If the +20 Vdc level is not measured, service the (lead) controlled device, power supply or installation wiring as necessary to insure proper power supply.

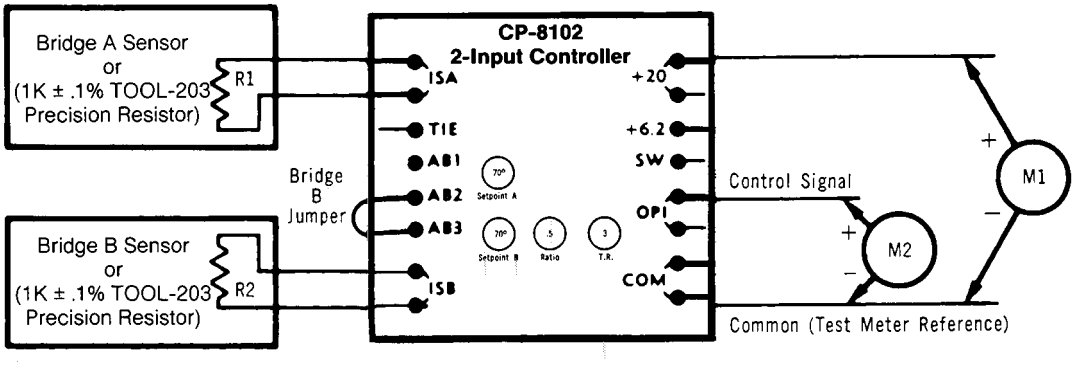


Figure-8 Field Calibration of CP-8102.

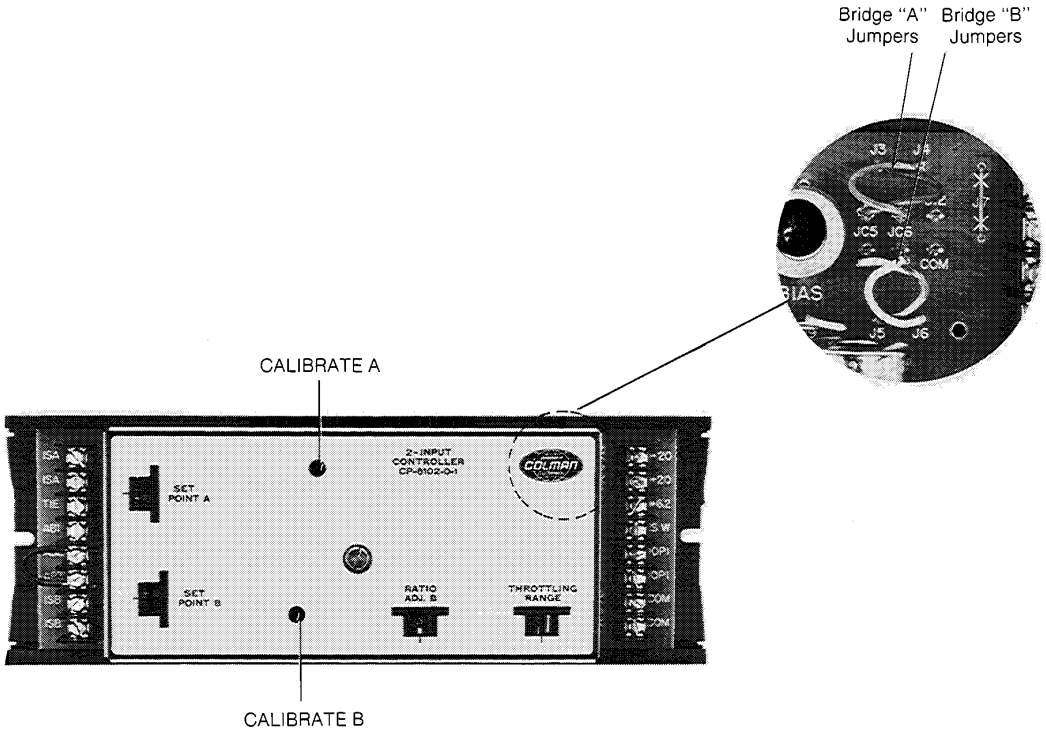


Figure-9 Bridge "A" and "B" Jumper Location for CP-8102.

