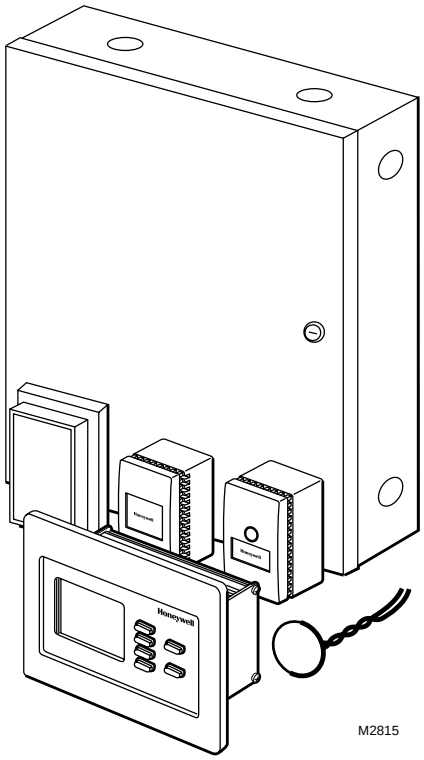
Honeywell

W180 Zone Control System



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Ordering Information

When purchasing replacement and modernization products from your Perfect Climate® and authorized systems distributors, refer to the TRADELINE® Catalog or price sheets for complete ordering number, or specify:

1. Model number.
2. Accessories, if desired.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Home and Building Control Sales Office (check the white pages of your phone directory).
2. Home and Building Control Customer Satisfaction
   Honeywell Inc., 1885 Douglas Drive North
   Minneapolis, Minnesota 55422-4386 (612) 951-1000

In Canada—Honeywell Limiteé, 740 Ellesmere Road, Scarborough, Ontario M1P 2V9. International Sales and Service offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, United Kingdom, U.S.A.

W180 Zone Control System Overview

This manual presents application information and installation, checkout, and troubleshooting procedures for the W180 Zone Control System (W180 System) (Fig. 1). The W180 System is used to optimize comfort and energy savings in a variety of residential and light commercial applications.

The W180 System:

— Can operate with the Honeywell TotalHome® System (versions 1.14 and greater), providing remote access and control for the homeowner. W180 Profiles and settings can change automatically with TotalHome® Modes.

— Can control different types of HVAC equipment (for example, radiant hydronic heating and air conditioning) as well as multiple sets of equipment (for example, four air conditioning units and four furnaces).

— Allows central control with the easy-to-use S321A Touchpad.

— Allows multiple S321A Touchpads to be located throughout the house or building for convenient operation.

— Supports a maximum of three Touchpads with the dc power supply provided by the W180A Controller.

— Allows unique and personalized names to be defined for each zone.

— Allows user to individually adjust settings in each zone.

— Has user-definable, system-wide Temperature Profiles for quick, easy control and adjustments.

— Permits separate temperature setpoints (for each zone) for any Temperature Profile.

— Allows PC interface for configuration and monitoring.

— Supports a wide variety of sensors, modulating dampers, 2-position valves, and HVAC equipment.

— Permits a maximum of 16 zones for heating only or cooling only, or a maximum of 10 zones for heating and cooling for each W180A Controller, depending on the equipment used.

— Accommodates virtually any HVAC configuration and provides the following zoned or individual room temperature control:
- Damper zoning.
- Hydronic valve zoning.
- Equipment zoning.
- Combination of damper, hydronic valve, and equipment zoning.
- Mixture of various HVAC systems.

— Does not require bypass dampers.

— Offers programmable HVAC equipment protection:
- Minimum air flow maintained via minimum duct area(for dampered forced air systems with standard induction blower motors).
- Temperature setpoint limits (range boundaries).
- Damper position tracking (with optional end switches and once-per-day position calibration).
- Minimum equipment off-time setting.
- Heat-to-cool switchover delay.
- Fan overrun periods.

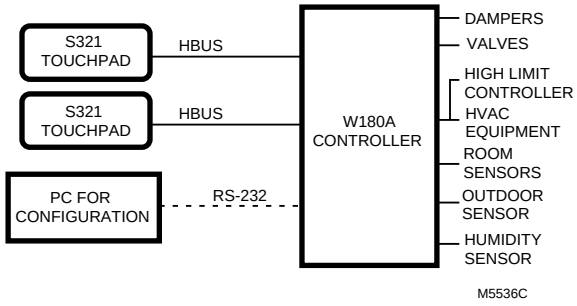
The W180 System is customized for each specific application using a Microsoft® Windows™-based PC setup program.

NOTE: The W180 System air distribution algorithm adjusts dampers to maintain a minimum airflow through each piece of controlled equipment. This algorithm is designed to work with all standard induction blower motors. If other blower motor types are used, alternate bypass damper strategies must be used.

NOTE: When the W180 System is used in conventional forced air systems, a return air temperature limit (for example, T675A) is required as a backup for high temperature limit.

See the Hardware Required section for a list of equipment used in the W180 Zone Control System. For basic information on HVAC systems, see Appendix C: HVAC System Basics.

Fig. 1—W180 Zone Control System block diagram.



Applicable Literature

Form Number	Title
50-7626	W180 Zone Control System Brochure
60-2133	V4043A,B,E; V4044A,B; V8043A,B,E,F,J; V8044A,B,E Motorized Valves Specification NOTE: The W180 System uses only the V8043 and V8044 Low Voltage Valves.
60-2200	T675A,B; T678A Temperature Controllers
62-0104	S321A Touchpad Specification
63-2044	C7130A Wall Mount Temperature Sensor Specification
63-4334	T7660A-D Space Temperature Sensors Specification
68-0100	Honeywell Trol-A-Temp® Zone Control Dampers Specification
68-0143	D635 Zone Damper Specification
69-0761	W180 Zone Control System Programmer's Manual
69-0770	W180 Zone Control System Owner's Manual
69-0807	W180 Zone Control System Installation Instructions
71-9204	Honeywell W180 Zone Control System Overview
71-9301	W180 Zone Control System Prewiring Guide
71-9302	W180 Zone Control System HVAC Configuration Form
71-9303	W180 Zone Control System Homeowner Lifestyle Worksheet

Glossary

AOBD-BM—Automatic Opposed Blade Damper-Bottom Mount.

AOBD-SM—Automatic Opposed Blade Damper-Side Mount.

AOBD—Automatic Opposed Blade Damper.

HBus—A Honeywell communications protocol.

HVAC System—A set of HVAC equipment that supplies heating and/or cooling to one or more zones.

PC—Personal Computer.

Schedule—A day and time associated with the start of a profile.

System Configuration—A unique grouping of equipment and zones that identifies a specific application for a W180A Controller.

Temperature Demand—A situation requiring heating or cooling in a temperature zone.

Temperature Profile—A group of temperature settings for each zone in the home or building.

Temperature Setpoint—A temperature value maintained in a zone.

Temperature Zone—A separate area of temperature control.

TotalHome® System—A Honeywell home automation system that includes the integration of security, HVAC, and lights and appliances.

Hardware Required

W180A CONTROLLER

A PC is required for initial configuration, but not for daily operation. The W180A Controller (Table 1) accepts inputs from sensors and controls dampers, valves, and HVAC equipment.

TABLE 1—W180A CONTROLLER.

OS Number	Name	Description/Notes
W180A1001	Zone Controller	Control panel in enclosure.

S321A TOUCHPAD

The S321A Touchpad (Table 2) is a user interface panel used to:

— Adjust temperature settings for individual zones—temporarily (override) or permanently.
— Adjust groups of settings throughout the system using Temperature Profiles.
— Change schedule times and/or temperature setpoints.
— Change the equipment settings and other system parameters.

TABLE 2—S321A TOUCHPAD.

OS Number	Name	Description/Notes
S321A1005	Touchpad	White with white trim ring and with backlighting.

TRANSFORMER

Table 3 lists the transformers supported by the W180 System.

TABLE 3—TRANSFORMER.

OS Number	Name	Description/Notes
AT72D1006	Transformer	24 Vac, 40 VA transformer. One required for W180A Controller. 4 x 4 in. plate-mounted. Additional transformer(s) required for dampers and valves.
AT72D1683	Transformer	24 Vac, 40 VA transformer. SUPER TRADELINE® model. One required for W180A Controller. Can be foot-mounted; plate-mounted on 4 x 4 in., 4 in. octagon, or 2 x 4 in. electrical boxes; or clamp-mounted via a junction box knockout. Additional transformer(s) required for dampers and valves.
AT140A1000	Transformer	24 Vac, 40 VA transformer. One required for W180A Controller. Foot-mounted, plate-mounted on 4 x 4 in., 4 in. octagon, or 2 x 4 in. electrical boxes; clamp-mounted via a junction box knockout, or panel-mounted. Additional transformer(s) required for dampers and valves.
AT140B1206	Transformer	24 Vac, 40 VA transformer. One required for W180A Controller. Foot-mounted. Additional transformer(s) required for dampers and valves.

HIGH LIMIT CONTROLLER

Table 4 lists the high limit controller supported by the W180 System.

TABLE 4—HIGH LIMIT CONTROLLER.

OS Number	Name	Description/Notes
T675A1508	Temperature Controller	Mount sensor in return air duct.

SENSORS

Table 5 lists the temperature sensors supported by the W180 System. A temperature sensor is required in each zone.

TABLE 5—SENSORS.

OS Number	Name	Description/Notes
107323A	Outdoor Temperature Sensor Shield	Used to house the 198212CA Outdoor Temperature Sensor.
198212CA	Outdoor Temperature Sensor	Used for outdoor temperature display and improved control.
C7130A1019	Wall Mount Temperature Sensor	White enclosure, wall mount.
C7180A1000	Flush Mount Temperature Sensor	White, round; flush mounts on wall. Can be lightly painted.
C7600C1008	Solid State Humidity Sensor	Mount in return air duct.
T7660A1017	Space Temperature Sensor	Beige enclosure, wall mount.
T7660B1015	Space Temperature Sensor	Wall mount sensor with override switch and status LED.

DAMPERS

Tables 6 and 7 list the most commonly used damper sizes. Several other damper sizes are available. See the Honeywell Trol-A-Temp® Zone Control Dampers Specification, form 68-0100, and D635 Zone Damper Specification, form 68-0143, for more information.

TABLE 6—RECTANGULAR TROL-A-TEMP®
SIDE-MOUNT (SM) AND BOTTOM-MOUNT (BM) ZONE DAMPERS.

Size	Dimensions in in. [mm]	Area in sq. in. [sq. mm]
6 inch	6 x 8 [152 x 203]	48 [30,856]
	6 x 10 [152 x 254]	60 [38,608]
	6 x 12 [152 x 305]	72 [46,360]
	6 x 14 [152 x 356]	84 [54,112]
	6 x 16 [152 x 406]	96 [61,712]
	6 x 18 [152 x 457]	108 [69,464]
	6 x 20 [152 x 508]	120 [77,216]
8 inch	8 x 8 [203 x 203]	64 [41,209]
	8 x 10 [203 x 254]	80 [51,562]
	8 x 12 [203 x 305]	96 [61,915]
	8 x 14 [203 x 356]	112 [72,268]
	8 x 16 [203 x 406]	128 [82,418]
	8 x 18 [203 x 457]	144 [92,771]
	8 x 20 [203 x 508]	160 [103,124]
	8 x 22 [203 x 559]	176 [113,477]
	8 x 24 [203 x 610]	192 [123,830]

Size	Dimensions in in. [mm]	Area in sq. in. [sq. mm]
10 inch	10 x 10 [254 x 254]	100 [64,516]
	10 x 12 [254 x 305]	120 [77,470]
	10 x 14 [254 x 356]	140 [90,424]
	10 x 16 [254 x 406]	160 [103,124]
	10 x 18 [254 x 457]	180 [116,078]
	10 x 20 [254 x 508]	200 [129,032]
12 inch	12 x 12 [305 x 305]	144 [93,025]
	12 x 14 [305 x 356]	168 [108,580]
	12 x 16 [305 x 406]	192 [123,830]
	12 x 18 [305 x 457]	216 [139,385]
	12 x 20 [305 x 508]	240 [145,940]
14 inch	14 x 14 [356 x 356]	196 [126,736]
	14 x 16 [356 x 406]	224 [144,536]
	14 x 18 [356 x 457]	252 [162,692]
	14 x 20 [356 x 508]	280 [180,848]

TABLE 7—ROUND ZONE DAMPERS.

Size	Diameter in in. [mm]	Area in sq. in. [sq. mm]
D635B1005	6 [152]	28.27 [18,146]
D635C1004	8 [203]	50.27 [32,365]
D635D1003	10 [254]	78.54 [50,671]

Size	Diameter in in. [mm]	Area in sq. in. [sq. mm]
D635E1002	12 [305]	113.1 [73,062]
D635F1001	14 [356]	153.94 [99,538]
D635G1000	16 [406]	201.06 [129,462]

VALVES

Table 8 lists the available valves.

TABLE 8—ZONE VALVES.

