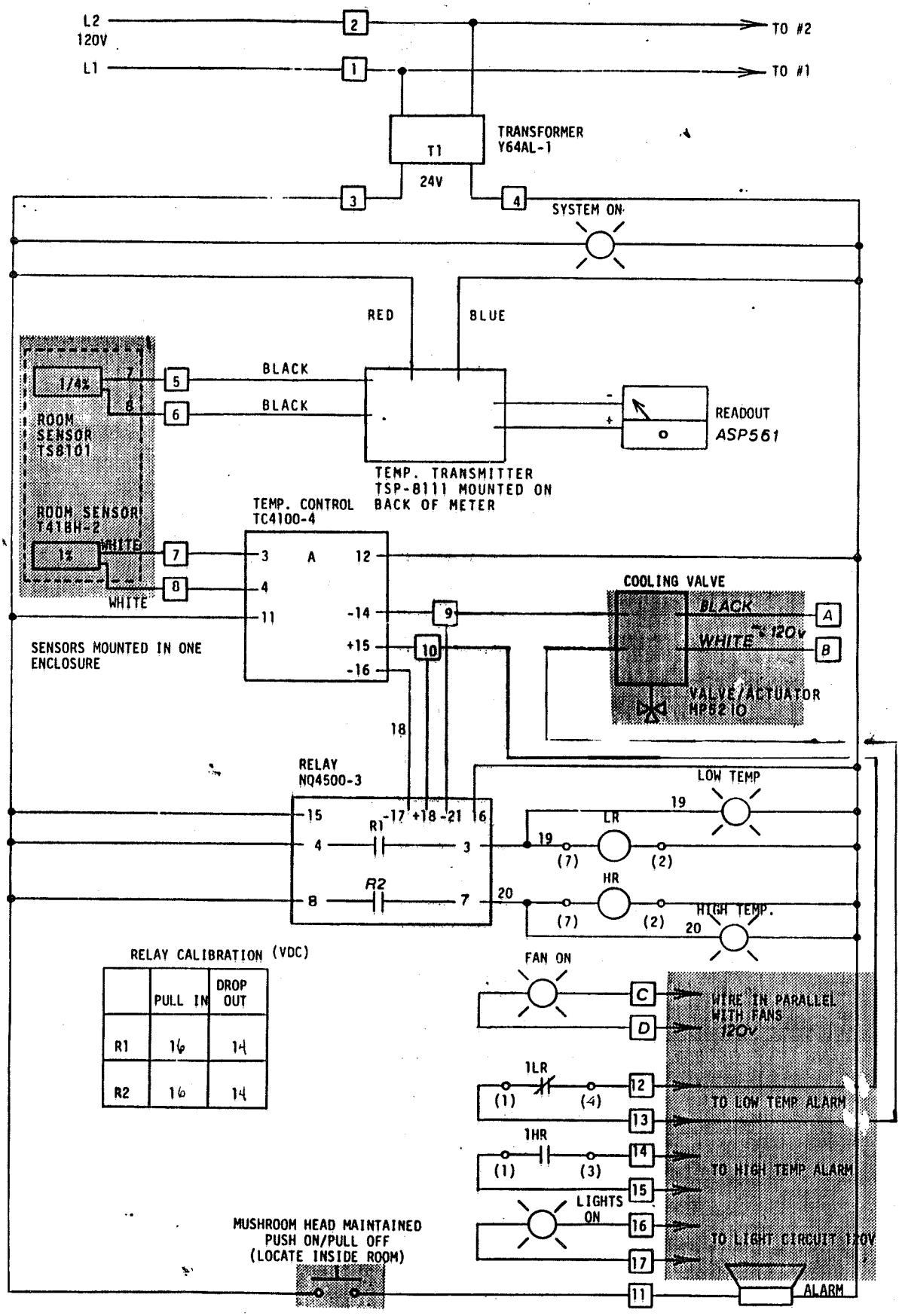
RM201A,211A,248A,319A



FOR MESSNER INC.

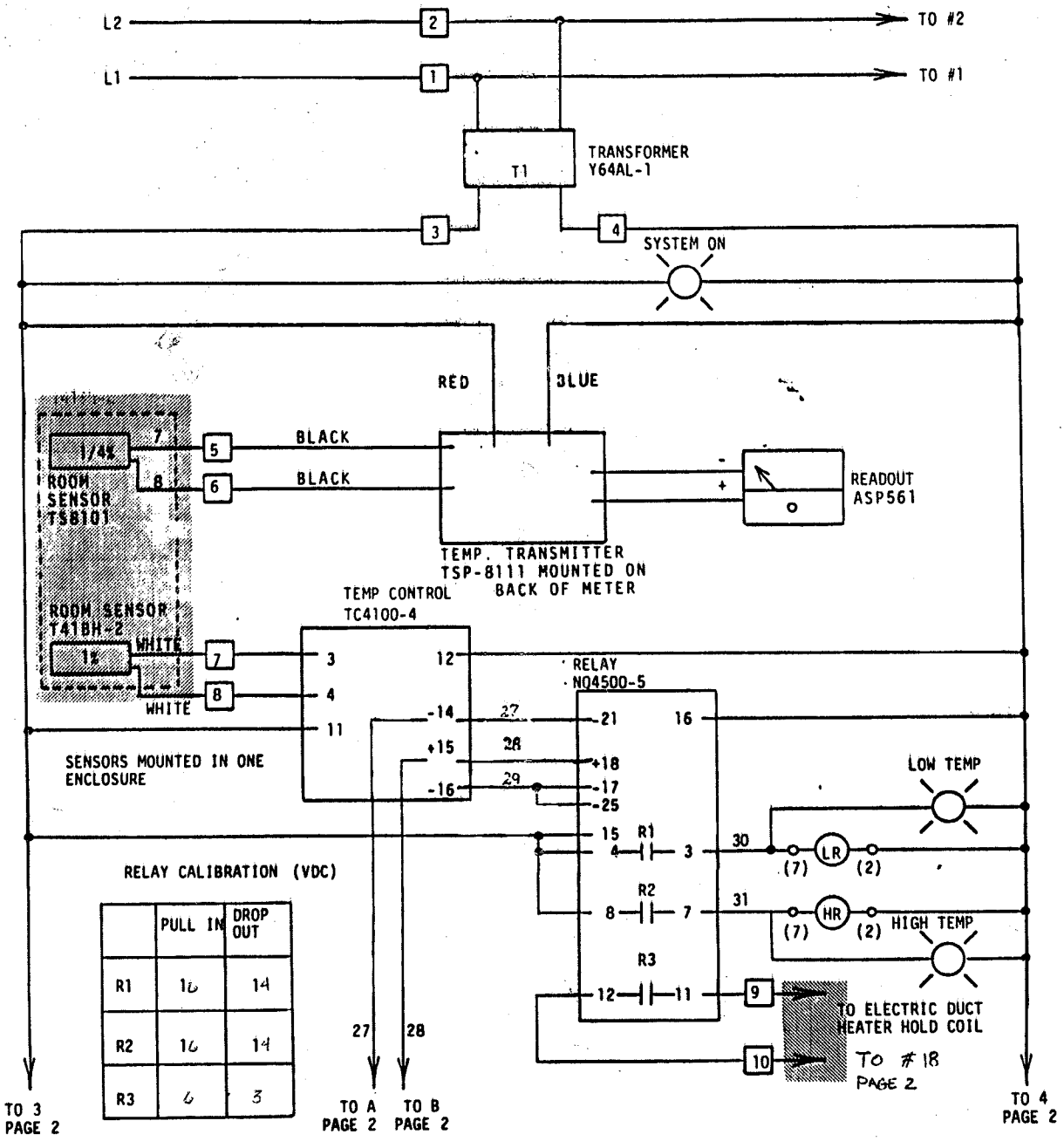
JOB U.W.PLANT SCIENCES FACILITY •6613

REVISIONS		
NO	DATE	BY
1	6-23-82	JCA
2	5-3-83	SJT
3		
4		

CONTROLS SUPPLIED BY
CLIMATIC CONTROL COMPANY, INC.
5061 WEST STATE STREET • MILW., WIS. 53208
TELEPHONE 259-9070 (414)

DRAWN BY	SCALE	DRAWING NO
VGG CHKD	DATE 5-31-81	B2530

RM 107,109,111,113,115,117,119,291A



RELAY CALIBRATION (VDC)