Controller Output

See Field Calibration Procedures, on this page, for calibration of "A" setpoint using sensor element substitutes.

Test

With signal output measured between OP1 and COM at 7.5±.2 Vdc, rotate setpoint "A" dial several degrees (in increments of 1°F) each way from 70° setting to vary the M2 reading from 1 to 15 Vdc. The number of degrees that setpoint dial "A" is changed to vary the reading on M2 3 Vdc should be approximately 3°F (if T.R. is set at 5°F, 3 Vdc will change over 5°F).

Service

See Field Calibration Procedures, on page 5, for calibration of "B" setpoint using sensor element substitutes. (Make certain that jumper is connected to AB2 and AB3.)

Adjusting setpoint “B” several degrees from 70°F setting will cause the M2 reading to vary from 1 to 15 Vdc.

If output voltage cannot be made to vary over a 1 to 15 Vdc range, then replace the CP-8102 as defective.

MAINTENANCE

Regular maintenance of the total system is recommended to assure sustained optimum performance.

TYPICAL APPLICATIONS

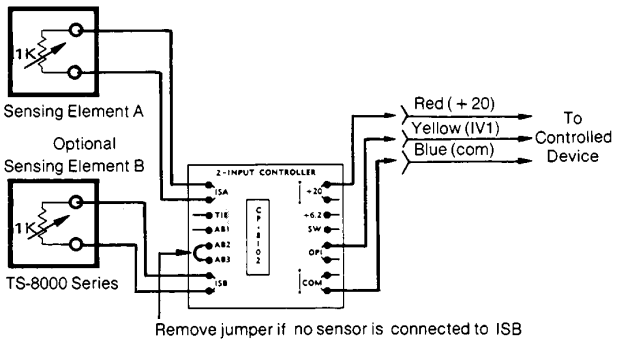


Figure-10 One or Two Temperature Sensor Applications.

Hot water reset is a typical application for a two sensor application of the CP-8102. For example, perimeter radiation temperature, with hot water as a heating medium, is increased as the temperature decreases. This method of control is known as reverse reset. A reset schedule shown below in Table 5 requires the hot water temperature to increase from 110° to 170°F, a change of 60°F, as the outside air temperature decreases from 60° to 0°F. If the throttling range of the CP-8102 controller is 10°F, the setting of the CP-8102 will be as follows:

Setpoint “A”: 110°

Setpoint “B”: 60°

Ratio Adjustment: 1 (change in outside air temperature/ change in hot water temperature).

Throttling Range: 10°F

Note: Controller function is Direct Acting* (see Table 2).

* Factory setting

Table-5 RESET SCHEDULE.

Outside Air Temp. (°F)	Water Temperature (°F)
60	110
0	170

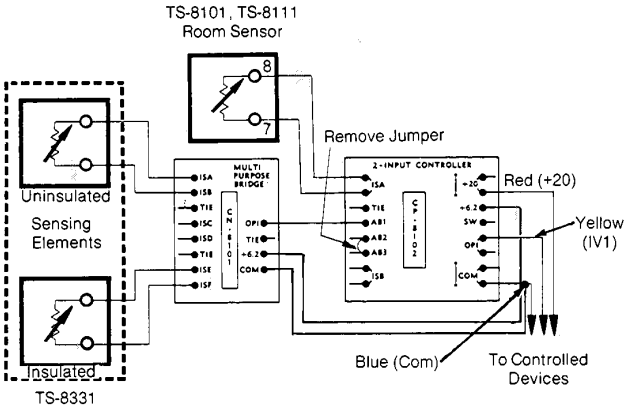


Figure-11 Derivative (Lagged) Sensor.