OS Number	Flow Capacity Rating		Pipe Connections	De-energized Position	Valve Body Pattern
	Cv	kV			
V8043A1003	3.5	3.0	1/2 in. flare	Normally closed	Straight-through
V8043A1011	3.5	3.0	1/2 in. sweat		
V8043A1029	3.5	3.0	3/4 in. sweat		
V8043A1037	3.5	3.0	1 in. sweat		
V8043A1193[a]	3.5	3.0	1/2 in. inverted flare		
V8043B1019	3.5	3.0	1/2 in. sweat	Normally open	
V8043B1027	3.5	3.0	3/4 in. sweat		
V8043E1004[b]	3.5	3.0	1/2 in. sweat	Normally closed	
V8043E1012[b]	3.5	3.0	3/4 in. sweat		
V8043E1020[b]	3.5	3.0	1 in. sweat		
V8043E1061[b]	8.0	6.9	3/4 in. sweat		
V8043E1079[b]	8.0	6.9	1 in. sweat		
V8043E1111[c]	3.5	3.0	3/4 in. sweat		
V8043E1129[b,a]	3.5	3.0	1/2 in. inverted flare		
V8043F1028[d,b]	3.5	3.0	1/2 in. sweat		
V8043F1036[d,b]	3.5	3.0	3/4 in. sweat		
V8043F1051[d,b]	3.5	3.0	1 in. sweat		
V8043F1093[d,b]	8.0	6.9	3/4 in. sweat		
V8043F1101[d,b]	8.0	6.9	1 in. sweat		
V8043J1003[e]	—	—	1/2 in. sweat	Normally open	
V8044A1002	4.0	3.4	1/2 in. flare	Port A normally closed	2-position diverting
V8044A1010	4.0	3.4	1/2 in. sweat		
V8044A1044	7.0	6.0	3/4 in. sweat		
V8044A1051	4.0	3.4	1/2 in. sweat		
V8044B1018[f]	4.0	3.4	1/2 in. sweat		
V8044E1003[b]	4.0	3.4	1/2 in. sweat		
V8044E1011[b]	7.0	6.0	3/4 in. sweat		
V8044E1078[b,a]	4.0	3.4	1/2 in. inverted flare		

[a] Order fittings separately (4074EJA, 4074EJB).
[b] Includes end switch for sequencing auxiliary equipment.
[c] Includes six sweat fittings (two each: 4074EHP, 4074EHM, 4074EHN).
[d] Terminal board connector.
[e] Steam only.
[f] Includes integral spdt Aquastat® Controller.

Specifications

NOTE: The specifications given in this publication do not include normal manufacturing tolerances. Therefore, an individual unit may not exactly match the listed specifications. Also, the products are tested and calibrated under closely controlled conditions and some minor differences in performance can be expected if those conditions are changed.

W180A CONTROLLER

MODEL: W180A1001.

POWER INPUT: 24 Vac/40 VA (transformer not included, but is required).

POWER CONSUMPTION: 40 VA max.

INPUTS: 16 analog/digital inputs configurable as switch, temperature, or general purpose type sensors.

OUTPUTS: 24 relays configured in 12 relay pairs. Each relay in a pair can be configured for individual devices that are powered from a common source.

PORTS: RS-232 for PC communication.

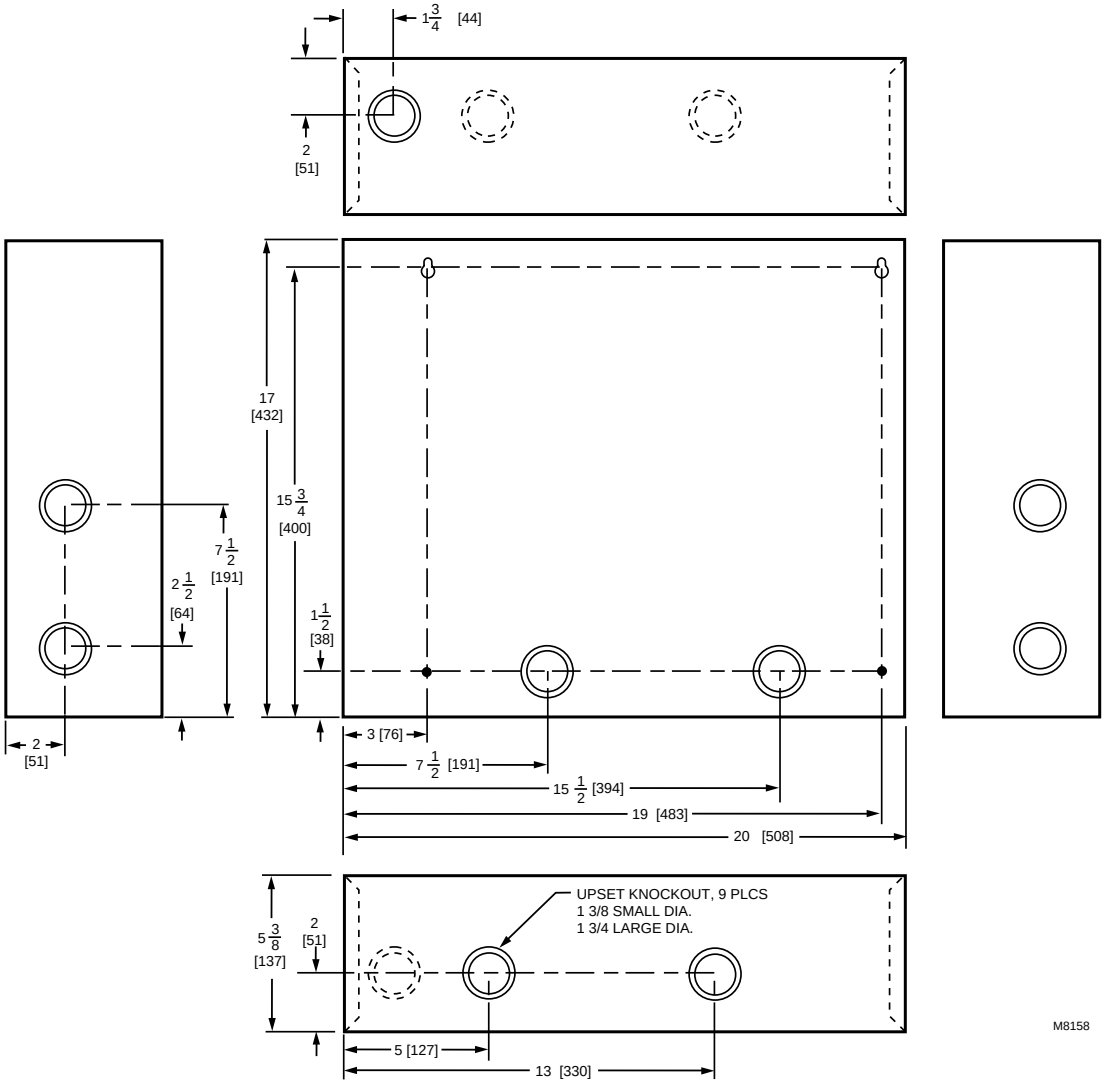
NUMBER OF W180 SYSTEMS THAT CAN BE CONNECTED TO A HONEYWELL TotalHome® SYSTEM: One; using HBus communications. Additional W180 Systems can be connected to TotalHome® only through contact closures to the W180 input configured as a Profile Trigger input.

NUMBER OF ZONES:

Maximum of 16 for heating only or cooling only systems, depending on the application and equipment.

Maximum of 10 for heating and cooling forced air systems, depending on the application and equipment.

Fig. 2—W180A Controller Enclosure dimensions in in. [mm].



NUMBER OF TOUCHPADS:
- Maximum of three using power provided through the W180A Controller.
- Maximum of five with addition of separate power supply.

NUMBER OF TEMPERATURE PROFILES: Maximum of 20.

ENVIRONMENTAL LIMITS:
- Ambient Temperature Operating Range: 32° to 110° F [0° to 43° C].
- Shipping Temperature Range: –20° to 120° F [–29° to 49° C].
- Ambient Humidity Rating: 5 to 90% RH.
- Corrosion: Minimum of ten year life in urban environment.

DIMENSIONS IN IN. [MM]: See Fig. 2.

WEIGHT IN LB [KG]: 20.3 [9.21].

S321A TOUCHPAD

MODEL: S321A1005.

POWER INPUT: 8 to 14 Vdc, Class 2, provided by the W180A Controller (maximum 250 mA required).

SIGNAL: HBus, 5V typical.

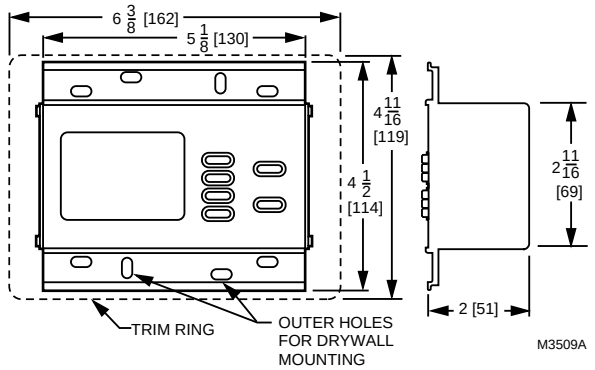
TERMINALS: Four pigtail wires interconnect to two power and four signal inputs from the controller.

ENVIRONMENTAL LIMITS:
- Ambient Temperature Operating Range: 32° to 110° F [0° to 43° C].
- Shipping Temperature Range: –10° to 120° F [–23° to 49° C].
- Ambient Humidity Rating: 5 to 90% RH.
- Corrosion: Minimum of ten year life in urban environment.

DIMENSIONS IN IN. [MM]: See Fig. 3.

WEIGHT IN OZ [G]: 14 [390].

Fig. 3—S321A Touchpad dimensions in in. [mm].



SENSORS

198212CA Outdoor Temperature Sensor

Provides outdoor temperature readings for the W180 System and Honeywell TotalHome® System when the systems are connected together using HBus communications.

MODEL: 198212CA: (5 ft [1.5m] cable attached).

SENSING RANGE: –40° to 120° F [–40° to 49° C].

SENSING ELEMENT: 3000 ohms, platinum, positive temperature coefficient (3484 ±6.5 ohms at 77° F [25° C]; 4.8 ohms per degree F [8.6 ohms per degree C]).

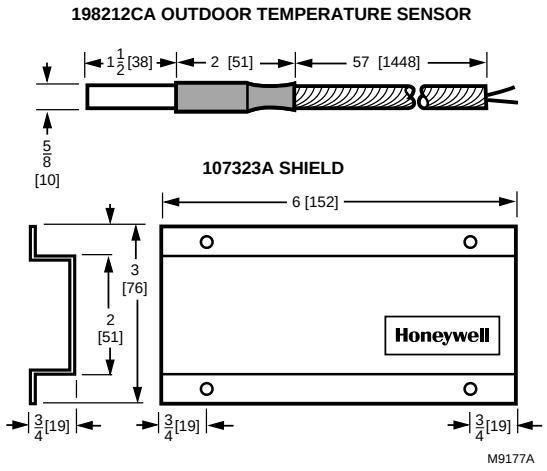
CABLE LENGTH: Maximum of 300 ft [90m] with 18 AWG twisted pair solid or stranded wire. For runs up to 150 ft [95m], 22 AWG wire may be used. Shielded cable is recommended for lengths longer than 50 ft [15m].

ACCESSORIES:

107323A Shield.
- Shielded Cable: Suggested for wiring distances greater than 50 ft [15m] to prevent possible electrical noise from causing erratic sensing.
- 4074CAV: 50 ft [15m].
- 4074CAW: 100 ft [30.4m].
- 4074CAY: 200 ft [61m].

DIMENSIONS: See Fig. 4.

Fig. 4—198212CA Outdoor Temperature Sensor dimensions in in. [mm].



C7130A Wall Mount Temperature Sensor

MODELS:
- C7130A1001: beige and brown.
- C7130A1019: white.

SENSING ELEMENT: 3000 ohms, platinum, positive temperature coefficient (3484 ±6.5 ohms at 77° F [25° C]; 4.8 ohms per degree F [8.6 ohms per degree C]).

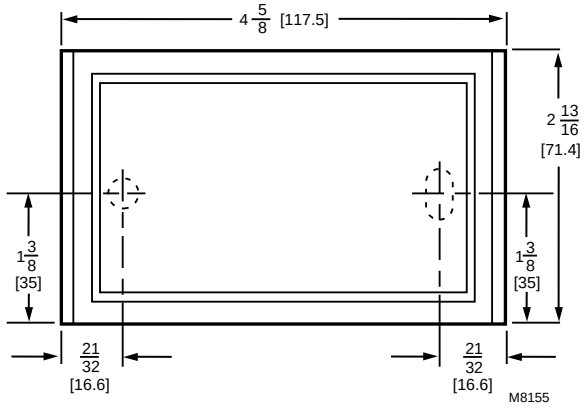
SENSING RANGE: 32° to 120° F [0° to 49° C].

CABLE LENGTH: Maximum of 300 ft [90m] with 18 AWG twisted pair solid or stranded wire. For runs up to 150 ft [95m], 22 AWG wire may be used. Shielded cable is recommended for lengths longer than 50 ft [15m]).

ACCESSORIES:
- Shielded Cable: Suggested for wiring at distances greater than 50 ft [15m] to prevent possible electrical noise from causing erratic sensing.
- 4074CAV: 50 ft [15m].
- 4074CAW: 100 ft [30.4m].
- 4074CAY: 200 ft [61m].