	PULL IN	DROP OUT
R1	16	14
R2	16	14
R3	6	3

REVISIONS		
NO.	DATE	BY
1	5-2-83	SJT
2		
3		
4		

CONTROLS SUPPLIED BY
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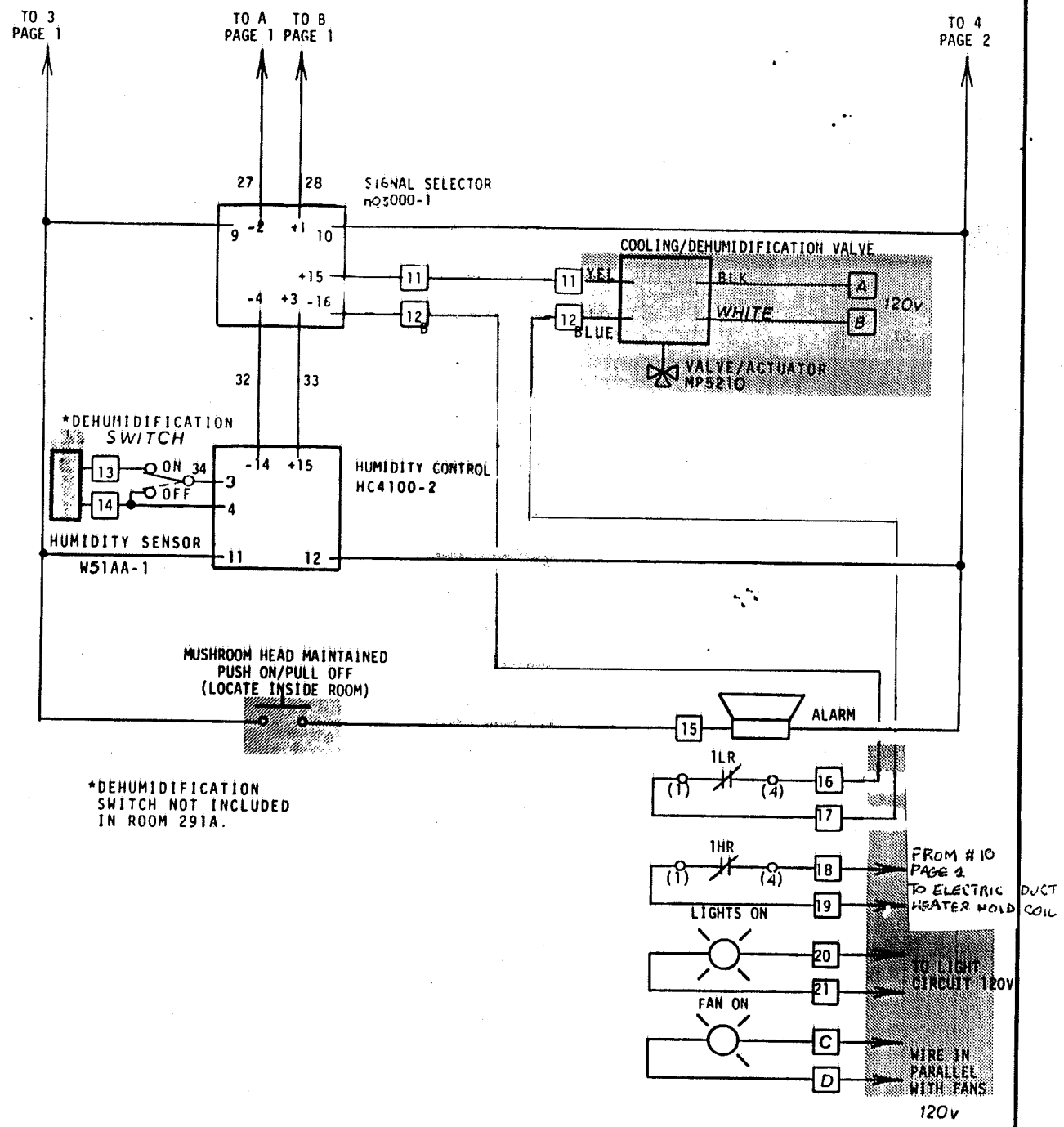
FOR MESSNER INC.

JOB U.W.PLANT SCIENCES FACILITY #6613

DRAWN BY VGG CHK'D
SCALE
DATE 9-2-81
DRAWING NO B2532-1



*DEHUMIDIFICATION SWITCH NOT INCLUDED IN ROOM 291A.

FOR MESSNER INC.

JOB U.W.PLANT SCIENCES FACILITY #6613

REVISIONS		
NO	DATE	BY
1	6-23-82	JCG
2	5 2 83	SJT
3		
4		

CONTROLS SUPPLIED BY

CLIMATIC CONTROL COMPANY, INC.

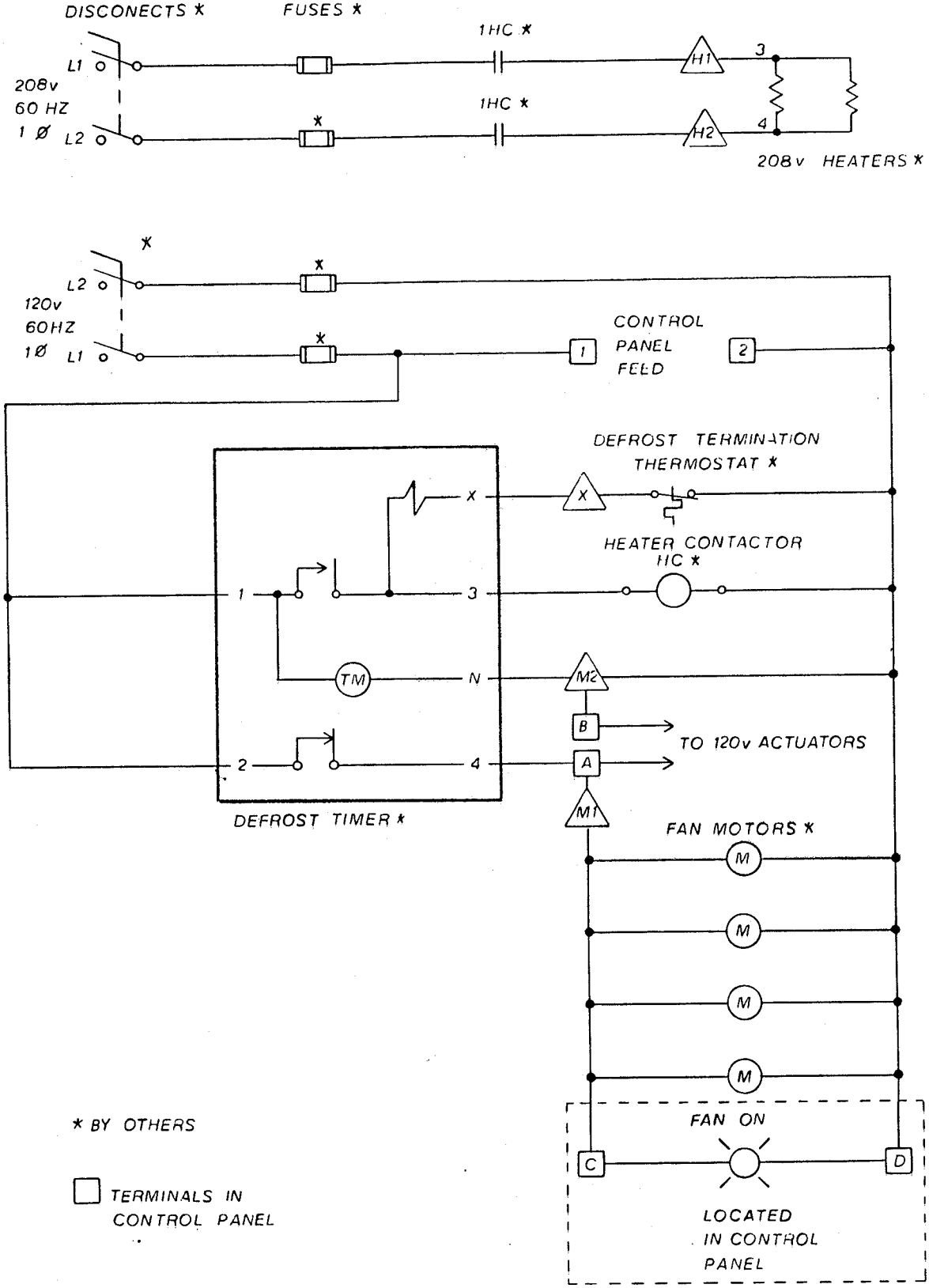
5081 WEST STATE STREET • MILW., WIS. 53208

TELEPHONE 259-9070 (414)

DRAWN BY	SCALE	DRAWING NO
JCG		B2532-2
	DATE 8-31-81	

DEFROST CIRCUIT FOR ALL UNITS

(DEFROST KIT 89)