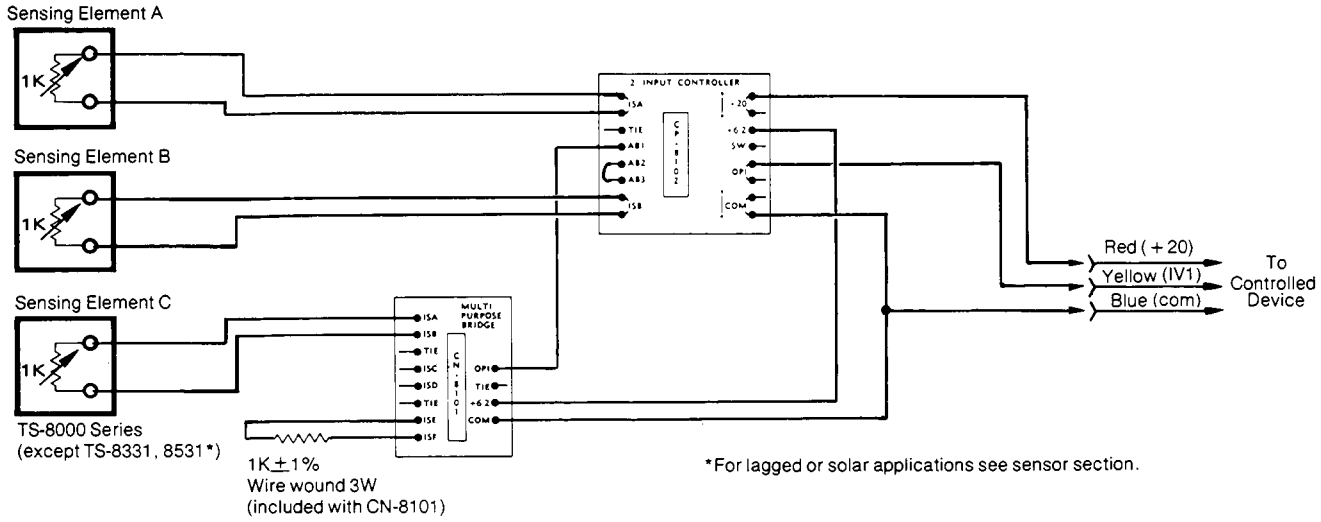
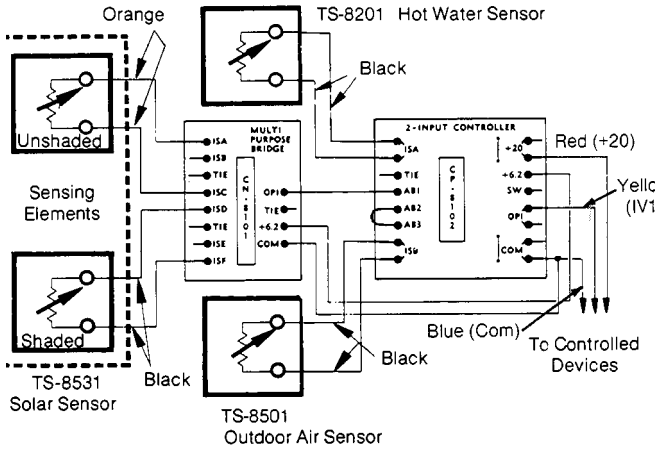
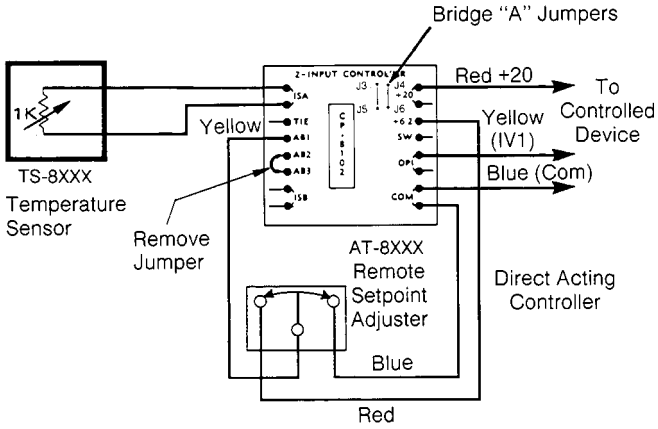


Figure-12 Three Temperature Sensor Application*.



CN-8101 Ratio Setting	Degrees Reset (No Sun to Full Sun)
0.5:1	70°F
1:1	35
5:1	7
10:1	3.5
20:1	1.75

Figure-13 Solar and Outdoor Air Reset of Hot Water (Direct Acting Output).



NOTE: If the controller bridge is reverse acting, the red and blue wires at the AT-8XXX Series must be reversed (red to common, blue to +6.2).