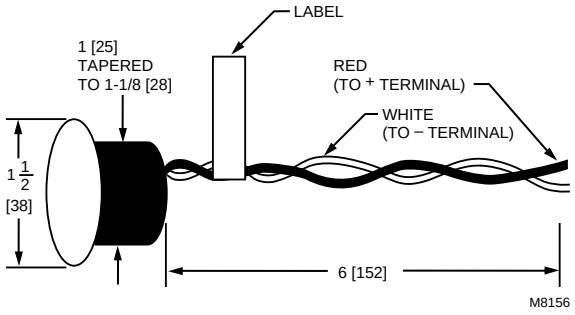
MOUNTING: Two holes provided in base of device for mounting onto wall 2 x 4 in. conduit box. The C7130A1019 (white) model can be mounted vertically or horizontally.
DIMENSIONS: See Fig. 5.

Fig. 5—C7130A Wall Mount Temperature Sensor dimensions in in. [mm].



C7180A Flush Mount Temperature Sensor
MODEL: C7180A1000.
SENSING RANGE: 0° to 100° F [–18° to 38° C].
ELECTRICAL RATINGS:
Input: 5V typical from W180A Controller.
Output: 0 to 2 mA corresponding to 0° to 100° F [0° to 38° C].
Maximum Power Consumption: 0.3 VA.
CABLE LENGTH: Maximum of 1000 ft [300m] using 16 to 22 AWG twisted pair, solid or stranded wire.
MOUNTING: 1 inch (max) hole. Sensor body is approximately 1 in. tapered to 1-1/8 in. diameter.
DIMENSIONS: See Fig. 6.

Fig. 6—C7180A Flush Mount Temperature Sensor dimensions in in. [mm].



C7180A

T7660A/T7660B Space Temperature Sensor
MODELS:
T7660A1017: beige.
T7660B1015: with override switch and status LED.
SENSING ELEMENT: 3000 ohms, platinum, positive temperature coefficient (3484 ±6.5 ohms at 77° F [25° C]; 4.8 ohms per degree F [8.6 ohms per degree C]).
SENSING RANGE: 32° to 120° F [0° to 49° C].
OVERRIDE SWITCH/LED (T7660B): Momentary contact switch with status LED.
CABLE LENGTH: Maximum of 300 ft [90m] with 18 AWG twisted pair solid or stranded wire. For runs up to 150 ft [95m], 22 AWG wire may be used. Shielded cable is recommended for lengths longer than 50 ft [15m]).
ACCESSORIES:
Shielded Cable: Suggested for wiring at distances greater than 50 ft [15m] to prevent possible electrical noise from causing erratic sensing.
4074CAV: 50 ft [15m].
4074CAW: 100 ft [30.4m].
4074CAY: 200 ft [61m].
MOUNTING: Wall or electrical box.
DIMENSIONS: See Fig. 7.

C7600C Solid State Humidity Sensor
MODEL: C7600C Solid State Humidity Sensor. Provides a 4 to 20 mA output in direct proportion to the relative humidity.
ELECTRICAL RATINGS:
Input: 20 Vdc (provided by the W180A Controller).
Output: 4 to 20 mA current signal; increases from 4 mA to 20 mA as humidity increases.
Maximum Power Consumption: 0.3 VA.
MAXIMUM POWER CONSUMPTION: 0.48 VA.
AMBIENT TEMPERATURE RANGES:
Operating: 32° to 125° F [0° to 52° C].
Shipping: –40° to 150° F [–40° to 66° C].
HUMIDITY RANGE: 10 to 90% RH.
RESPONSE TIME: 90 percent of change at 75° F [24° C].
Airflow: 500 fpm.
Time: two minutes.
HUMIDITY SENSING ELEMENT: Polyimide film (capacitance changes with change in humidity).
DIMENSIONS: See Fig. 8.
MOUNTING: Duct mount indoors, or outdoors protected from rain and direct sunlight.
ELECTRICAL CONNECTIONS: Two 1/4-inch quick-connect terminals.
APPROVAL: UL Flammability Rating: UL94V-0.

Fig. 7—T7660A/T7660B Space Temperature Sensor dimensions in in. [mm].

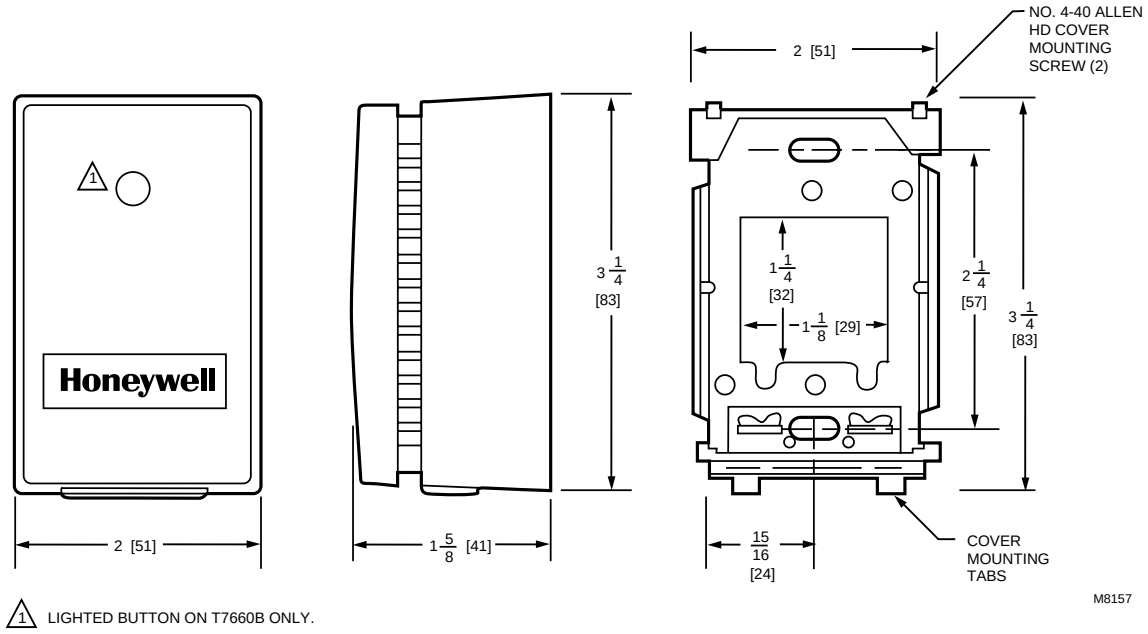
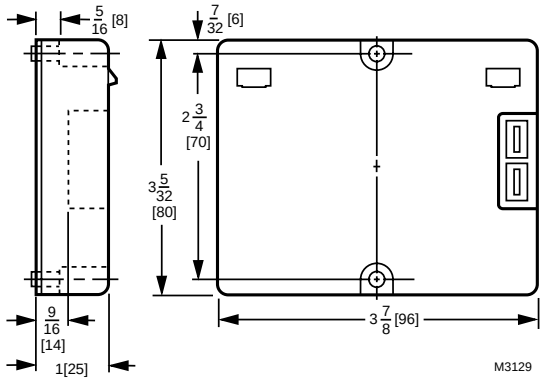


Fig. 8—C7600C Solid State Humidity Sensor dimensions in in. [mm].



DAMPERS

D635 Zone Dampers

NOTE: If a custom-sized damper is required, it may be used with an ML6161A1000 Direct Coupled Actuator and be fully compatible with the W180 System.

MODELS: Includes ML6161A1000 Actuator (35 lb.-in. torque, 90 second timing to control 90° dampers).

OS Number	Damper Diameter (Inches)
D635B1005	6
D635C1004	8
D635D1003	10
D635E1002	12
D635F1001	14
D635G1000	16

ELECTRICAL RATINGS:
- Input Voltage: 24 Vac +20%/–30%, 50/60 Hz.
- Power Consumption (Maximum) at 24 Vac: 2W, 85 mA, 2.2 VA.

TEMPERATURE RATINGS:
- Ambient: 32° to 130° F [0° to 52° C].
- Shipping and Operating: –20° to 130° F [–29° to 40° C].

HUMIDITY RATING: 5 to 95% RH, noncondensing.

DAMPER LEAKAGE: 1% nominal of flow.

DAMPER POSITION VERSUS FLOW RATE: See the Specifications packed with the damper.

TORQUE RATINGS:
- Running: 35 lb.-in. [4.0 N•m].
- Breakaway: 35 lb.-in. [4.0 N•m].
- Stall: 45 lb.-in.[5.0 N•m] minimum. 65 lb.-in. [7.4 N•m] maximum.

MOTOR TIMINGS: 90 seconds for 90° stroke.

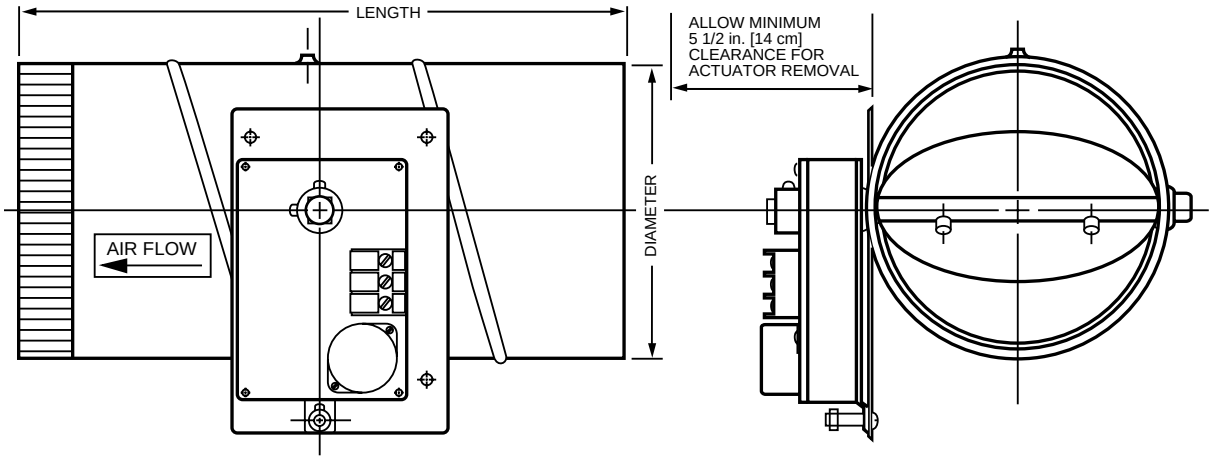
MATERIALS:
- Damper Blade: 16 gauge corrosion resistant steel.
- Blade Seal: Neoprene rubber with UL94HF1 rating.
- Damper Shell: 24 gauge galvanized steel, 60 to 10 inch; 20 gauge galvanized steel, 12 to 16 inch.

DIMENSIONS:
- Damper Portion: See Fig. 9.
- Actuator: See Fig. 10.

APPROVALS:
- Underwriter's Laboratories Component Recognized: File No. E4436, Guide No. XAPX.
- CSA certified.

ACCESSORIES:
- 201052B Two Auxiliary Switches.
- 7640QW Metal Enclosure (to run conduit to actuator).

Fig. 9—D635 Damper dimensions in in. [mm].



OS NUMBER	AREA IN SQ. IN.	DIAMETER IN IN. [CM.]	LENGTH IN IN. [CM.]	PRESSURE DROP IN IN.WC [kPa]	FLOW RATE cfm
D635B1005	28.3	6 [15.24]	12 [30.48]	0.05 [0.167]	180
				0.075 [0.254]	210
				0.1 [0.339]	240
D635C1004	50.3	8 [20.32]	12 [30.48]	0.05 [0.167]	410
				0.075 [0.254]	485
				0.1 [0.339]	580
D635D1003	78.5	10 [25.40]	12 [30.48]	0.05 [0.167]	693
				0.075 [0.254]	849
				0.1 [0.339]	980
D635E1002	113.1	12 [30.48]	13 [33.02]	0.05 [0.167]	1200
				0.075 [0.254]	1460
				0.1 [0.339]	1600
D635F1001	153.9	14 [35.56]	15 [38.10]	0.05 [0.167]	1336
				0.075 [0.254]	1636
				0.1 [0.339]	1890
D635G1000	201.1	16 [60.64]	17 [43.18]	0.05 [0.167]	1690
				0.075 [0.254]	2080
				0.1 [0.339]	2400