FOR **MESSNER INC.**

JOB **U.W. PLANT SCIENCES FACILITY #6613**

REVISIONS		
NO	DATE	BY
1		
2		
3		
4		

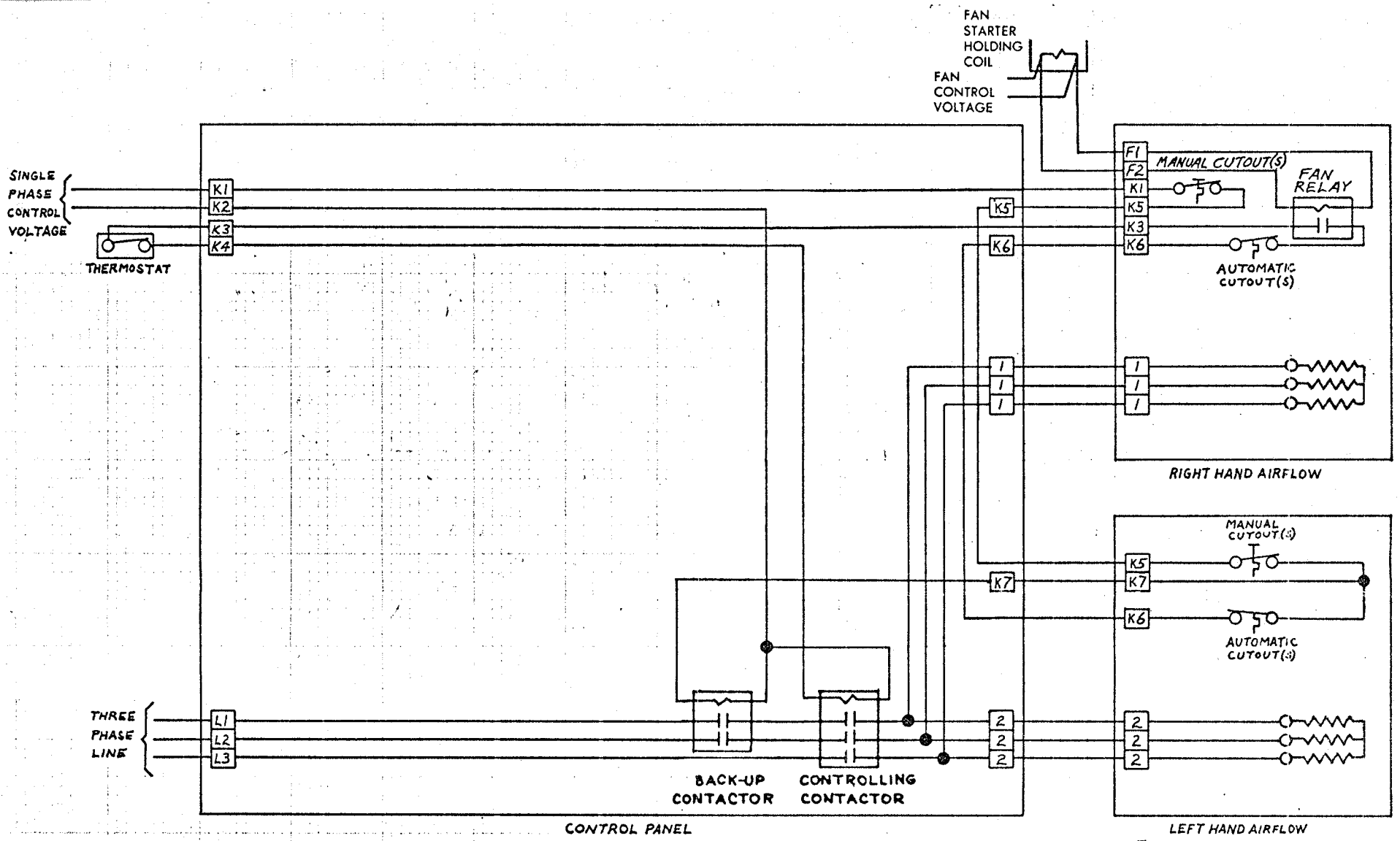
CONTROLS SUPPLIED BY

CLIMATIC CONTROL COMPANY, INC.

5061 WEST STATE STREET • MILW., WIS. 53208

TELEPHONE 259-9070 (414)

DRAWN BY	SCALE	DRAWING NO
JCG	NONE	B2532-3
CHK'D	DATE 7-1-82	



USE ____ AWG SUPPLY WIRE. INTERCONNECTING WIRE: 12 AWG POWER. ____ AWG CONTROL.
USE SUPPLY WIRE SUITABLE FOR 75°C. WIRE CONTROL CIRCUIT PER CLASS 1 ART. 725 OF N.E.C.

31	32	
IF CHECKED, THIS HEATER MAY BE WIRED WITH_____ AWG MIN. SUPPLY WIRE PER 424-22 (d) NEC, IF THE HEATER IS CONTROLLED IN ONE OF THE FOLLOWING 3 WAYS: (1) TWO OR MORE THERMOSTATS, (2) TWO OR MORE STAGE THERMOSTAT, (3) PROPORTIONING TYPE CONTROL.	USE_____ AWG MIN. SUPPLY WIRE.	INDEECO 830-25602-26-01

INDUSTRIAL ENGINEERING AND EQUIPMENT COMPANY
425 HANLEY INDUSTRIAL COURT ST LOUIS, MO 63144 314 644 4300

General Instructions

MA-5200 and MA-5300 Series
Two-Position Actuators
MP-5200 Series
Proportional Actuators

DEVICE INFORMATION

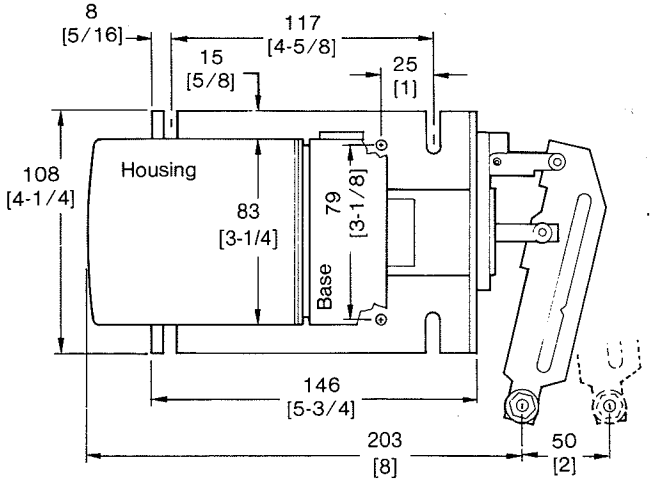
Identification

This General Instruction Sheet is concerned with all MA and MP-5200-0-0-2 and MA-5330 Series Actuators. Actuators with the part number suffix "-500" have a built-in adjustable SPDT switch. When working with actuators manufactured before this series, refer to replacement section below.

Pre-Installation

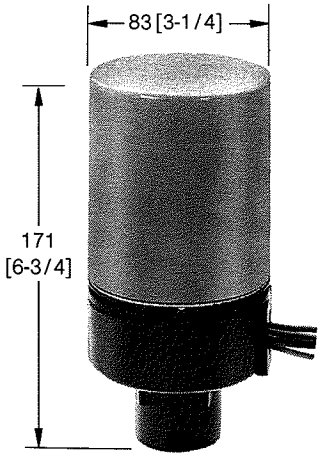
MA and MP-5210 Series: These actuators, two position and proportional, respectively, are supplied without additional linkage or hardware. AV-600 valve linkage and appropriate valve body or AM-601 damper linkage must be ordered separately.

Figure 1. AV-600, Valve Linkage

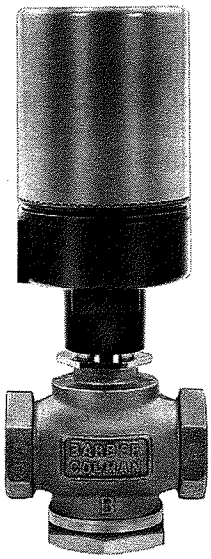


All Dimensions in Millimeters
[Inches in Brackets]

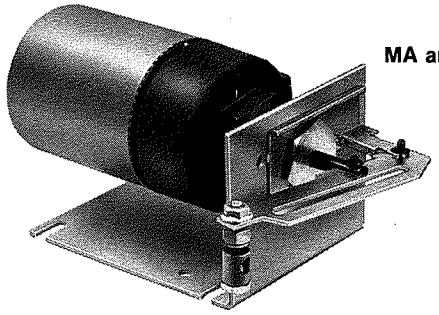
Figure 2. AM-601 Damper Linkage



MA and MP-5210 Series



MA and MP-5210 Series
AV-600 and Valve Body
NOTE: Allow 76mm [3"] above actuator for removal



MA-5330 Series and MP-5220 Series

MA-5330 Series and MP-5220 Series: These actuators, two position and proportional, respectively, are supplied with AM-601 damper linkage. Also required for installation will be four 1/4-inch diameter bolts or other fasteners to mount the actuator. Additional hardware normally required for linking the damper would be:

AM-132—balljoint connector for damper crank arm
AM-122—straight connector for damper crank arm
AM-125—8 mm (5/16-inch) link rod x 508 mm (20-inch)
AM-111 thru 115—damper shaft crank arms

When actuators have the optional auxiliary switch, an XDDH-132 adjusting wrench is available for adjustment.

Before mounting the device check for dents, bent parts and signs of oil leakage. Also check supply voltage against requirements, shown below:

Part Number	Voltage Requirements 50/60 Hz (Vac) Input: 10 watts
MA-MP-5XX0	120
MA-MP-5XX1	240
MA-MP-5XX2	208
MA-MP-5XX3	24

INSTALLATION

Requirements

These actuators will operate correctly in any position and are unaffected by normally encountered environmental conditions. Ambient temperature limitations: For MA Series, minimum is -17°C (0°F) and maximum is 60°C (140°F). For MP-5220 Series, minimum is -28°C (-20°F) and maximum is 60°C (140°F).