Figure-14 Single Input with Remote Setpoint.

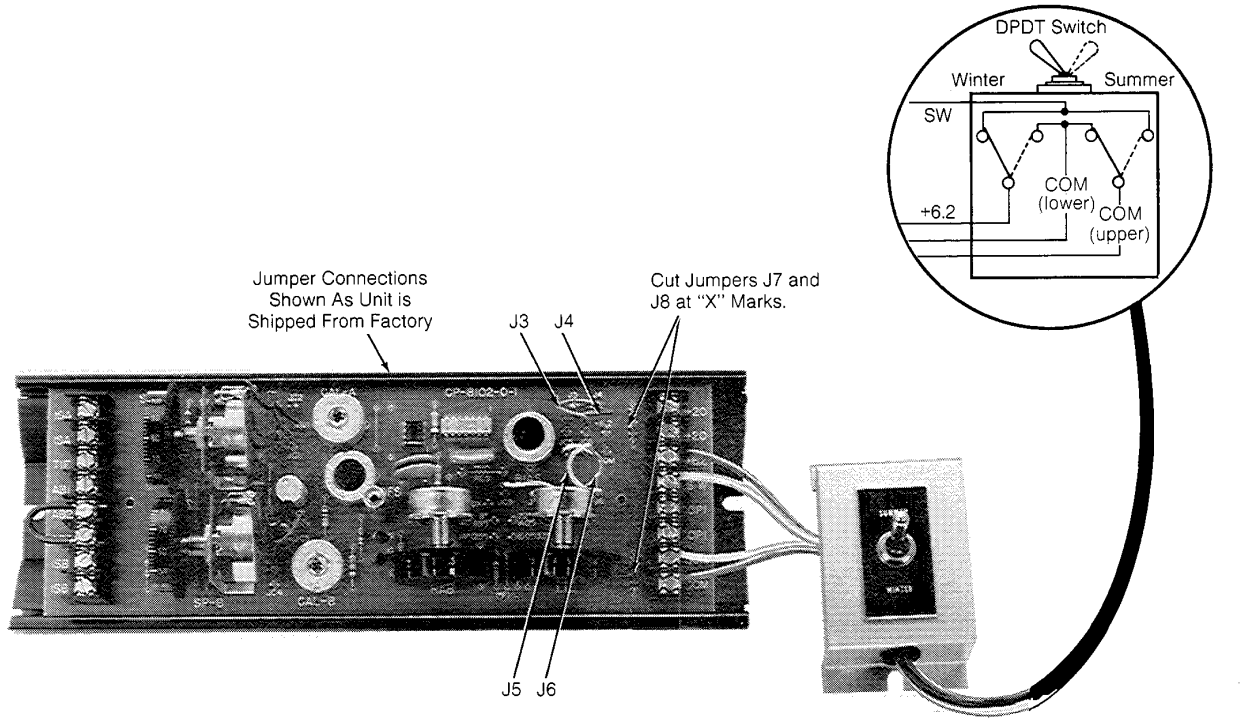


Figure-15 Single Unit Winter-Summer Switching.

1. Cut both jumpers that are located between the terminal strip and cover on the right hand side of the device (see Figure 15).
2. Connect D.P.D.T. switch (CYZP-11 or equivalent) according to Figure 15.

Note: Switch contacts should have pilot duty ratings and maintain a 1 ohm or less contact rating over its normal life.

3. No recalibration of CP-8102 is required.

SINGLE UNIT SUMMER/WINTER SWITCHING (Continued):

Table-6 BRIDGE CONNECTIONS FOR SUMMER/WINTER (See Figure 15).

BRIDGE "A" (MAIN SENSOR)		BRIDGE "B" (RESET SENSOR)		RESET OF SETPOINT "A"		JUMPER TO PIN CONNECTIONS			
Winter	Summer	Winter	Summer	Winter	Summer	J3	J4	J5	J6
D.A.	R.A.	D.A.		Reverse	Direct	JC5	JC6	COM	+6.2
R.A.	D.A.	D.A.		Direct	Reverse	JC6	JC5	COM	+6.2
D.A.	R.A.	R.A.		Direct	Reverse	JC5	JC6	+6.2	COM
R.A.	D.A.	R.A.		Reverse	Direct	JC6	JC5	+6.2	COM
D.A.		D.A.	R.A.	Reverse	Direct	COM	+6.2	JC5	JC6
R.A.		D.A.	R.A.	Direct	Reverse	+6.2	COM	JC5	JC6
D.A.		R.A.	D.A.	Direct	Reverse	COM	+6.2	JC6	JC5
R.A.		R.A.	D.A.	Reverse	Direct	+6.2	COM	JC6	JC5