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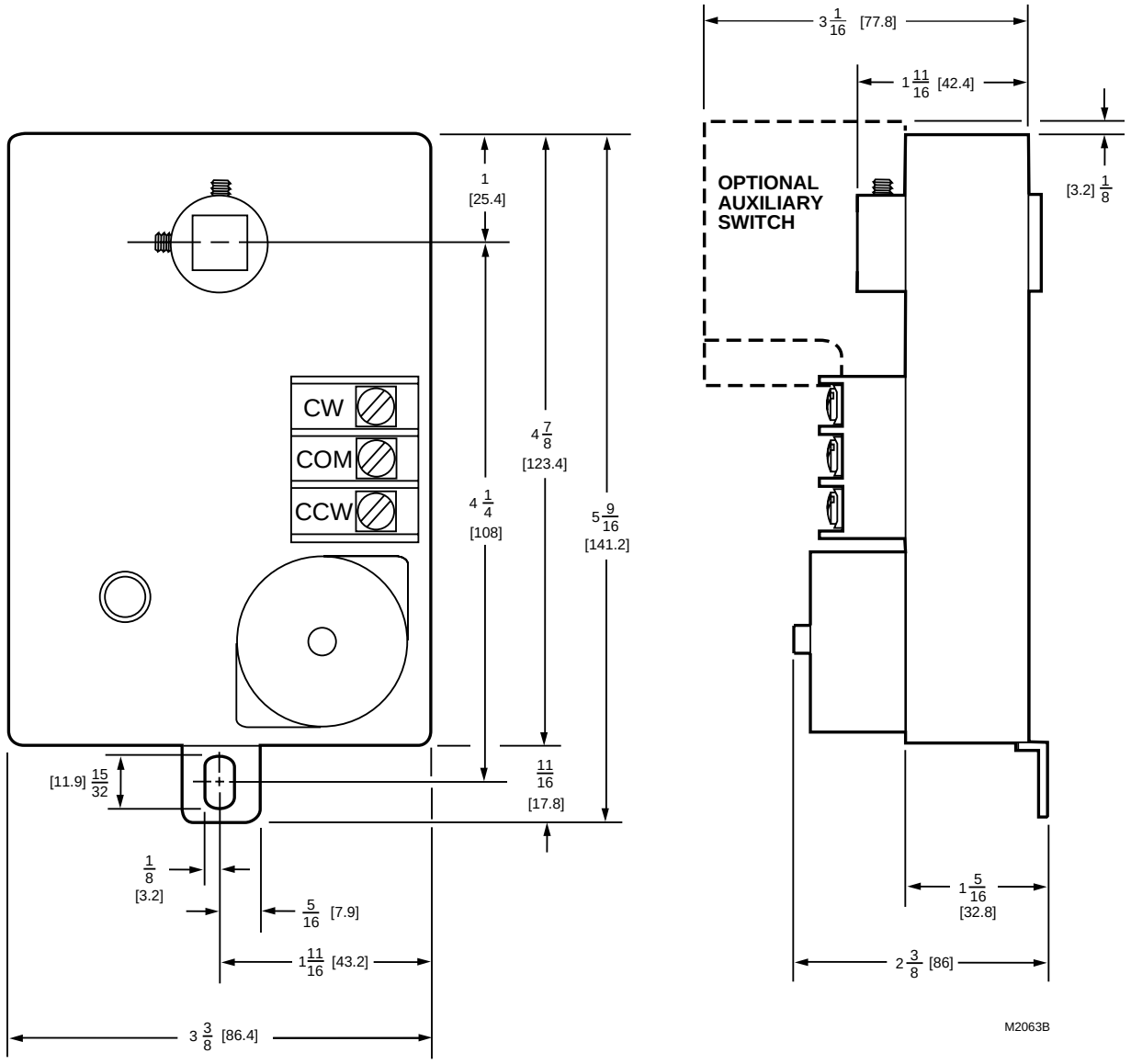
Fig. 10—ML6161 Direct Coupled Actuator dimensions in in. [mm].



AOBD and AOBD-BM Rectangular Dampers

NOTE: Do not use static pressure regulating dampers with the W180 System.

AMBIENT TEMPERATURE RANGE: –55° to 200° F [–48° to 93° C].

ELECTRIC ACTUATOR: AOBD and AOBD-BM only: 24 Vac, 50/60 Hz. Mounts horizontally or vertically. Locks to damper drive shaft. Torque rated to fit damper size. 30 second cycling time.

ELECTRICAL RATINGS: Power Supply: 24 Vac, 50/60 Hz.

HUMIDIFIER: For humidification, use evaporative type or return air type humidifiers. Do not use spray or atomization type humidifiers installed in the furnace plenum or air supply duct.

MOUNTING: Install into a 3-in. [76 mm] opening in the air duct and secure using sheet metal screws provided.

WIRING CONNECTIONS: Screw terminals on electronic actuator face plate. Actuator cover protects terminals after installation.

BLADES: Heavy gauge extruded aluminum. Aerodynamic blades reduce air turbulence, noise, vortexing, and loss of air velocity.

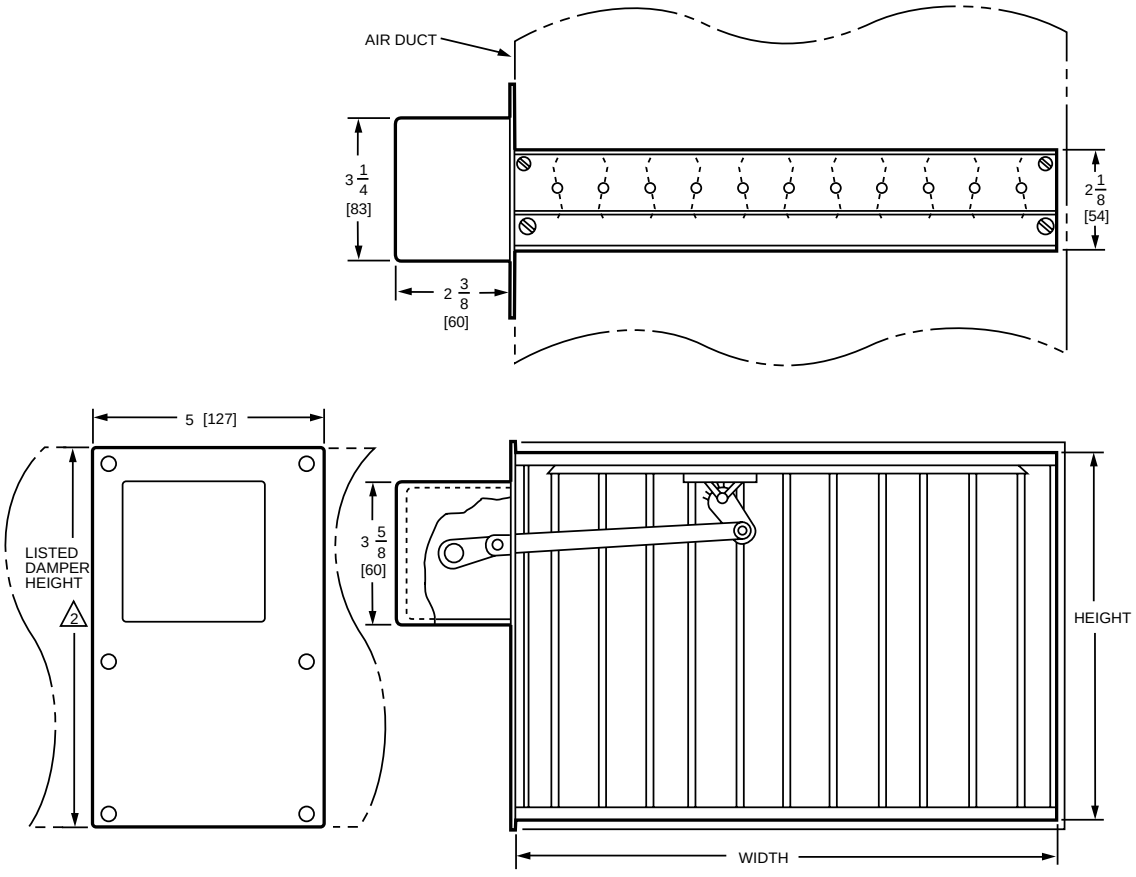
DIMENSIONS:

AOBD: See Fig. 11.

AOBD-BM: See Fig. 12.

ACCESSORIES: Set of Damper Mounting Tracks (Model SDMT): Two U channel mounting tracks 12 in. [305 mm] long used to hold large size dampers, multiple dampers, and undersized dampers in proper alignment.

Fig. 11—Automatic opposed blade damper dimensions.



HEIGHT DIMENSIONS: 4, 6, 8, 10, 12, OR 14 INCHES [102, 152, 203, 254, 305, OR 356 MILLIMETERS] 1

TO ENSURE PROPER FIT, DAMPER HEIGHT IS 3/16 INCH [5 MILLIMETERS] LESS THAN THE LISTED HEIGHT DIMENSION.

WIDTH DIMENSIONS: 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, OR 30 INCHES [203, 254, 305, 356, 406, 457, 508, 559, 610, 660, 711, OR 762 MILLIMETERS]. 1

TO ENSURE PROPER FIT, DAMPER WIDTH IS 1/8 INCH [3 MILLIMETERS] LESS THAN THE LISTED WIDTH DIMENSION.

1 ADDITIONAL SIZES AVAILABLE (WIDTH X HEIGHT): 16X16, 18X16, 18X18, 20X16, 20X18, AND 20X20. SIZES NOT AVAILABLE (WIDTH X HEIGHT): 8X10, 8X12, 8X14, 10X12, 10X14, AND 12X14.

2 LISTED DAMPER HEIGHT = ACTUAL AIR DUCT HEIGHT

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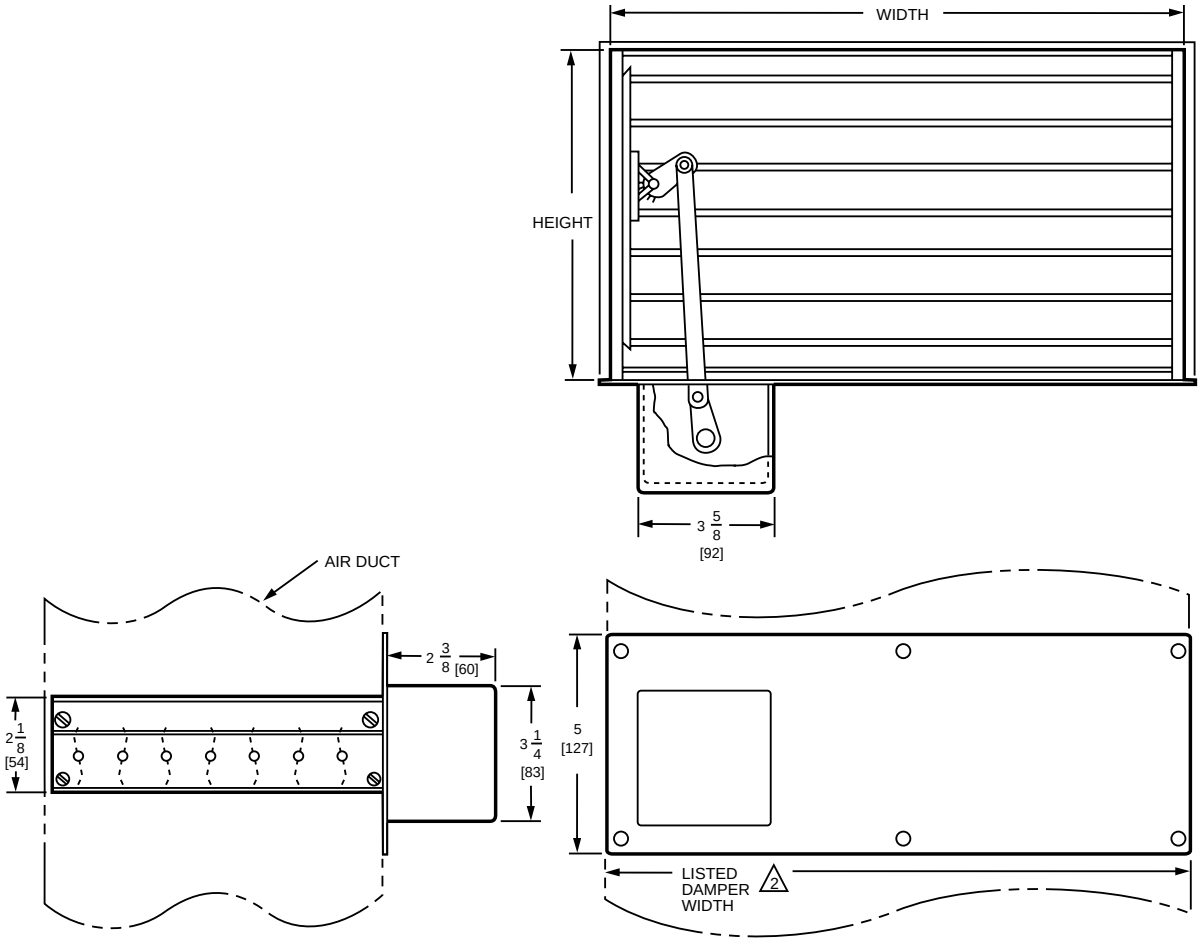
Fig. 12—Automatic opposed blade damper-bottom mount dimensions.



HEIGHT DIMENSIONS: 6, 8, 10, 12, AND 14 INCHES [152, 203, 254, 305, 356, MILLIMETERS]. 1

TO ENSURE PROPER FIT, ACTUAL DAMPER HEIGHT IS 1/8 INCH [3 MILLIMETERS] LESS THAN LISTED HEIGHT DIMENSION.

WIDTH DIMENSIONS: 8, 10, 12, 14, 16, 18, AND 20 INCHES [203, 254, 305, 356, 406, 457, 508, MILLIMETERS]. 1

TO ENSURE PROPER FIT, ACTUAL DAMPER WIDTH IS 3/16 INCH [5 MILLIMETERS] LESS THAN LISTED WIDTH DIMENSION.

1 ADDITIONAL SIZES AVAILABLE (HEIGHT X WIDTH): 16X16, 16X18, 16X20, 18X18, 18X20, 20X20.
SIZES NOT AVAILABLE (HEIGHT X WIDTH): 10X8, 12X8, 12X10, 14X8, 14X10, 14X12.