Procedure

CAUTION

Do not twist or exert any force on actuator housing during installation. Either turn the base by hand or if necessary use 1-5/8" open end wrench on flats provided on the base.

Figure 3

1. Before installing the device, check to be sure that it operates properly.

   MP (proportional) actuators. These actuators require the proper input voltage **(Figure 4)** and a control voltage of 1 to 15 Vdc. The actuator with the proper valve or damper linkage should go from retract to extend position as the control voltage goes from approximately 6 to 9 Vdc. For this checkout step, the AD-8301 manual positioner may be used to supply the control voltage.

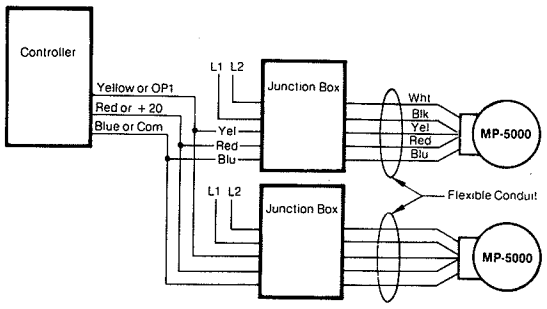


Figure 4. MP Wiring

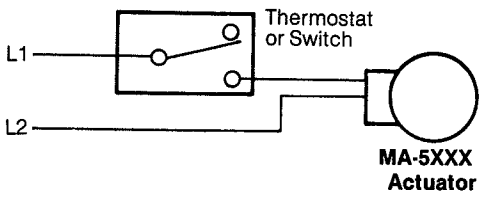


Figure 5. MA Wiring

MA (two position) actuators: When the proper ac voltage **(Figure 5)** is applied, the actuator motor should run causing the actuator to extend.

2. Install and connect the device physically.

   a. Damper actuators: Position actuator and mark mounting holes using the actuator bracket as a template.

      The best position for the actuator is with the actuator crank arm and the crank arm on the driven shaft, at a 90° angle to the linkrod at midstroke. It may be necessary to swivel the actuator linkage to arrive at the best mounting location.

      Allow adequate working space to wire the actuator into the system.

      Drill mounting holes for the appropriate 1/4-inch diameter mounting fasteners and mount the actuator. The actuator must be mounted firmly enough to prevent excessive actuator movement under normal damper loading. If there is excessive actuator movement, the damper may not fully open or fully close.

   b. Valve actuators: Remove as required the valve body from the actuator by loosening the 1-5/8-inch flange nut.

      Pipe the valve body into the system. Note: Be sure that the actual flow is in the same direction as the arrows on the valve body indicate. Allow 76mm (3 inches) above the actuator case for reattachment and removal.

      Reattach the actuator to the valve body as required.

3. Wire the actuator into the system.

   Low voltage units wired to NEC codes may use Class Two wiring. Wire line voltage units wired to NEC codes.

Actuator Voltage (Vac)	Wire Size (GA)	Maximum Two Wire Run Meters (Feet)
24	14 12	91.5 (300) 146.3 (480)
120	14	1067 (3500)
208/240	14	1829 (6000)

   To determine the allowable maximum run for multiple actuator wiring, divide the maximum run shown above for a given wire size and voltage by the number of actuators on that run.

   Use wire nuts on power leads from a Class A power source. Power lead colors are shown as follows: Black – common to all voltages that follow. White – for 120 Vac. Black with blue tracer – for 24 Vac. Black with brown tracer – 208 Vac. White with black tracer — 240 Vac. All leads are 1.2 m (4 feet).

MP (proportional) actuators:

NOTE: System 8000 controllers can control a maximum of two (2) MP-5200 Series Actuators. AD-8101 adaptors can be added as shown in EN-111 to control two additional MP-5200 Series per adaptor.

Actuator wires are connected as shown in **(Figure 4).** Barber-Colman approved, three conductor twisted 18 AWG wire has 600 volt PVC insulation and should be used from the controller. This twisted wire can be put in the same conduit with power wiring to the actuator. Also acceptable is any three wire (18 ga.) cable with Class I lead insulation in conduit separate from line voltage **(Figure 4).**

MA (two position) actuators: These are wired as shown with the thermostat or switch device controlling the off-on status of the actuator motor **(Figure 5).**

4. Finish the damper actuator mechanical hook-up. After wiring, assemble the straight connector, linkrod, balljoint connector, and damper shaft crank arm as shown **(Figure 6).**

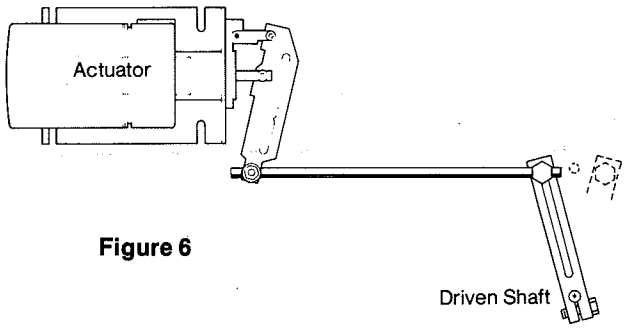


Figure 6

Tighten both the actuator connector to the linkrod and the damper crank arm to the damper shaft. Both crank arms should be approximately 90° to the linkrod at midstroke. Normally dampers are linked to full heat with the actuator retracted.

By extending and retracting the actuator the actuator crank arm will rotate 80°. (See Number 1 above.)

Determine the proper radius on the damper shaft crank arm to fully open and close the damper.

Tighten down the connector to the damper crank arm and the linkrod.

The installation is now complete.

Auxiliary Switch

Hydraulic actuators may be ordered with a built-in adjustable SPDT auxiliary switch **(Figures 7 and 8).** This switch must be ordered as part of the actuator and cannot be field installed. Note: For MP Series actuators only, the switch common wire is internally connected to the black power lead. Because of this, the switch must be wired to control the same voltage as the actuator itself. Switch rating is 10 amperes at 120/240 Vac. Leads are 1.2m (4 feet).

The switch's brown wire is normally open and the orange wire is normally closed. The switching point is adjustable over the entire actuator stroke and is factory set to occur at the retracted end. Use XDDH-132 to adjust the switch point.

CHECKOUT

The actuator is now installed and should run properly when the system is energized. The following checks can be easily performed to see if the device is operational.

MP Series Actuators: First, the actuator motor should run continually when power is applied. If the motor is not running, something is wrong with either actuator or the supply voltage. Second, the damper or valve should go from full heat to full cool shaft extended as the control signal goes approximately from 6 to 9 Vdc, as measured between yellow and blue leads.

NOTE: At very low ambient temperature (around minus 20°F) the actuator may run slowly until the oil warms up. This condition may exist for 30 minutes.

MA Series Actuators: When the proper voltage is supplied to the actuator, the actuator motor should run, causing the actuator shaft to extend.

If the actuator fails to function properly, refer to the section on repairs.

RUN/ADJUST

No adjustments are made at the actuator. All adjustments are made at the controller.

Theory of Operation

See Figures 6 and 7. The permanently sealed oil filled case (1) contains a movable hydraulic piston assembly (2) and an electric pump (3) for the hydraulic system. The pump generates a fluid pressure which is transmitted to the top of the piston. Opposing the hydraulic force is the spring of the valve or damper linkage.

MA Series Actuators: The electric pump (3) is powered by the input supply voltage and runs whenever the voltage is applied. When power is removed, the oil flows back through the pump by means of check valve (6) and the actuator retracts.

MP Series Actuators: The electric pump (3) is powered by the input supply voltage, and runs continuously. An unregulated power supply (4) is powered by a transformer winding from the pump

motor winding. The power supply produces 20 Vdc which powers the controller. The controller returns a 1 to 15 Vdc control voltage to the actuator transducer (5). This controls the internal pressure and the resultant actuator action.

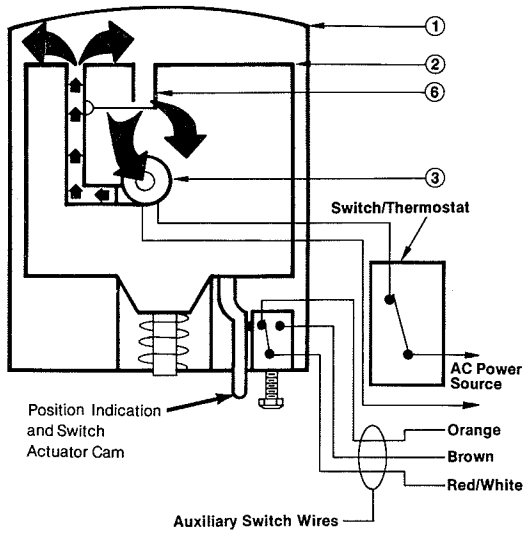


Figure 7. MA Series Actuator

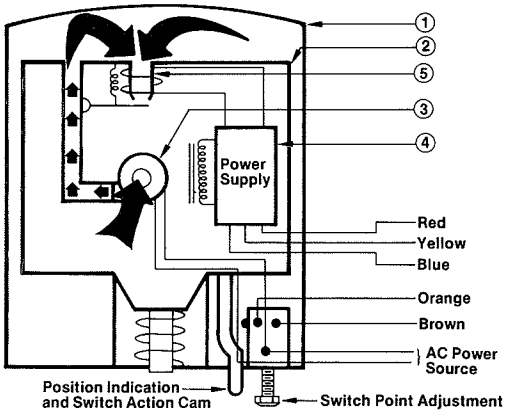


Figure 8. MP Series Actuator

MAINTENANCE

The power unit of the actuator is sealed in oil and requires no maintenance.