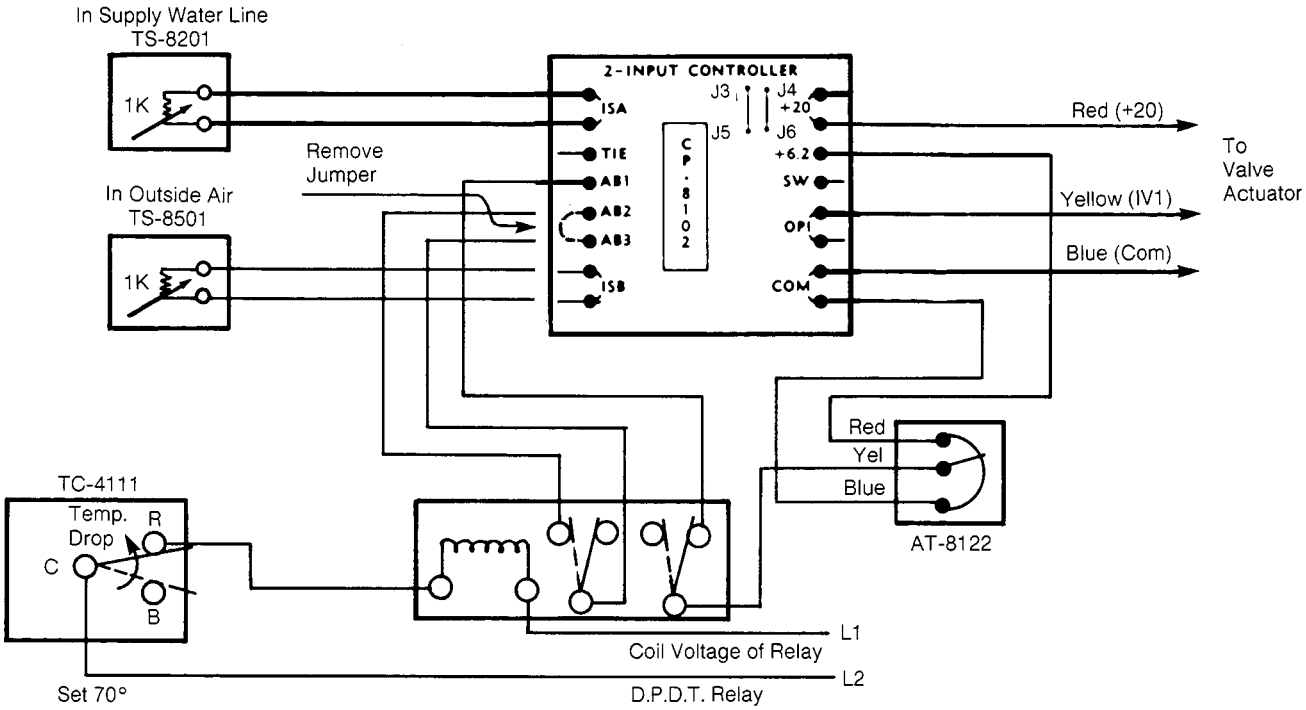


TABLE 7. TYPICAL RESET SCHEDULE

Outside Air Temp. (°F)	Water Temperature (°F)
70°	110°
0°	140°
Above 70°	85°

Outside air temperature reset of supply water temperature with fixed temperature of 85°F with outside air temperature of 70°F.