2 LISTED DAMPER WIDTH = ACTUAL AIR DUCT WIDTH

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TOOLS REQUIRED

The following tools and equipment are required to install a W180 Zone Control System:

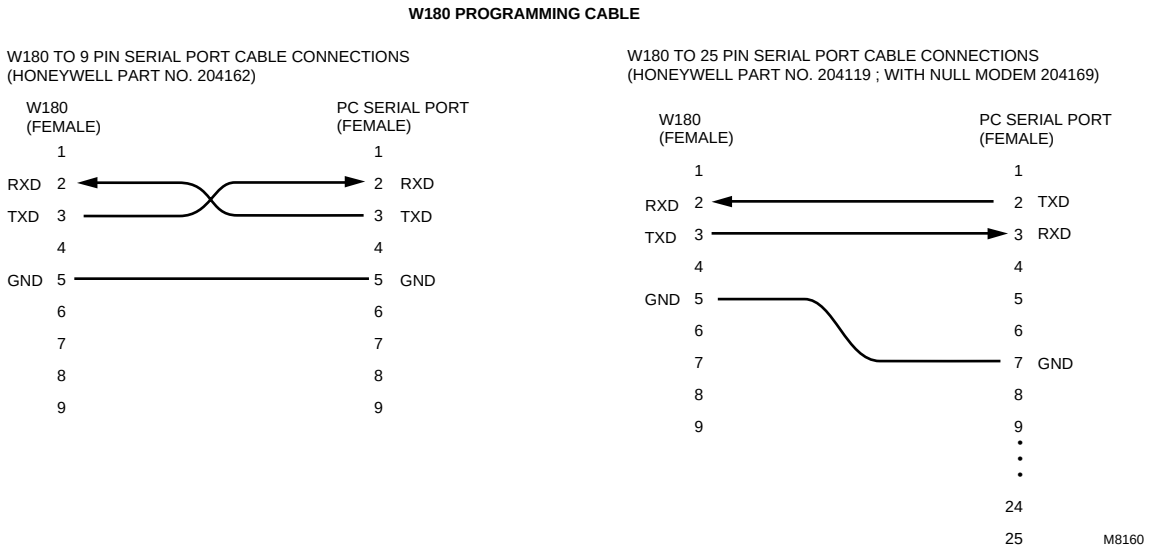
— Hammer
— Screwdriver (flathead)
— Pliers
— Wire cutters
— Wire strippers
— Electric drill
— Sheet metal shears
— Utility knife
— Voltmeter/multimeter
— Thermometer
— 3/4-inch plywood (20 in. by 17 in.) and mounting hardware suitable for the wall on which the W180A Controller enclosure will be mounted.

NOTE: Studs at 16 in. o.c. may also be used for mounting.

PC REQUIREMENTS

1. IBM® PC/AT™ or compatible 286, 386, or 486 personal computer. The 386 or 486 personal computer are recommended.
2. At least 4 MB of RAM.
3. MS-DOS version 5.0 or later.
4. Microsoft® Windows™ version 3.1 or later.
5. A 20 MB (minimum) hard disk drive. A 40 MB or larger hard disk drive is recommended.
6. A 3-1/2 or 5-1/4 in., high-density disk drive.
7. A serial or bus mouse.
8. Serial port for RS-232 connection to W180A Controller.
9. Serial port for serial mouse, if used.
10. RS-232 interconnect cable from the W180A Controller to the PC (Fig. 13).

Fig. 13—RS-232 Cable pin-out.



Application

GENERAL

The following must be accomplished to properly plan a job and order the equipment:

— Determine the W180 System requirements:
- Required equipment, zones served, and number of stages.
- Required auxiliary equipment.
- Zoning requirements and the number and type of sensors, dampers, and valves.
- Power requirements.
- Inputs (including special inputs) and outputs.
- Number of S321A Touchpads.
- Equipment mounting locations.
- Wiring.

— Determine the Temperature Profiles.

CAUTION

To prevent damage to the W180A Controller, do not connect either side of the 24 Vac transformer secondary that is used to power the W180A Controller to earth ground.

⚠ CAUTION

The W180 System requires an earth ground from the earth ground terminal (18 AWG or heavier wire connected to a cold water pipe) as shown in Fig. 24.

DETERMINE THE W180 SYSTEM REQUIREMENTS

1. Obtain a copy of the floor plans and check that there is no conflict between the building design and the proposed installation.

NOTES:

a. Mount the W180A Controller in a centralized location to minimize wire runs though the building.
b. Mount the S321A Touchpads in any convenient indoor locations.
c. Use low voltage controls for HVAC units.

2. Complete the HVAC Configuration Form to determine the temperature sensor inputs and zoning, relay output usage (set automatically by the Setup software), HVAC system information, and number of S321A Touchpads.

NOTES:

a. HVAC Configuration Worksheet—Use the configuration worksheet (located in Appendix B) to make sure that System configuration and hardware limits are not exceeded. Before entering temperature sensor data or other information, enter the customer data on the worksheets.
b. Temperature input usage—Each temperature zone needs a temperature sensor. A temperature zone with no damper or valve designated operates the associated heating/cooling system like a thermostat would in the same location. When the heating system is zoned, indicate if dampers or valves are to be used. Make sure the names used correspond to the names used on the relay assignments. When combining hydronic or radiant heating with forced air cooling to serve common areas, use separate sensors for each system.
c. Relay output usage—The 12 relay sets are electrically independent and perform different tasks depending on the assignments. There are a total of 24 relays available. Add together all relays required to operate the HVAC equipment. The remaining relay pairs can be used to operate dampers and valves. Each modulating damper requires two relays in a relay pair. All other valves and HVAC equipment loads require one relay each. Calculate the total number of relays required by the proposed system. The total number of relays required cannot total more than 24. Note that a relay set shares the same input; therefore, the devices connected to each relay of a set must use the same voltage supply. If the two devices controlled by the two relays within a relay pair are powered by different voltage supplies (transformers), use a separate relay to isolate the two voltage supplies (Fig. 23).
d. T7660B Space Temperature Sensor—This sensor requires two sensor inputs and one relay output.
e. HVAC—The System is compatible with all common residential HVAC systems that use low voltage controls (thermostats) for operation. The following are required for configuration:

HVAC CONFIGURATION TABLE.

Function	Definition	Minimum	Maximum	Default
Auto Switch-over Time (Minutes)	This is the minimum length of time the system will wait before automatically switching from heat to cool or cool to heat.	10	240	10
Minimum Duct Area—Heat (Percent)	The minimum aggregate damper open area will never be lower than this setting in the heating mode. Dampers to zones not calling for heat will modulate partially open when the system demand alone does not provide adequate open damper area.	25	100	25 (75 to 85% max cfm)
Minimum Duct Area—Cool (Percent)	The minimum aggregate damper open area will never be lower than this setting in the cooling mode. Dampers to zones not calling for cooling will modulate partially open when the system demand alone does not provide adequate open damper area.	35	100	35 (65 to 75% max cfm)

(Continued)

HVAC CONFIGURATION TABLE *(Continued)*.

Function	Definition	Minimum	Maximum	Default
Anticipation —Heat	For heating equipment. A value greater than 1 increases the equipment cycle rate; a value less than 1 decreases the equipment cycle rate. Recommended values: —Electric: 1.5. —Forced Air: 1.2. —Heat Pump: 1.0. —Hydronic/Radiant: 0.8.	0.0	1.5	1.0
Anticipation —Cool	For cooling equipment. A value greater than 1 increases the equipment cycle rate; a value less than 1 decreases the equipment cycle rate. Recommended values: —Cooling Compressor: 1.0.	0.0	1.5	1.0
Overrun Time—Heat	The length of time in minutes the fan defined for this stage is active following a call for heating.	0	30	2
Overrun Time—Cool	The length of time in minutes the fan defined for this stage is active following a call for cooling.	0	30	2
Minimum Off Time—Heat	The length of time in minutes that must expire following a call for heating before the stage equipment may be activated again.	3	30	3
Minimum Off Time—Cool	The length of time in minutes that must expire following a call for cooling before the stage equipment may be activated again.	3	30	3
Lockout Temperature —Heat	When the outdoor temperature is above this temperature, the stage is locked out.	10° F	99° F	90° F
Lockout Temperature —Cool	When the outdoor temperature is below this temperature, the stage is locked out.	10° F	99° F	50° F
Outside Temp for Alt. Eq.—Heat	When the actual outdoor temperature is below this value, any heating equipment set up during configuration as Alt. Eq.—Heat will be activated in place of the equipment defined as Normal—Heat.	10° F	99° F	40° F
Outside Temp for Alt. Eq.—Cool	When the actual outdoor temperature is above this value, any cooling equipment set up during configuration as Alt. Eq.—Cool will be activated in place of the equipment defined as Normal—Cool.	10° F	99° F	90° F
Stage Differential—Heat	The number of degrees below setpoint the average zone demand must exceed before this stage is activated.	1st Stage: 0° F 2nd Stage: 1st Stage + 1° F 3rd Stage: 2nd Stage + 1° F	1st Stage: 20° F 2nd Stage: 20° F 3rd Stage: 20° F	1st Stage: 0° F 2nd Stage: 4° F 3rd Stage: 6° F
Stage Differential—Cool	The number of degrees above setpoint the average zone demand must exceed before this stage is activated.	1st Stage: 0° F 2nd Stage: 1st Stage + 1° F (1° F) 3rd Stage: 2nd Stage + 1° F (2° F)	1st Stage: 20° F 2nd Stage: 20° F 3rd Stage: 20° F	1st Stage: 0° F 2nd Stage: 4° F 3rd Stage: 6° F
Stage Attributes—Emergency Heat	Use this equipment during manual system override to Emergency Heat mode in place of the first stage heat pump equipment in heating.			

3. Determine if power is available at the W180A Controller location. The W180A Controller is powered by a separate dedicated 24 Vac transformer. When suitable power is not available where the W180A Controller will be located, add the appropriate power connections. A maximum of three S321A Touchpads can be powered through the W180A Controller.

! CAUTION

To prevent damage to the W180A Controller, do not connect either side of the 24 Vac transformer secondary to earth ground.

4. Determine the equipment locations. For single family residential buildings, a separate drawing for the HVAC system might not be available. If a separate HVAC drawing is not available, draw the duct and damper layout on the architectural plans. If any of the temperature control zones of a particular forced air HVAC system are controlled by motorized dampers, *all* zones on that particular HVAC system must be controlled by dampers. Observe the following when determining equipment locations:

— W180A Controller: Locate the W180A Controller in a central location that will minimize the length of wire runs.

— Touchpad: Mount the Touchpads in any room convenient for the user. However, mounting in bathrooms and other high humidity areas is not advised. The power supply provided with the W180A Controller supports a maximum of three Touchpads. If more Touchpads are required, additional power supplies must be provided. Mount the Touchpad 5 ft 4 in. [1.6m] above the floor or as specified by the customer for easy viewing.

— Dampers and valves (observe the following):
- Locate dampers where they can be easily accessed after installation.
- Locate the dampers close to the HVAC unit.
- If the HVAC equipment supplies more than one zone, because all zones served by the equipment have at least one damper or valve.
- To assure proper operation, properly size dampers for the air duct. If the damper is forced into an undersized air duct, the excess pressure can jam the damper blades and cause improper operation.
- Do not install dampers in heating systems where spray or atomizing type humidifiers are installed in the furnace plenum or air supply duct. Excessive lime or mineral deposits accumulate on damper blades and cause improper operation. For humidification, use evaporative or return air type humidifiers.

— Indoor temperature sensors. (One temperature sensor is required for each control zone; three types of indoor temperature sensors can be used with the system: C7130, C7180, and T7660.) Locate indoor temperature sensors:
- On an interior wall.
- Near the return air flow.
- Out of the sun.
- Away from supply registers.
- Away from hot or cold sources.
- About 60 inches above the floor.
- Free from obstructions.

— Outdoor temperature sensor. An outdoor temperature sensor is required whenever alternate fuel equipment is going to be controlled or if outdoor temperature lockout is desired. A typical location would be under the roof overhang on the least sunny side of the building. Locate the outdoor temperature sensor:
- Out of the sun (consider the seasonal position of the sun).
- Away from exhausts that may affect the temperature reading.

— Humidity sensor:
- Exposed to freely circulating air.
- Duct mount indoors, or outdoors protected from rain, snow, and direct sunlight.
- In areas with 500 ft/min minimum air flow.

— Alternate fuel equipment. For mounting location requirements, see the literature for the equipment.

5. Determine the wiring. Fig. 14 and Table 9 detail the various wires that are allowed. Figs. 15 through 20 show typical device wiring.

NOTES:

a. All wiring must conform to all local codes and ordinances.
b. Keep large inductive loads such as motors and fans off the power circuits feeding any portion of the system.
c. Motorized damper wiring should not be run through air ducts or plenums. If such routing is necessary, only type FPLP (fire) wire may be used.
d. Verify the number of conductors required to operate each HVAC unit.
e. Leave at least 24 inches of wire at the device end and 24 inches at the W180A Controller end.
f. Label all wires at both ends and record wire data on the job drawings.
g. Use twisted pair cables for wiring to the temperature sensors and S321A Touchpads.
h. Run wiring so that it will not be damaged during other installations.
i. Prewire all devices as home runs back to the W180A Controller.
j. Do not wire a mechanical thermostat in parallel with the system controls.
k. When the HVAC unit is more than 100 cable feet from the W180A Controller, calculate the voltage drop on the cable. Determine the worst-case power consumption, loop resistance of the cable, and cable

gauge that will allow a minimum of 19 Vac to be applied to the HVAC controls. Use isolating relays to lower long loop current requirements.