REPAIR

MA Series Actuators:

1. Check the actuator by applying the proper supply voltage.
2. The motor should run when power is applied, if not, the actuator is defective and should be replaced.
3. The actuator should extend; if it does not, check the mechanical linkage.Either the mechanical linkage prevents proper action or the actuator is defective.
4. If the linkage moves properly, but the actuator does not extend, replace the actuator.
5. If applying power causes the actuator to perform correctly, the actuator and linkage are functional and the wiring and thermostat should be checked.

MP Series Actuators: Repairs to this device consist mainly of checking the unit wiring and replacement of the power supply. Other field repairs are not recommended. Use the procedure below to locate a malfunction.

1. The actuator motor should run continually. If it does not run, check the supply voltage and the unit wiring.
2. Voltage between the blue (–) and the red (+) leads should be 20±1 Vdc.
3. Input voltage on the blue (–) and yellow (+) wires should be between 1 and 15 Vdc. If it is not, refer to EN-111 for service information.

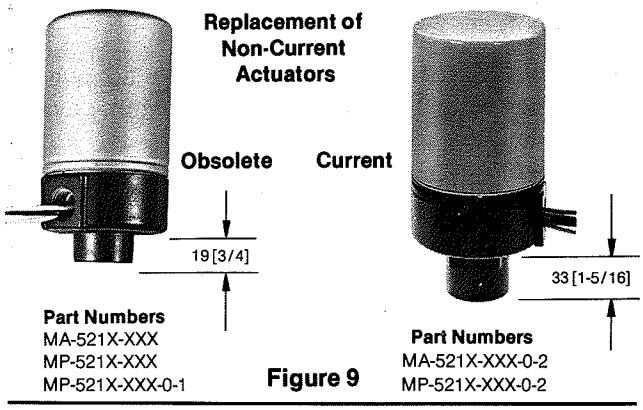


Figure 9

Obsolete or Current Damper Linkage

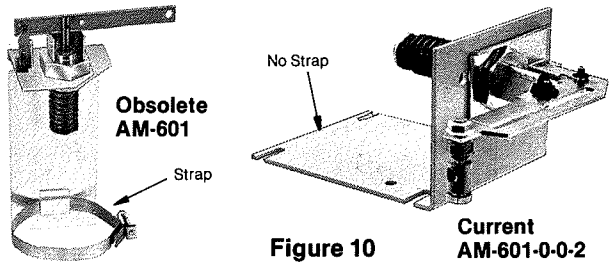


Figure 10

Obsolete Valve Linkages or AV-600 Linkage

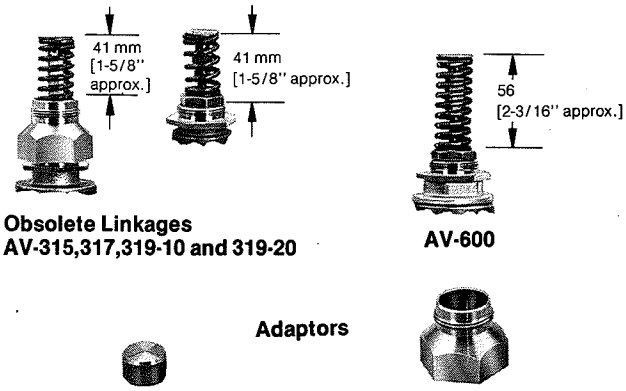


Figure 11

NOTE: When replacing MP-521X-XXX with MP-521X-XXX-0-2 consult EN-111, Section C.1.2.

Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION
1300 Rock Street, Rockford, Illinois, U.S.A., 61101

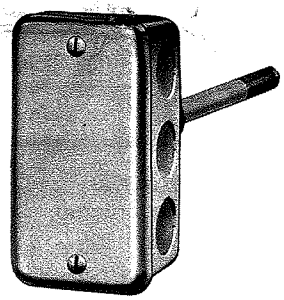
JOHNSON CONTROLS

Johnson Controls, Inc.
Controls Group

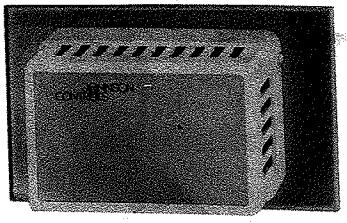
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53201

TE-6100 Completed Sensor/Hardware Assemblies

TE-6100 completed assemblies are used in a wide variety of temperature sensing applications. In addition to these completed units (See Table 1), there are various other sensing elements and hardware configurations that may be field assembled, depending on the application. Refer to bulletin TE-6000 for available temperature sensing elements and bulletin TE-6001 for available hardware configurations.



TE-6100-3



TE-6100-8, -960 and -961 (with T-4000 Cover)

TE-6100-10

Specifications

Product		TE-6100 Completed Sensor/Hardware Assemblies
Models		See Table 1
Elements	**TE-6100-1 Through -8**	Nickel Wire Resistance Type
	TE-6100-10	Temperature Elements: Nickel Wire, Humidity Element: CAB (Carbon Particles Enclosed in Cellulose Acetate Butyrate)
	TE-6100-960,-961,-962	PTC Silicon
Reference Resistances	**TE-6100-1 Through -8**	1000 Ohms @ 70°F (21°C)
	TE-6100-10	1000 Ohms @ 70°F (21°C), 50% RH
	TE-6100-960,-961,-962	1035 Ohms @ 77°F (25°C)
Temperature Coefficient	**TE-6100-1 Through -8**	Positive, Approx. 3 Ohms/F° (5.4 Ohms/C°)
	TE-6100-960,-961,-962	Positive, Approx. 4.3 Ohms/F° (7.7 Ohms/C°)
Resistance Tolerances	**TE-6100-1,-2,-4,-8**	± 1.0% @ 70°F (21°C)
	TE-6100-3	± 0.5% and ± 0.25% @ 70°F (21°C)
	TE-6100-5	± 0.25% @ 70°F (21°C)
	TE-6100-10	± 1.0% (Both Sensors) @ 70°F (21°C)
	TE-6100-960,-961,-962	+ .05%-.15% @ 77°F (25°C)
Ambient Operating Environment	**TE-6100-1,-2,-3**	-50 to 250°F (-46 to 121°C)
	TE-6100-4,-5	Up to 550°F (288°C)
	TE-6100-8	0 to 130°F (-18 to 54°C), 10 to 90% RH, Non-Condensing
	TE-6100-10	52 to 78°F (11 to 26°C) Operating Range, 30 to 80% RH; 40°F (4°C) Minimum Ambient Temperature, 120°F (49°C) Max
	TE-6100-960,-961	32 to 104°F (0 to 40°C), 10 to 90% RH, Non-Condensing, Limited by an 85°F (29°C) Dew Point
	TE-6100-962	-40 to 216°F (-40 to 102°C)
Set Point Range	**TE-6100-8**	55 to 85°F (13 to 29°C), °F and °C Scales Furnished
	TE-6100-960	50 to 85°F (10 to 29°C), °F and °C Scales Furnished
Accessory for TE-6100-4,-5		WZ-1000-4 Stainless Steel Immersion Well, 1/2 in. (13 mm) I.D., 1/2 in. -14 NPT, Less Thermal Compound, 600°F and 400 PSIG (316°C and 2756 kPa)
Accessories for TE-6100-960,-961		TE-6001-961 Pushbutton Switch and TE-6001-962 Toggle Switch

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

24-4034-42
Rev. A

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Models

TE-6100-1 through -8 temperature sensing assemblies are designed for use with Cybertronic® temperature controllers, GQ-4000 Indication Systems, the DSC-8500 Digital System Controller and JC/85 Building Automation Systems. The sensing portion of these assemblies is a nickel wire winding which varies its resistance with temperature changes.

The **TE-6100-1 and -2** averaging element assemblies have 17 and 8 ft. (5.2 and 2.4 m) elements respectively and are suitable for duct mounting as well as other applications.

The **TE-6100-3** duct insertion assembly is designed for control and/or indication. This assembly has a dual wound nickel wire element that consists of an element winding on each of two concentric tubes. The outer tube thermally insulates the inner tube and its winding to produce a time lag in sensing temperature changes. When used in a control system, this element provides an effect similar to rate action, which will prevent cycling caused by sudden large temperature changes.

The **TE-6100-4 and -5** high temperature well insertion assemblies are used for control or indication of steam or hot water temperatures up to 550°F (288°C) in pipes and tanks. These assemblies use a rigid rod on which the nickel wire is wound. The sensors have a resistance tolerance of ± 1.0% and ± 0.25% respectively. A WZ-1000-4 stainless steel immersion well must be used with these assemblies in all applications.