Setpoint "A": 110°F

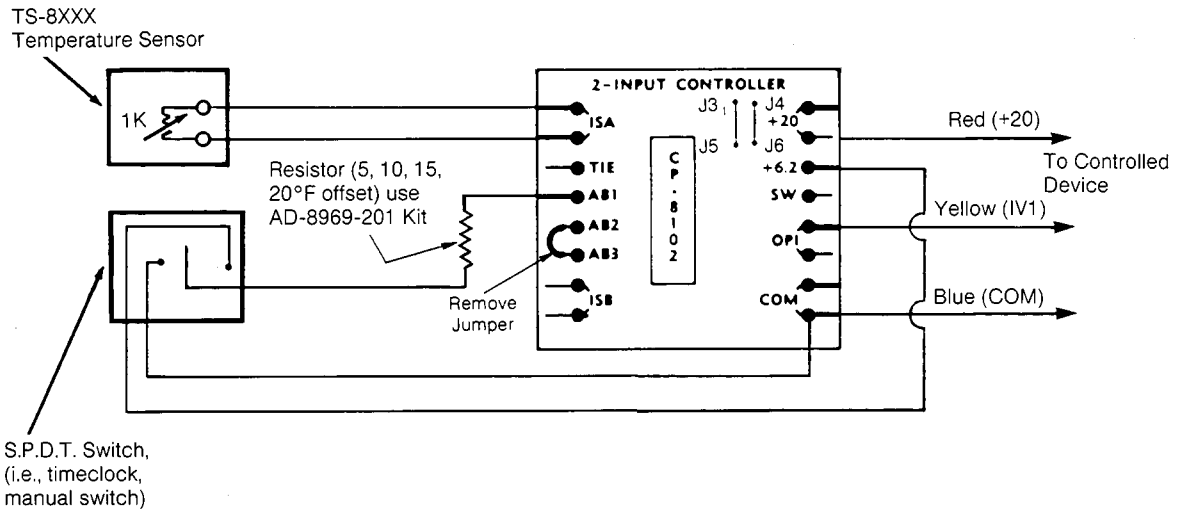
Setpoint "B": 70°F

Ratio Adjustment: 2.33

Throttling Range: 10°F

AT-8122: Set 45°F for S.P. of 85 where O.A. is above 70°F. Relay is energized with outside air temperature below 70°.

Figure-16 Outside Air Temperature Reset of Hot Water with Fixed Temperature with Outside Air Temperature Above Selected Values.



Offsetting setpoint for Direct Acting Controller:

Raise, connector resistor to +6.2 terminal.

Lower, connect resistor to COM terminal.

Offsetting setpoint for Reverse Acting Controller:

Raise, connect resistor to COM terminal.

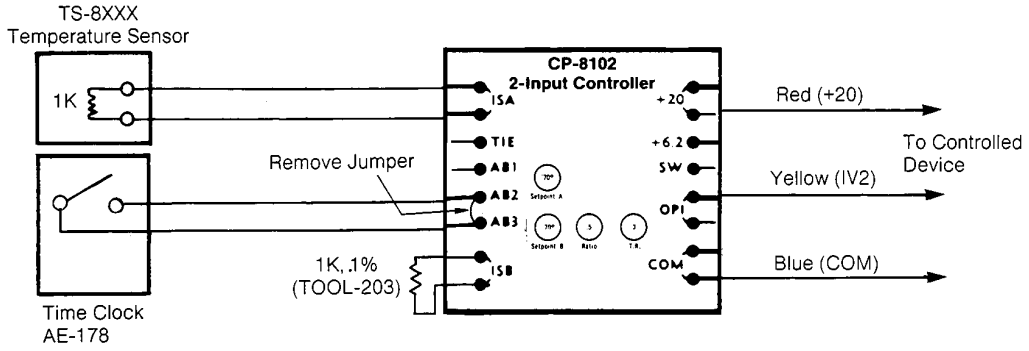
Lower, connect resistor to +6.2 terminal.

NOTE

Standard two conductor twisted wire should be used if remote switching is employed.

Resistor must always be located at CP-8102.

Figure-17 Setpoint Offset.