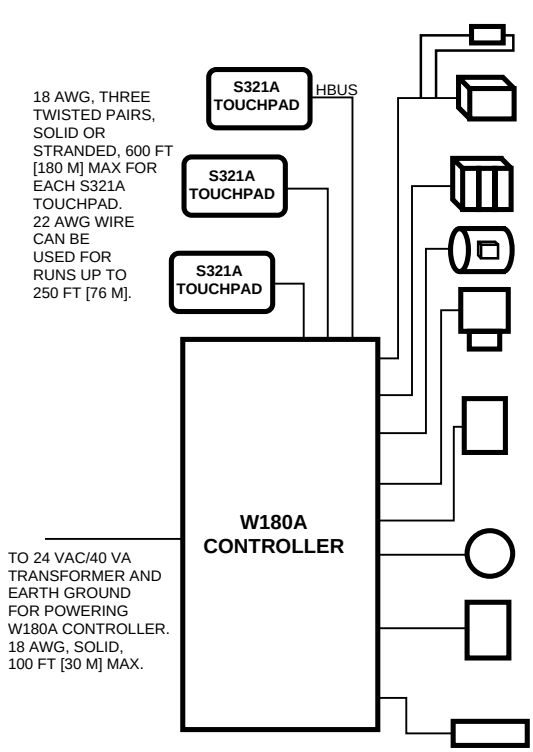
l. Use UL Listed/CSA Approved cable to connect to the 24 Vac power to the unit.

m. Do not run sensor or S321A Touchpad wires with HVAC control switching wires.

! CAUTION

To prevent damage to the equipment, do not connect any voltage source greater than 24 Vac to any circuit of the system.

Fig. 14—Wiring specifications.



T675A HIGH LIMIT CONTROLLER
18 AWG (MIN). SOLID OR STRANDED. TO BE WIRED IN SERIES WITH THE HEATING CONTROL ON CONVENTIONAL FORCED AIR SYSTEMS.

HVAC EQUIPMENT
18 AWG (MIN). SOLID OR STRANDED. VERIFY THE NUMBER OF CONDUCTORS REQUIRED TO OPERATE EACH HVAC UNIT. 100 FT [30 M] MAX. IF DISTANCE IS MORE THAN 100 FT [30 M], CALCULATE WORST-CASE POWER CONSUMPTION, CABLELOOP RESISTANCE, AND WIRE GAUGE TO ALLOW 19 VAC (MIN) TO BE APPLIED TO HVAC EQUIPMENT. USE ISOLATING RELAYS TO LOWER LONG LOOP CURRENT REQUIREMENTS.

AOBD HONEYWELL/ TROL-A-TEMP RECTANGULAR DAMPERS
18-22 AWG, THREE CONDUCTORS, SOLID OR STRANDED, 1000 FT [300 M] MAX.

D635B-G ZONE DAMPERS
18-22 AWG, THREE CONDUCTORS, SOLID OR STRANDED, 1000 FT [300 M] MAX.

V8043A,B,E,F,J; V8044A,B,E MOTORIZED VALVES
18-22 AWG, TWO CONDUCTORS, SOLID OR STRANDED, 1000 FT [300 M] MAX. IF AN END SWITCH IS USED, ADDITIONAL WIRES ARE REQUIRED TO POWER THE CIRCULATION PUMP.

C7130A WALL MOUNT ROOM TEMPERATURE SENSOR
T7660A SPACE TEMPERATURE SENSOR
18 AWG, TWISTED PAIR, SOLID OR STRANDED, 300 FT [90 M] MAX. 22 AWG WIRE CAN BE USED FOR RUNS UP TO 150 FT [45 M]. DO NOT RUN WIRING WITH LOAD SWITCHING OR POWER WIRES. USE SHIELDED CABLE FOR RUNS GREATER THAN 50 FT [15 M] TO MINIMIZE ELECTRICAL NOISE ON SENSOR WIRES. ACCESSORY SHIELDED CABLES (FT [M]): 4074CAV, 50 [15]; 4074CAW, 100 [30]; 4074CAY, 200 [61].

C7180A FLUSH MOUNT TEMPERATURE SENSOR
18-22 AWG, TWISTED PAIR, SOLID OR STRANDED, 1000 FT [300 M] MAX. DO NOT RUN WIRING WITH LOAD SWITCHING OR POWER WIRES.

T7660B SPACE TEMPERATURE SENSOR WITH OCCUPIED OVERRIDE
18 AWG, THREE TWISTED PAIRS, SOLID OR STRANDED, 300 FT [90 M] MAX. 22 AWG WIRE CAN BE USED FOR RUNS UP TO 150 FT [45 M]. DO NOT RUN WIRING WITH LOAD SWITCHING OR POWER WIRES.

198212CA OUTDOOR TEMPERATURE SENSOR
18 AWG, TWISTED PAIR, SOLID OR STRANDED, 300 FT [90 M] MAX. 22 AWG WIRE CAN BE USED FOR RUNS UP TO 150 FT [45 M]. DO NOT RUN WIRING WITH LOAD SWITCHING OR POWER WIRES. USE SHIELDED CABLE FOR RUNS GREATER THAN 50 FT [15 M] TO MINIMIZE ELECTRICAL NOISE ON SENSOR WIRES. ACCESSORY SHIELDED CABLES (FT [M]): 4074CAV, 50 [15]; 4074CAW, 100 [30]; 4074CAY, 200 [61].

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TABLE 9—WIRING.

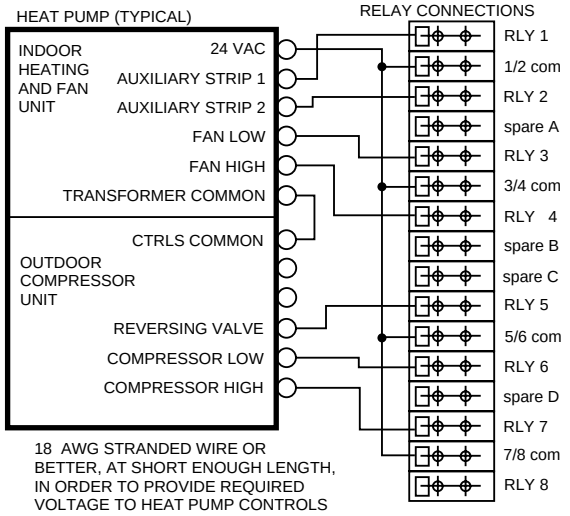
Device	Mounting Location	Notes
W180A Controller	Locate to minimize wire runs.	1. Requires dedicated 24 Vac, 40 VA transformer to power W180A Controller. ⚠ ***CAUTION*** To prevent damage to the W180A Controller, do not connect either side of the 24 Vac transformer secondary to earth ground. ⚠ ***CAUTION*** The W180 Zone Control System requires an earth ground (18 AWG or heavier wire connected to a cold water pipe).
HVAC Equipment	Where required.	⚠ ***WARNING*** Wherever possible, avoid connecting separate power sources to the same relay set common. See the W180 Zone Control System Programmer's Manual, form 69-0761, for more information regarding relay assignments. 2. If HVAC unit is more than 100 ft [30.5m] from W180A Controller, calculate worst-case power consumption, cable loop resistance, and wire gauge that will allow 19 Vac (min) to be applied to HVAC equipment. Use isolating relays to lower long loop current requirements. 3. Any HVAC control that requires more than 1A of continuous current at 24 Vac must be separated from the W180A Controller output with an isolating relay. 4. HVAC units must have low voltage controls. Forced air zoning requires tree structure where each zone has individual damper/valve for control. 5. Requires separate transformer. Number of actuators powered by each transformer depends on transformer VA rating.
S321A Touchpad	In any room about 5 ft, 4 in. [1.6m] above floor or as specified by customer. Do not mount in high humidity areas. Can mount in 3-gang electrical box.	6. Up to three S321A Touchpads can be powered from the dc power provided by the W180A Controller.
T675A Temperature Controller	In duct where the sensing element is exposed to the average temperature. Do not mount near hot pipes and cooling coils.	—
C7180A Flush Mount Temperature Sensor	On inside wall about 5 ft [1.5m] above floor, away from hot or cold areas, water pipes, air ducts, discharge air, dead air, and radiation from lights, appliances, and the sun.	

(Continued)

TABLE 9—WIRING *(Continued).*

Device	Mounting Location	Notes
198212CA Outdoor Temperature Sensor	Away from radiation from sun, preferably on north wall.	7. Accessory Cables (ft [m]): a. 4074CAV: shielded cable, 50 [15]. b. 4074CAW: shielded cable, 100 [30.4]. c. 4074CAY: shielded cable, 200 [61].
C7130A Wall Mount Room Temperature Sensor	On inside wall about 5 ft [1.5m] above floor, away from hot or cold areas, water pipes, air ducts, discharge air, and radiation from lights, appliances, and the sun.	
T7660A Space Temperature Sensor		
T7660B Space Temperature Sensor with Occupied Override		
C7600C Solid State Humidity Sensor	Where it is exposed to freely circulating air (500 ft/min minimum air flow), but protected from rain and direct sunlight.	8. Connect the 20 Vdc input wire from the W180A to the + terminal. Connect the W180A analog input wire to the sensor– terminal.
AOBD Honeywell/ Trol-A-Temp® Rectangular Dampers	Where required.	9. Requires transformer separate from the W180A Controller transformer. Five damper actuators (max) per 40 VA transformer. 10. Use a modified 3-wire daisy chain wiring technique to simplify wiring or use five wires and wire as home runs.
D635B-G Zone Dampers	Where required.	11. Requires transformer separate from the W180A Controller transformer. Eighteen damper actuators (max) per 40 VA transformer. 12. Use the daisy chain wiring technique to simplify wiring and eliminate multiple wires at the W180A Controller.
V8043A,B,E,F,J V8044A,B,E Motorized Valves	Where required.	13. Requires transformer separate from the W180A Controller transformer. Five V8043 Zone Valves (max) per 40 VA transformer. 14. On all hydronic systems, the W180A must have direct and independent control of all valves and pumps. Therefore, valve end switches must not control circulation pumps.

Fig. 15—Typical standard heat pump wiring.



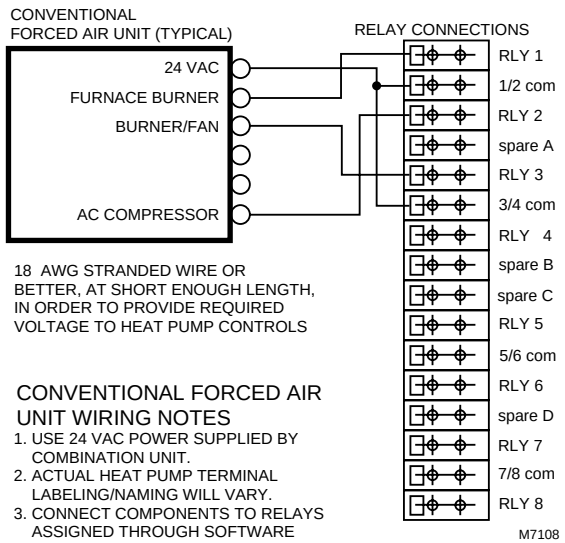
18 AWG STRANDED WIRE OR BETTER, AT SHORT ENOUGH LENGTH, IN ORDER TO PROVIDE REQUIRED VOLTAGE TO HEAT PUMP CONTROLS

HEAT PUMP WIRING NOTES

1. USE 24 VAC POWER SUPPLIED BY HEAT PUMP.
2. ACTUAL HEAT PUMP TERMINAL LABELING/NAMING WILL VARY.
3. CONNECT COMPONENTS TO RELAYS ASSIGNED THROUGH SOFTWARE CONFIGURATION.

M7107

Fig. 16—Typical standard combination unit wiring.



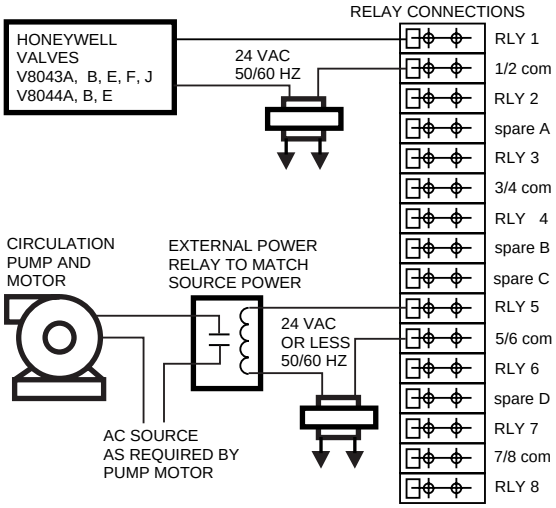
18 AWG STRANDED WIRE OR BETTER, AT SHORT ENOUGH LENGTH, IN ORDER TO PROVIDE REQUIRED VOLTAGE TO HEAT PUMP CONTROLS

CONVENTIONAL FORCED AIR UNIT WIRING NOTES

1. USE 24 VAC POWER SUPPLIED BY COMBINATION UNIT.
2. ACTUAL HEAT PUMP TERMINAL LABELING/NAMING WILL VARY.
3. CONNECT COMPONENTS TO RELAYS ASSIGNED THROUGH SOFTWARE CONFIGURATION.

M7108

Fig. 17—Typical hydronic system equipment wiring.