The **TE-6100-8** room element assembly consists of a nickel wire sensor, set point adjustment, wallplate adapter and mounting bracket. A T-4000 cover is required and must be ordered separately. See Table 4 for available covers.

Table 1: Models

TE-6100-	Description
1,2	Averaging nickel wire Elements with Handi-box
3	Dual Wound nickel wire Element with Handi-box
4,5	High Temperature Well Insertion nickel wire Elements with Handi-box
8*	Room Temperature Nickel Wire Element with Set Point
10	Enthalpy Sensor with Holder and Mounting Bracket
960*	Room Temperature PTC Silicon Element with Set Point
961*	Room Temperature PTC Silicon Element without Set Point
962	Averaging PTC Silicon Element with Duct Insertion Tube

*Order T-4000 Cover Separately

The **TE-6100-10** enthalpy sensor assembly is used with the R41E Load Sequenced Economizer Control System to control an outdoor air damper. It can also be used with the R34 Differential Temperature Controller for enthalpy comparison. This assembly senses the total heat (temperature and humidity) of outside air by utilizing two nickel wire temperature sensing elements and one humidity sensing element. The sensors are connected into a controller bridge which produces a DC signal proportional to the total heat of the air. The resistance is 1000 ohms when the control point is 70°F (21°C), 50% RH.

The **TE-6100-960 and -961** are used with DSC-1000 applications. These assemblies consist of a PTC silicon sensor, set point adjustment (-960 only), wallplate adapter and mounting bracket. The TE-6100-960 has five wires and the TE-6100-961 has three. A T-4000 cover is required and must be ordered separately.

The **TE-6100-962** averaging element assembly is used with the DSC-1000 in duct insertion applications. This assembly consists of a PTC silicon element mounted in a metal tube.

Operation

When used with a Cybertronic temperature controller or a GQ-4000 Indication System, the sensor portion of the TE-6100-1 through -8 assemblies completes a bridge circuit. If the temperature at the element changes, the resistance of the element changes and unbalances the bridge in proportion to the change. In control applications, a variation from the bridge set point produces a signal which is applied to a control amplifier. An indication bridge produces a signal proportional to the element resistance which is used as an input to an indication meter or a precision recorder.

When used with the DSC-8500, the FIC-101 Field Interface Controller converts the resistive input into a digital output for use by the FIC-101 main microprocessor. This microprocessor directs interlock and incremental control functions and communicates with the PCR-102 Processor Board by sending data and status information and receiving commands.

The ANT-10n Analog Temperature Input Point Module of the JC/85 converts the resistive input from the TE-6100-1 through -8 into a DC voltage pulse which is then processed by the Field Processing Unit (FPU). The pulse is converted

into digital format for transmission to the Central Processing Unit (CPU).

The TE-6100-10 enthalpy sensor assembly is typically used as an economizer control limit on unitary air conditioning equipment. As long as the total heat of the outdoor air is below the setting of the "return to minimum" adjustment on the master panel, the outside air damper is controlled by the space requiring cooling. When outdoor conditions are above the set point, the outside air damper closes to the minimum setting.

The TE-6100-960, -961, and -962 assemblies have a PTC silicon sensor and are used with the DSC-1000 Network. These assemblies are set up to input a varying resistance into the controller. When the temperature at the sensor changes, the resistance of the sensor changes. This changes the sensor voltage and causes the system to adjust to meet the demand. The sensor will exhibit a positive resistance change with temperature.

Mounting

The averaging elements of the TE-6100-1 and -2 assemblies should be secured in duct applications to prevent element damage.

Caution: A 3 inch minimum bend radius must be maintained.

The dual wound element of the TE-6100-3 assembly should be attached to a duct with #6 sheet metal screws or a threaded mounting flange. A WZ-1000-4 stainless steel immersion well must be used with TE-6100-4 and -5 assemblies.

Locate TE-6100-8, -960 and -961 assemblies on a wall where air is free to circulate around the element, but away from nonrepresentative air conditions such as drafts or heat radiation. Mount these assemblies 5 to 6 ft. (1.5 to 1.8 m) above the floor on a standard electrical wallbox. A mounting bracket and wallplate adapter are furnished with these assemblies. See mounting detail illustration.

The TE-6100-10 assembly must be located where it is exposed to freely circulating outside air. An ideal location is the outside air intake behind the weather louver so rain does not directly impinge on the sensors.

The TE-6100-962 assembly is attached to a duct with #6 sheet metal screws. The tube may be shortened up to 8 inches by removing the end cap, cutting the tube, and reinstalling the end cap.

Wiring

Caution: Disconnect power supply before wiring connections are made to prevent electrical shock or possible damage to the equipment.

TE-6100-1 through -5 assemblies are equipped with an electrical enclosure and 18 AWG pigtail leads for wiring connections. The leads of the elements are white except for one set of leads on the dual wound element. The leads of the outer winding (± 0.5%) are black. The leads of the inner winding (± .25%) are white.

In wiring a TE-6100-4 and -5 to a controller or bridge, always use high temperature wire.

The TE-6100-8 nickel wire room element assembly has 6-in. (152 mm) white and violet leads for connection with system wiring. Connections are made in the wallbox with wire nuts or other approved connectors. Wire to TC-6100 terminals 3 and 4. It does not matter which lead goes to which terminal.

The TE-6100-962 averaging assembly has 18 AWG violet pigtail leads for wiring connections.

The TE-6100-960 and -961 have color-coded 18 AWG wires. Connections are made in the wallbox with wire nuts or other approved connectors.

Wiring between a TE-6100 assembly and Cybertronic temperature controllers does not normally require shielding. If the wiring is to be routed through electrically noisy environments such as motor control centers, relay panels, or lighting panel boards, it may be necessary to use shielded cable to minimize the effects of transient voltages and other sources of electromagnetic interference.

Sensor wiring to controllers may be run in the same conduit as AC power as long as the power consumption is continuous. Transient voltages generated during power switching may be induced into the sensor wiring causing upsets or failures in the connected components. Since transients are generally caused by inductive loads, sensor wiring should not be combined with any relay or motor control circuits which are frequently interrupted, nor with frequently switched lighting loads.

Recommended installation practices with controllers include:

1. Separate conduit for sensors where line voltage switched power is present.
2. Separate conduit when switched low voltage loads of 50 VA or more are present.
3. When sensor wiring and AC power wiring are together in the same conduit, runs up to 300 ft. (91 m) should pose no problems, but longer distances may cause sufficient AC pickup to disrupt proper controller operation. Extension leads for TE-6100-9 should not exceed 100 ft. (30.5 m).
4. Maintain as much physical separation as possible where

AC power and sensor wiring exist in a common panel.

5. If items 1 through 4 cannot be followed, use shielded cable for sensor leads. Trim back shield at sensor and tape to prevent grounding. Connect the shield(s) to terminal 1 on the TC-6100. Make sure the shield is continuous and not grounded at any point.

Shielded wire is not required for connection to GQ-4100 indication bridges. However, the conditions for using shield and separate conduit with controllers apply to GQ-4100 bridges when they are used with a CQ-2200 Alarm Unit. Connect the shield to terminal 5 on the GQ-4100.

Shielded wire is always required for connection to the DSC-1000, DSC-8500 and JC/85. If used with the DSC-8500, the sensor is terminated at the analog input terminals of the FTB-102 Field Terminal Board. Another shield wire is terminated at the point of wire entry into the panel. An element used with the JC/85 is terminated inside the FPU enclosure on the motherboard TM strip associated with the ANT-10n point module.

See wiring diagrams. All wiring must be in accordance with applicable electrical code requirements.

Repair Information

Field repairs must not be made. For replacement sensors, contact the nearest Johnson Controls branch office.

Table 2
Temperature vs Resistance

Temperature		Nominal Resistance (Ohms)		
°F	°C	-1,-2,-3 & -8	-4,-5	-960,-961,-962
-50	-46	674	—	—
-40	-40	699	—	605
-30	-34	725	—	633
-20	-29	751	—	665
-10	-23	777	—	698
0	-18	803	—	732
10	-12	830	—	768
20	-7	858	—	804
30	-1	885	—	842
40	4	914	—	881
50	10	942	—	921
60	16	971	—	962
70	21	1000	1000	1005
77	25	1021	1021	1035
80	27	1030	1031	1048
90	32	1060	1062	1093
100	38	1090	1094	1139
110	43	1121	1126	1186
120	49	1152	1159	1234
130	54	1184	1192	1283
140	60	1216	1225	1333
150	66	1248	1259	1385
160	71	1281	1293	1437
170	77	1314	1328	1491
180	82	1348	1363	1546
190	88	1382	1398	1602
200	93	1417	1434	1659
210	99	1452	1471	1718
220	104	1487	1507	—
230	110	1524	1544	—
240	116	1560	1580	—
250	121	1597	1617	—
275	135	—	1709	—
300	149	—	1801	—
325	163	—	1901	—
350	177	—	2006	—
375	191	—	2121	—
400	204	—	2241	—
425	218	—	2368	—
450	232	—	2498	—
475	246	—	2635	—
500	260	—	2775	—
525	274	—	2919	—
550	288	—	3066	—

Table 3: TE-6100-960 Set Point Potentiometer Calibration

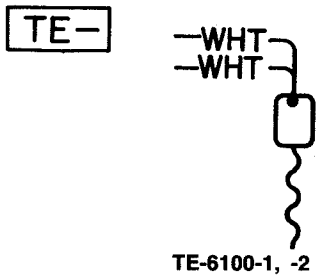
°C	°F	% Of Supply	Reference Voltage
10	50	72.4	3.620
11.1	52	70.0	3.500
12.8	55	66.3	3.314
15	59	61.3	3.063
15.6	60	60.1	3.003
18.3	65	53.8	2.689
20	68	50	2.500
21.1	70	47.5	2.374
23.9	75	41.2	2.059
25	77	38.7	1.935
26.7	80	34.9	1.747
28.9	84	30.0	1.500
30	86	27.6	1.380

NOTE: The reference voltages are meaningless if the supply voltage is not 5.000 volts. Use percentage of supply to calculate output for other input voltages.