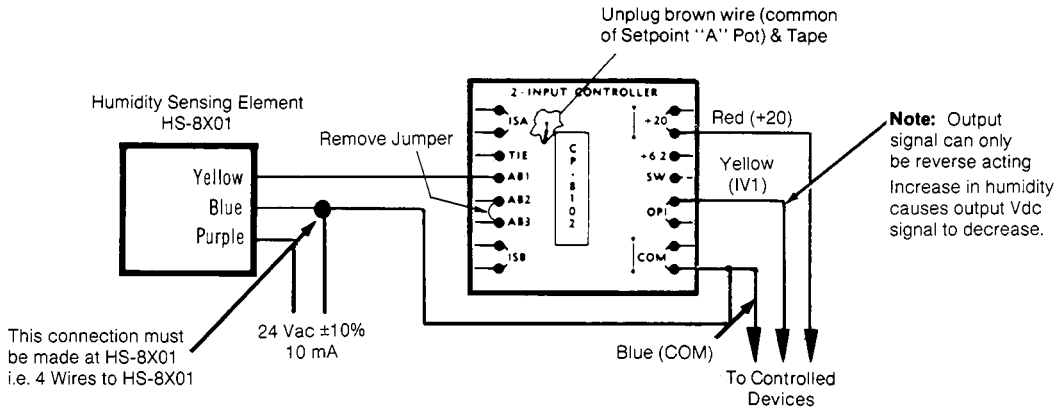


Install 1000 ohm 1% (TOOL-203) resistor in ISB. Install AE-178 7 day time clock. Set setpoint "B" as desired for night setback.

TABLE 8. TYPICAL NIGHT SETBACK SCHEDULE

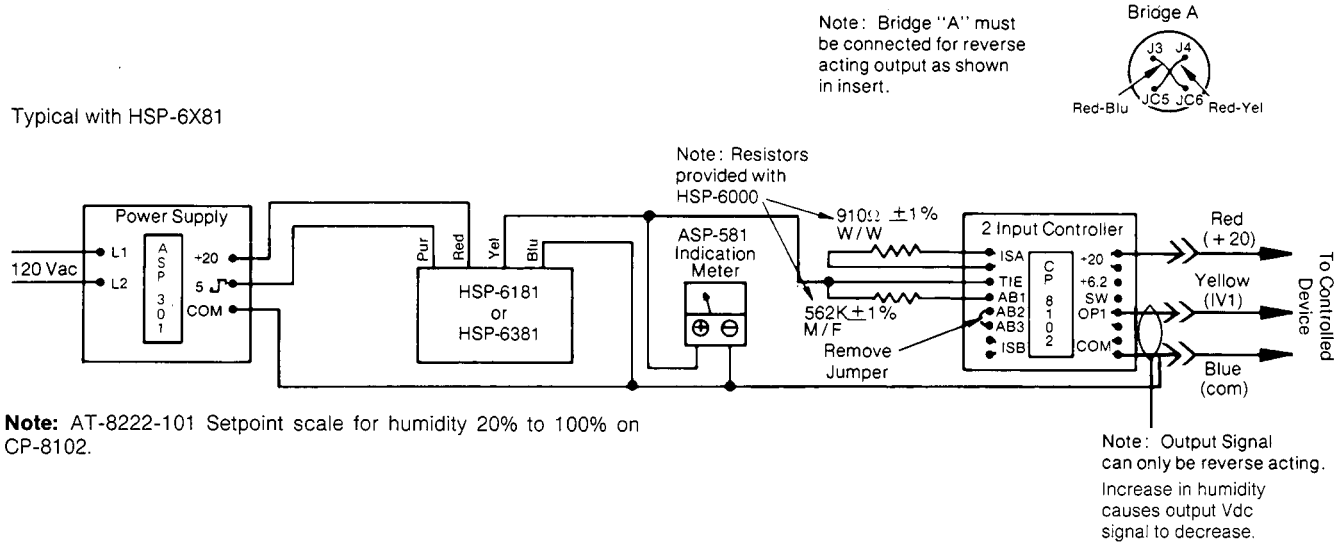
Setpoint "B"	Night Setback
70°F (21.1°C)	No Setback
65°F (18.3°C)	5°F (2.8°C) Setback
60°F (15.6°C)	10°F (5.6°C)Setback
55°F (12.8°C)	15°F (8.3°C) Setback

Figure-18 Night Setback.



Note: Settings of 2-6 throttling range result in 2-6% RH throttling range for 3 Vdc output change. 6 TR is maximum setting.

Figure-19 Humidity Control.



Note: AT-8222-101 Setpoint scale for humidity 20% to 100% on CP-8102.

Figure-20 Humidity Control and Indication.

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