CAUTION

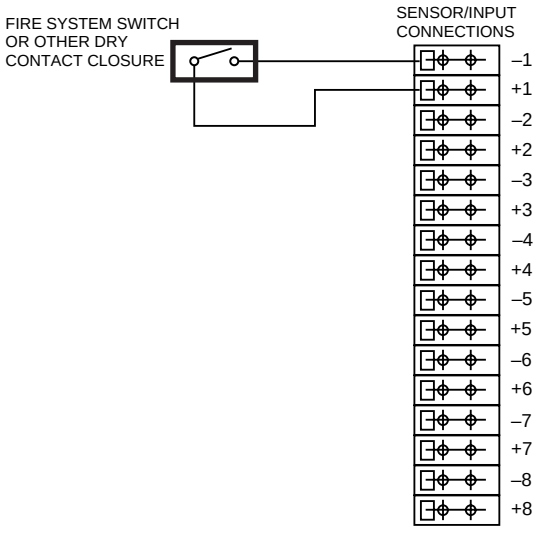
DO NOT ATTEMPT TO CONTROL PUMP MOTOR DIRECTLY THROUGH W180A RELAYS.
(MAX LOAD ON RELAYS = 24 VAC, AT 1 AMP)

WIRING NOTES:

1. DISCONNECT POWER SUPPLY BEFORE BEGINNING INSTALLATION.
2. CONNECT UP TO THREE VALVES IN PARALLEL TO THE SAME CONTROLLER RELAY.
3. USE APPROPRIATE POWER SOURCE AND POWER RELAY TO CONTROL POWER TO A CIRCULATION PUMP AND MOTOR.
4. CIRCULATION PUMPS MUST BE CONTROLLED THROUGH A SEPARATE RELAY OUTPUT. THE W180 WILL NOT OPERATE CORRECTLY IF PUMPS ARE CONTROLLED SOLELY BY A VALVE END SWITCH.

M7110A

Fig. 18—Typical fire switch wiring.



M7109

Fig. 19—Typical D635 damper wiring.

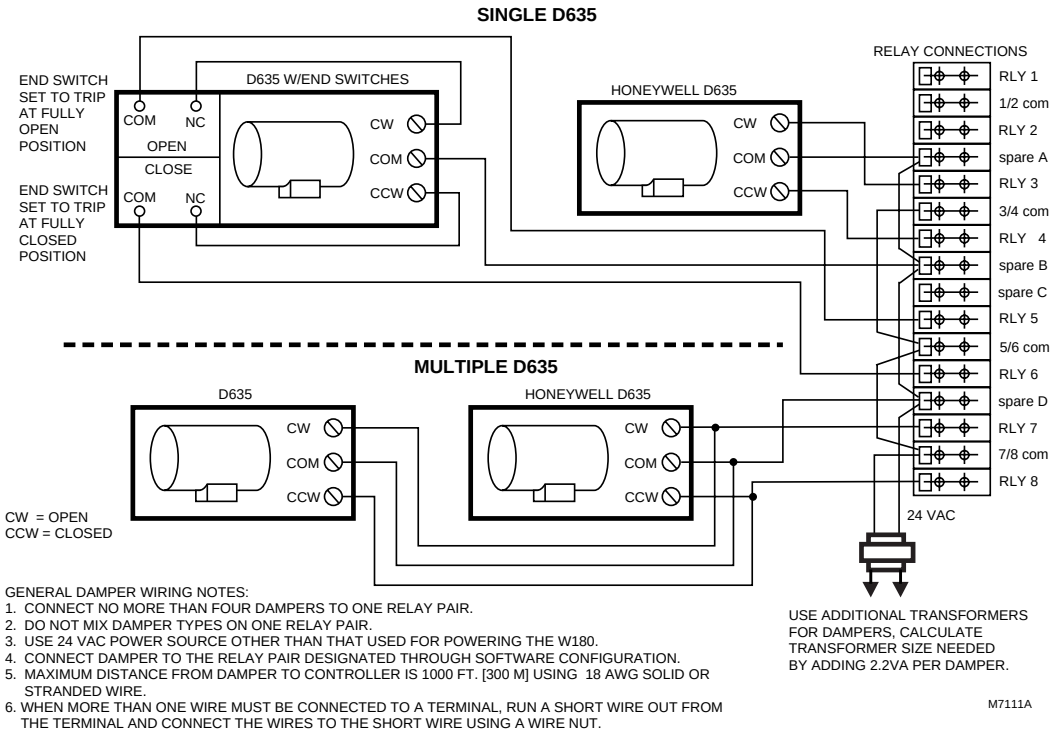
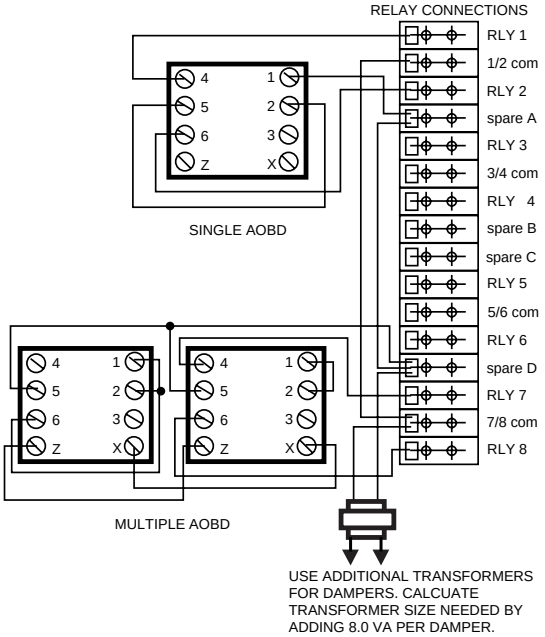


Fig. 20—Typical Trol-A-Temp® damper wiring.



GENERAL DAMPER WIRING NOTES:
1. CONNECT NO MORE THAN FOUR DAMPERS TO ONE RELAY PAIR.
2. DO NOT MIX DAMPER TYPES ON ONE RELAY PAIR.
3. CONNECT THE LAST DAMPER (MULTIPLE DAMPERS CONNECTED TO ONE RELAY PAIR) AS SHOWN FOR THE RESPECTIVE DAMPER TYPE.
4. USE 24 VAC POWER SOURCE OTHER THAN THAT USED FOR POWERING THE W180.
5. CONNECT DAMPER TO THE RELAY PAIR DESIGNATED THROUGH SOFTWARE CONFIGURATION.
6. MAXIMUM DISTANCE FROM DAMPER TO CONTROLLER IS 1000 FT. [300 M] USING 18 AWG SOLID OR STRANDED WIRE.

M8165A

DETERMINE THE TEMPERATURE PROFILES

Determine and enter the Profile Name, Profile Start Time, Days the profile is used, and desired heating and cooling temperatures for each room in the house/building. The example below shows a typical schedule for a house. A profile:

— Can have different start times for different days of the week.

— May be scheduled for only some days.

— May not have a start time at all.

Complete the Homeowner Lifestyle Worksheet in Appendix B for the customer. Use it when programming the System.

Homeowner Lifestyle Worksheet

Directions:
1. Provide Zone Names (up to 10), Profile Names (up to 20), and Start Times.
2. Indicate the desired heating and cooling setpoints.
3. Identify with a 4 which zones are occupied for each profile.

W180 Zone Control System

Preferred Temperature Setpoints*

Occupied–Heating 68 Unoccupied–Heating 60

Occupied–Cooling 74 Unoccupied–Cooling 78

No.	Profile Name	Start Time	Days	Zone 1 Living Room	Zone 2 Kitchen	Zone 3 Dining Room	Zone 4 Family Room	Zone 5 Kid's Room	Zone 6 Master Bedroom	Zone 7 Guest Room	Zone 8 Master Bathroom	Zone 9 Bathroom	Zone 10 Den
1	Wake	5:30A 7:00A	M-F Sa, Su	✓	✓			70/74	70/74		70/74	70/74	
2	Leave	8:00A 9:00A	M-F Su										
3	Return	4:00P 11:00A	M-F Su	✓	✓		✓	✓			✓	✓	
4	Sleep Kids	9:00P 10:00P	Su-Th F, Sa								68/78	68/78	
5	Sleep Mode	10:30P 11:30P	Su-Th F, Sa								68/78	68/78	
6	Holiday Home	N/A	N/A	✓	✓	✓	✓	✓	✓		✓	✓	
7	Out of Town	N/A	N/A										
8	Entertain	N/A	N/A	✓	✓	✓	✓	✓	✓	✓	✓	✓	
9	Home Office	N/A	N/A	64/78	64/78							✓	✓
10													

*Setpoints can be different than "preferred setpoints", see example.

M8328

Installation and Wiring

GENERAL

Check the equipment for damage immediately upon receipt and note any visible damage with the carrier. Unpack the W180A Controller and check to see that nothing was jarred loose during shipping.

NOTE: The following procedures explain how to install the hardware in pre-existing buildings. See Fig. 14 and Table 9 for prewiring information.

W180A CONTROLLER

Fig. 2 shows the W180A Controller enclosure mounting hole locations. The W180A Controller enclosure can be surface mounted in any dry, accessible area. Avoid areas of excessive heat and/or humidity. Mount the W180A Controller enclosure as follows:

CAUTION

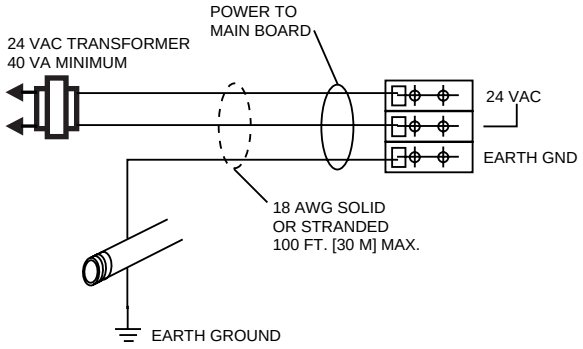
Do not allow material from the wall (for example, wood or metal shavings) to enter the enclosure.

1. If mounting the W180A Controller enclosure on a wall *that does not have studs 16 inches OC*, obtain a 3/4-inch thick piece of plywood and trace the outline of the keyhole slots and round holes onto the plywood and secure the plywood to the supporting wall as indicated in the job drawings. If mounting the W180A Controller enclosure on a wall *with studs 16 inches OC*, position the enclosure on the studs as indicated in the job drawings and trace the outline of the keyholes on the studs.
2. Start a 3/4-inch wood screw in each of the top keyholes.
3. Hang the W180A Controller enclosure from the screws.
4. Start a 3/4-inch wood screw in each of the remaining holes.
5. Tighten all wood screws.
6. Remove all appropriate knockouts and install bushings (obtained locally) to protect the wires entering the enclosure.
7. Connect the field wiring to the W180A Controller termination board as shown on the job drawings and Fig. 21.

NOTES:

a. When more than one wire must be connected to a terminal, use the same gauge wires.
b. See Fig. 22 for terminal designations.
c. See Fig. 23 for proper power supply isolation when wiring two HVAC systems.

Fig. 21—W180A Controller power source and ground wiring.



CAUTION:
1. EARTH GROUND CONNECTION IS MANDATORY.
2. EARTH GROUND MUST BE A RELIABLE CONNECTION:
   – COLD WATER PIPE
   – GROUNDING ROD
   – BUILDING METAL FRAMEWORK
3. THE THIRD WIRE GROUND IN THE ELECTRICAL WIRING OF A BUILDING SHOULD NOT BE USED BECAUSE IT IS DIFFICULT AND OFTEN IMPOSSIBLE TO ESTABLISH ITS RELIABILITY AS AN EARTH GROUND.
4. TO AVOID POSSIBLE DAMAGE TO THE W180 CONTROLLER, DO NOT CONNECT THE EARTH GROUND TO THE SECONDARY SIDE OF THE 24 VAC TRANSFORMER.

M8166A

Fig. 22—Input/output terminal designations.