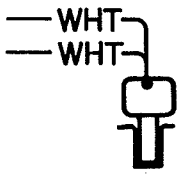
Table 4: Accessories/Repair Parts

Name of Part	Code No.	
Electrical Wall Box Mounting Adapter Kit - Includes Wallplate Adapter, Mounting Bracket, and Screws	TE-1800-9600	
Plastic Cover	Aluminum Faceplate	Gold & Brown Faceplate
HORIZONTAL		
without S.P. Window or Thermometer, with JCI Logo	T-4000-2139	T-4000-2639
without S.P. Window, with °F/°C Thermometer and JCI Logo	T-4000-2140	T-4000-2640
Exposed S.P., without Thermometer, with JCI Logo	T-4000-2141	———
Exposed S.P., with °F/°C Thermometer and JCI Logo	T-4000-2142	T-4000-2642
HORIZ OR VERTICAL		
without S.P. Window, Thermometer, or JCI Logo	T-4000-2138	———
VERTICAL		
without S.P. Window or Thermometer, with JCI Logo	T-4000-2144	T-4000-2644
Exposed S.P., without Thermometer, with JCI Logo	T-4000-2145	T-4000-2645
Exposed S.P., with °F/°C Thermometer and JCI Logo	T-4000-2146	———
Thermistor Sensor Assembly for DQ-4000 Series Only (Repair Part)	TE-6100-9	

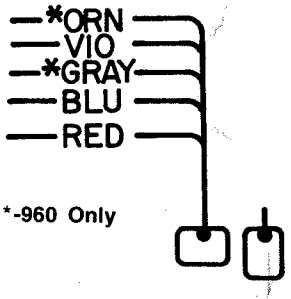
Application and Drawing Identification



TE-6100-1, -2

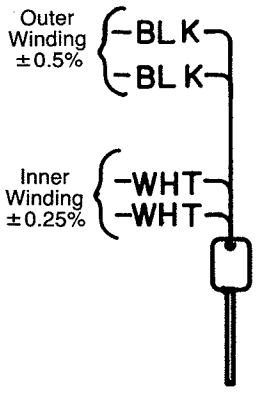


TE-6100-4, -5

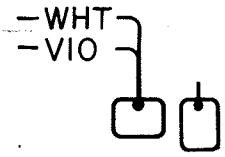


*-960 Only

TE-6100-960, -961

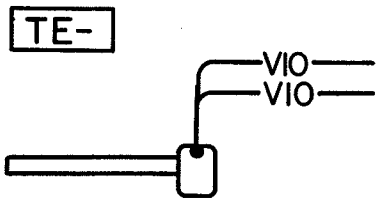


TE-6100-3



TE-6100-8

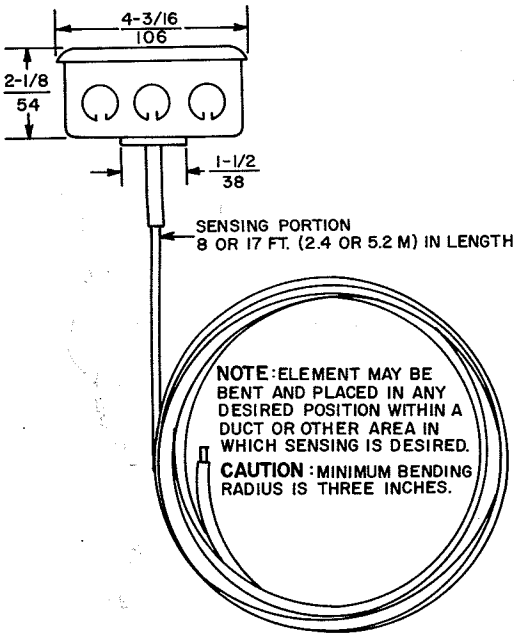
TE-6100-10



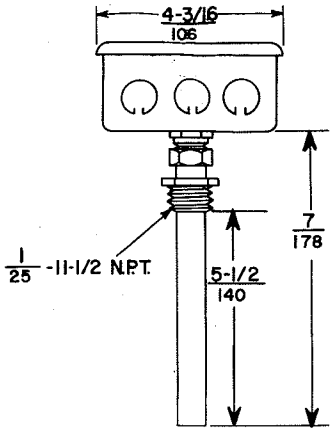
TE-6100-962

See BEIMS 45-2.03-2.

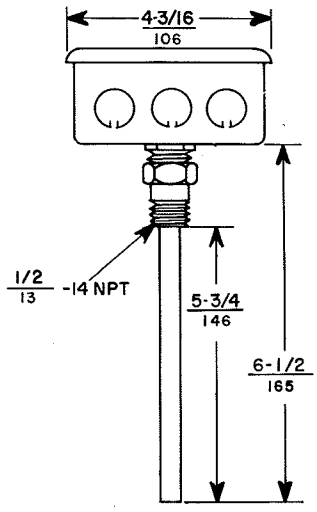
Dimensions in. / mm



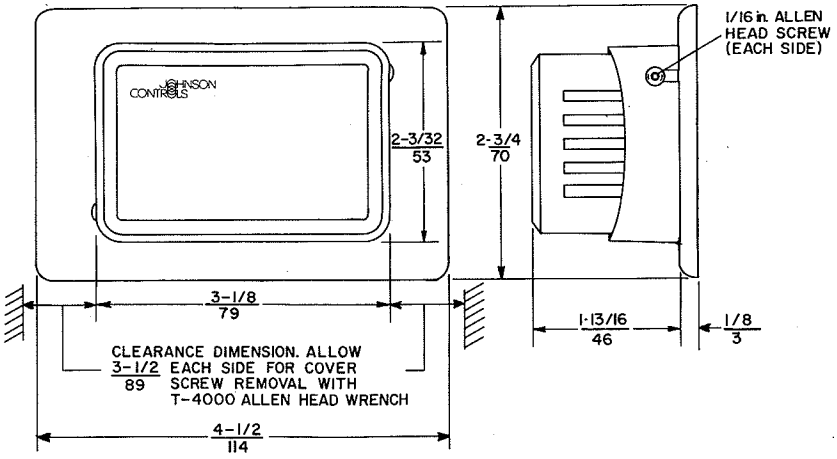
TE-6100-1, -2
Averaging Elements



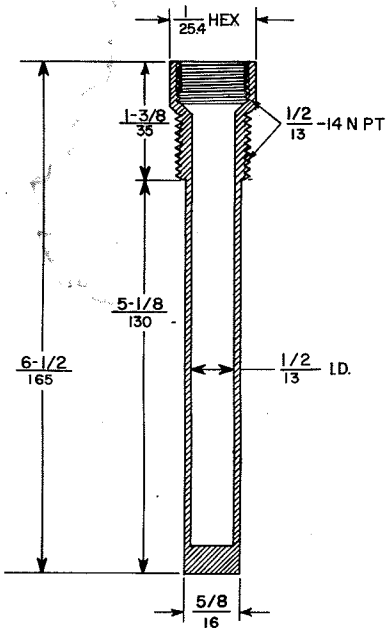
TE-6100-3 Dual Wound
Duct Insertion Element



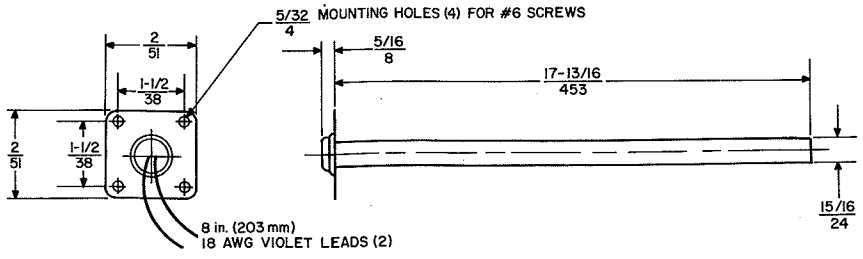
TE-6100-4, -5 High Temp
Well Insertion Element



TE-6100-8, -960 and -961

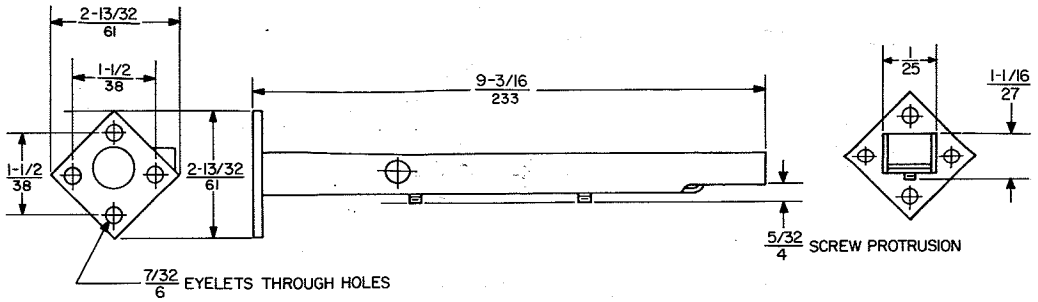


WZ-1000-4 Immersion Well
(Used with TE-6100-4, -5)



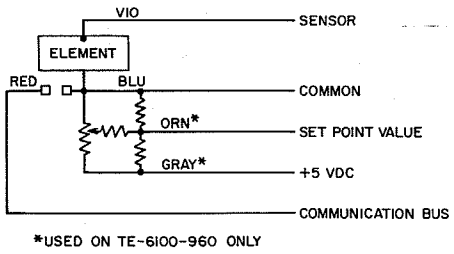
TE-6100-962

Dimensions $\frac{in.}{mm}$ Cont.

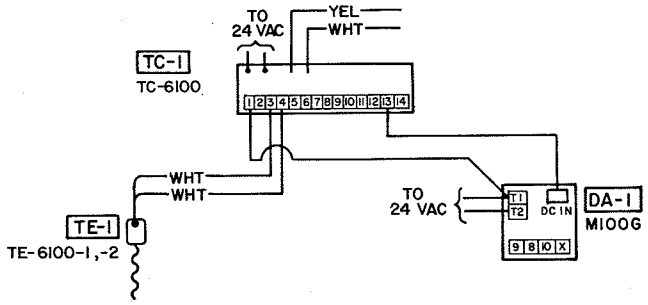


TE-6100-10

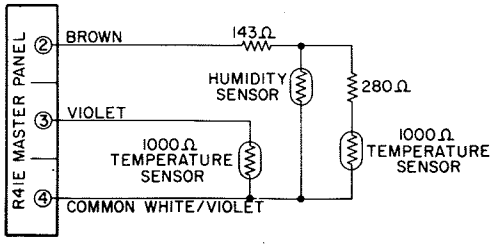
Applications/Wiring



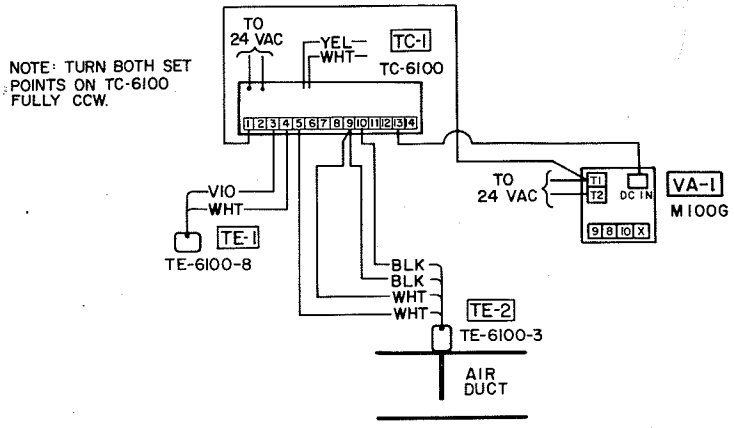
TE-6100-960 and -961 Wiring Color Code



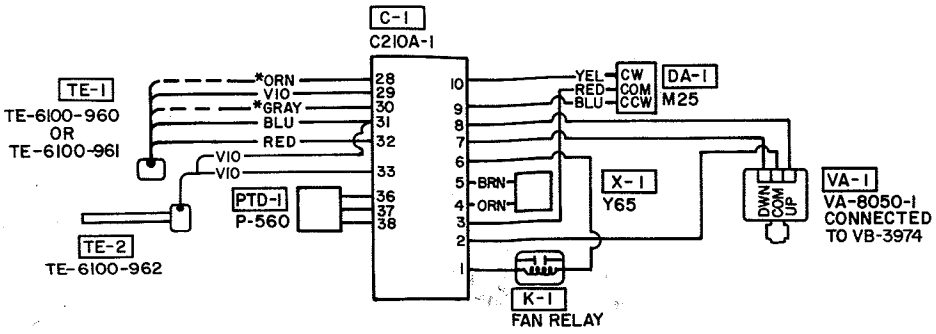
Wiring for Duct Temperature Sensing with TE-6100-1, -2 Averaging Element



Wiring Diagram Showing TE-6100-10 Connected to R41E Terminals

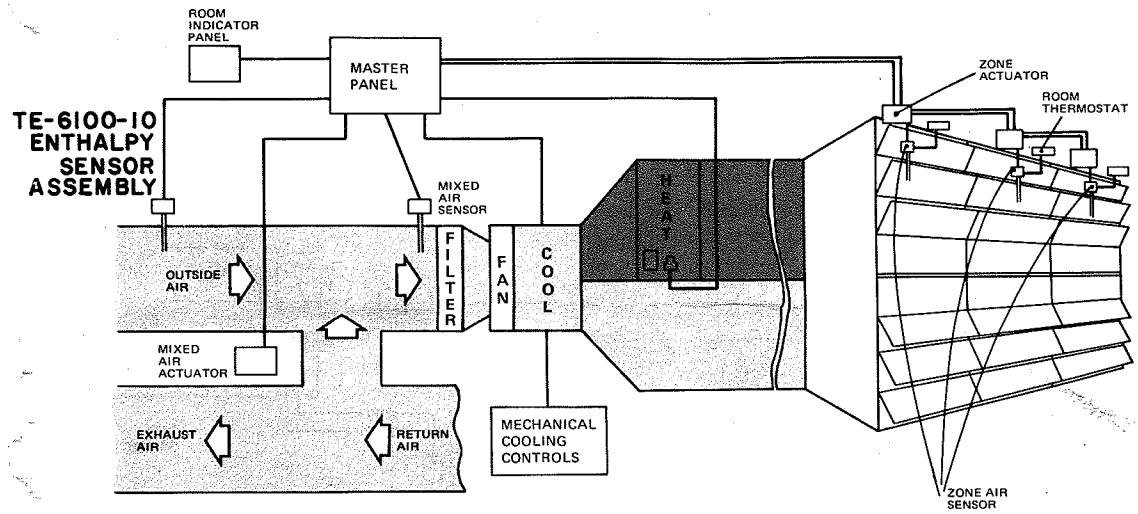


Wiring for Air Duct Temperature Sensing with Dual Wound Element

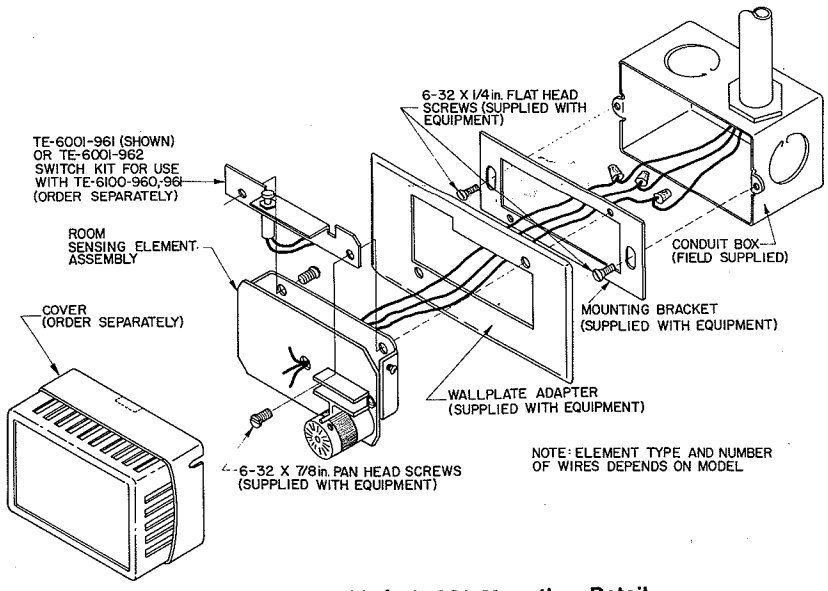


*ADDITIONAL CONNECTIONS FOR TE-6100-960 REMOTE SET POINT W/SENSOR

TE-6100-960 and -961 Typical Wiring Application



Typical Installation Showing Location of TE-6100-10 Sensor



TE-6100-8, -960 and -961 Mounting Detail