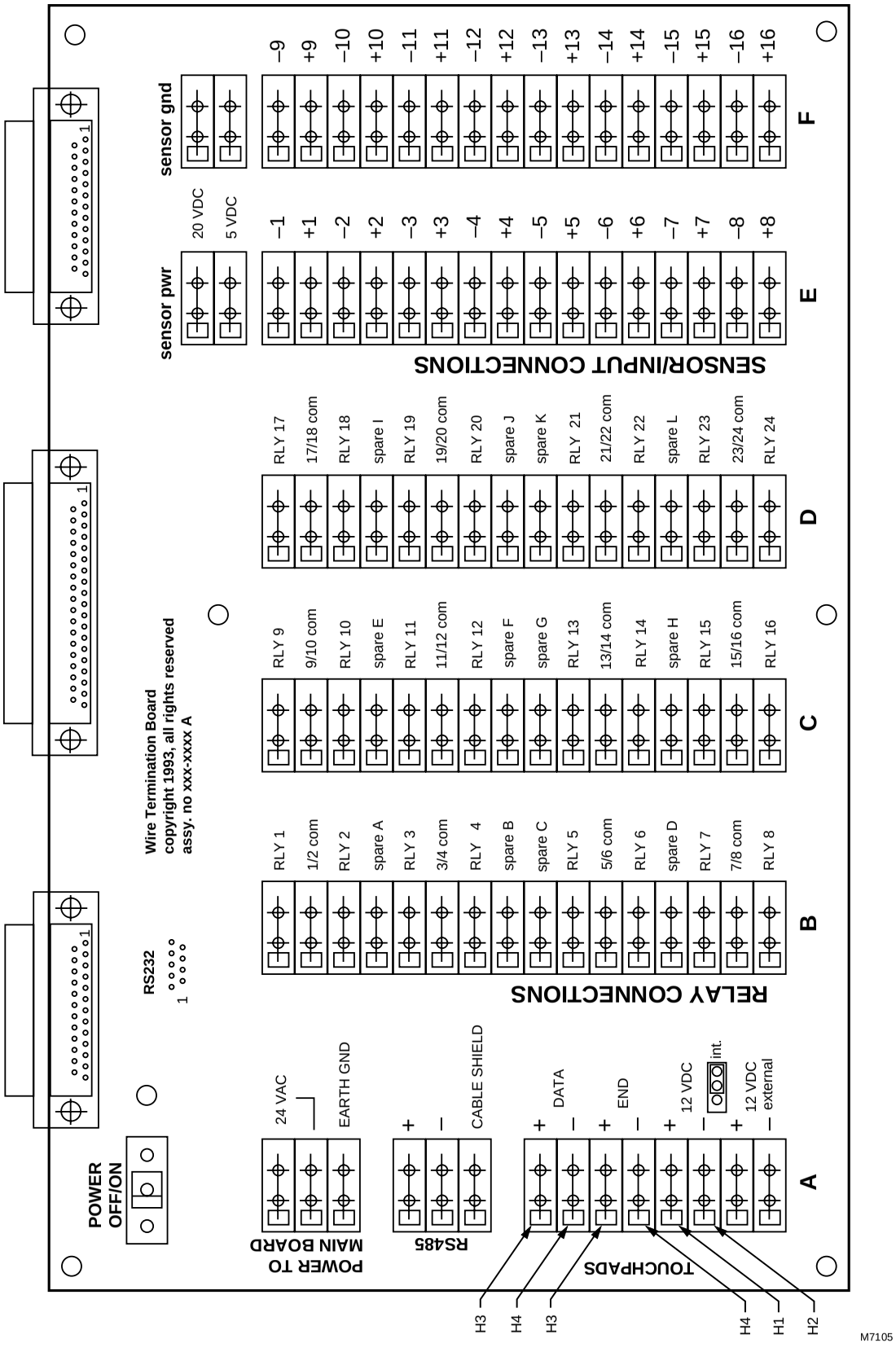
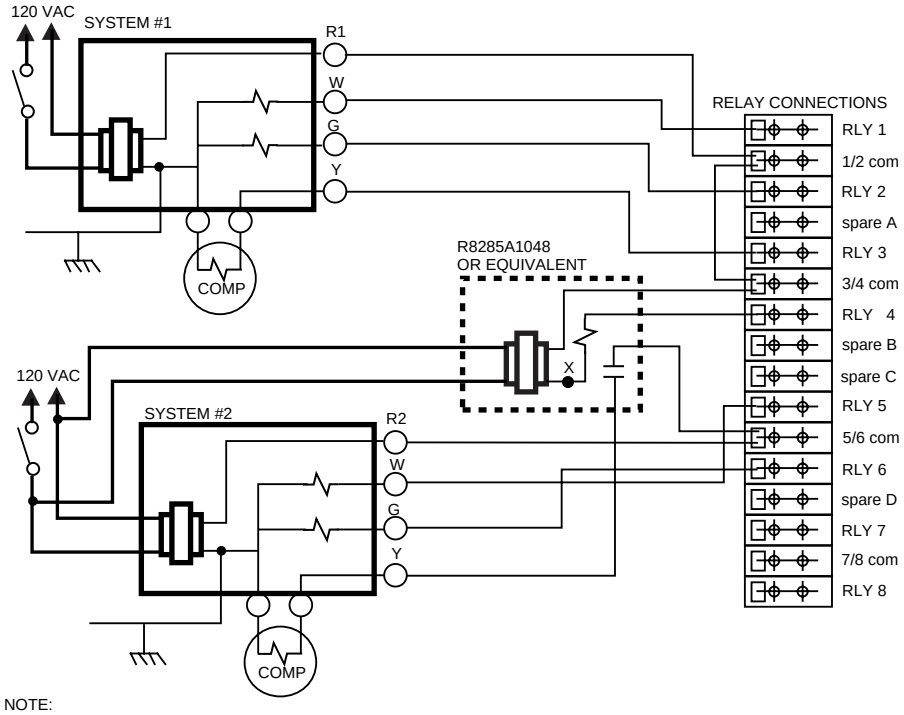


Fig. 23—Typical wiring for two HVAC systems to assure power supply isolation.



NOTE:
1. TO ENSURE ISOLATION, R1 MUST NOT BE CONNECTED TO R2.
2. TO ENSURE ISOLATION, THE TRANSFORMER AT POINT X MUST NOT BE CONNECTED TO AN EARTH GROUND.

M8167

HONEYWELL TotalHome® SYSTEM

Wiring and connections between the TotalHome® System and the W180 System are provided by the installer of the TotalHome® System. The TotalHome® System and the W180 System should each have their own, separate HBus networks. This allows the systems to work independently of each other. After verifying that both systems are operating properly as stand-alone systems, they can be interconnected through the HBus network.

The TotalHome® installer will connect two wires between the two controllers, one for HBus Data + (H3) and one for HBus Data – (H4), and mark these wires at both ends.

Prior to servicing either system, disconnect the interconnecting wires. Reconnect these wires after servicing is completed. Verify proper operation of the combined system.

S321A TOUCHPADS

NOTES:

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings and description given on the product to make sure the product is suitable for your application.
3. Installer must comply with all local building codes and ordinances when installing this product.
4. Installer must be a trained, experienced service technician.
5. The Touchpad may be mounted in a 3-gang junction box or in a hole cut in a drywall panel.
6. After installation is complete, check out product operation as provided in these instructions.

CAUTION

Disconnect power before installation to prevent electrical shock or equipment damage.

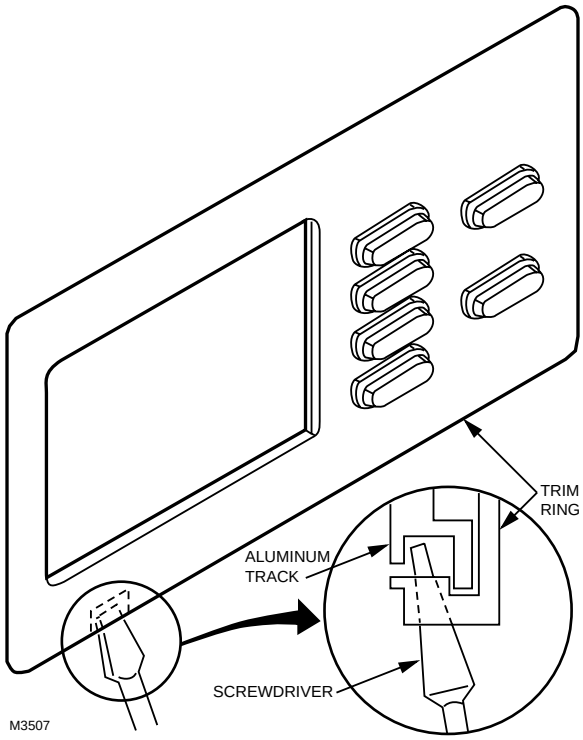
The Touchpad may be located in any room. However, mounting in bathrooms and other high humidity areas is not advised. Multiple Touchpads may be installed for convenience. Because the Touchpad does not perform temperature sensing, location is not as limited as for a thermostat. The Touchpad may be located at a customer-specified height above the floor. When the customer does not specify, mount the Touchpad for best viewing (at or slightly below eye level; usually 5 ft., 4 in. [1.63m] above the floor).

Install and wire the Touchpad as follows:

1. Remove the Touchpad from its package. Set aside all mounting materials (for example, screws, plastic screw anchors) until later in the mounting procedure.

2. Use a flat-bladed screwdriver to remove the trim ring from the Touchpad (Fig. 24). Set aside the cover until the Touchpad has been mounted.

Fig. 24—Removing the trim ring.



3. Mount the Touchpad in a 3-gang junction box or drywall as follows:

— 3-gang junction box (Fig. 25):

a. Make sure that the location chosen is clear of studs and other possible obstructions behind the drywall.
b. Place the 3-gang junction box on the wall at the selected location and use it as a stencil to outline the portion of the drywall to be cut away.
c. Cut the opening for the junction box.
d. Mount the junction box in the cutout.
e. Run the 6-wire connecting cable (Belden® 8742, for example) from the junction box to the advance zoning controller, leaving a minimum of 3 in. [76 mm] of wire exposed in the junction box for connection to the Touchpad.
f. Connect the four Touchpad signal and power wires to the 6-wire connecting cable (red wire for input power, black wire for common, green and yellow wires for signals) using wire nuts. See Fig. 26 and 27. If more than three Touchpads are being wired to the W180A Controller, see Fig. 28 for auxiliary power wiring. If required, connect the wiring between TotalHome® System and W180 System (Fig. 29).

Fig. 25—Mounting S321A Touchpad in a 3-gang junction box.

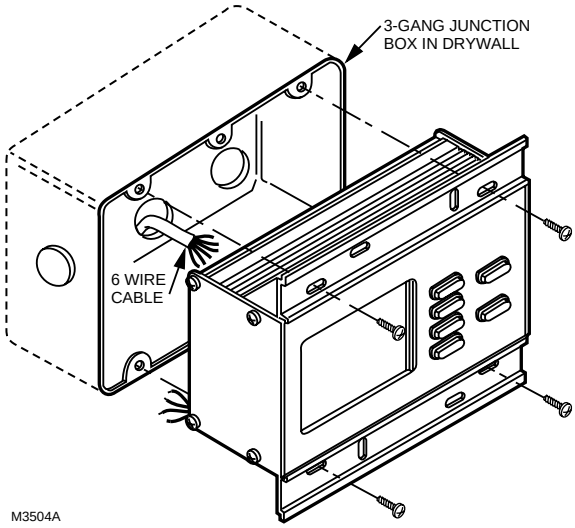
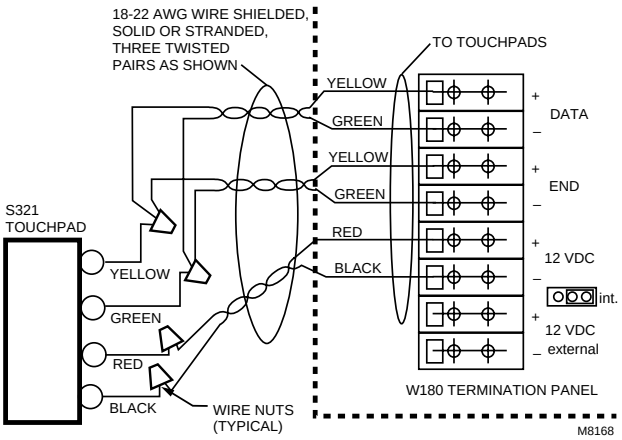
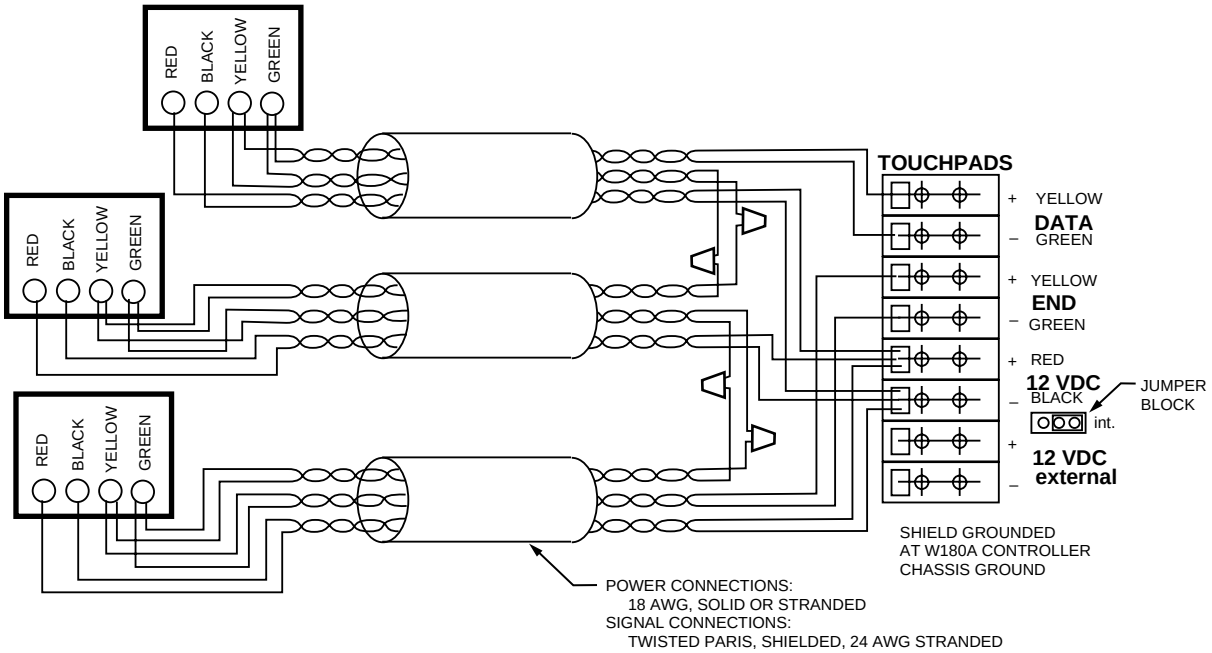


Fig. 26—Wiring the S321A Touchpad to the W180A Controller.



g. Mount the Touchpad in the junction box in the four inside mounting holes, using the screws supplied.
h. Position the trim ring on the Touchpad (note the UP reference on the rear surface of the trim ring) and snap it onto the Touchpad.

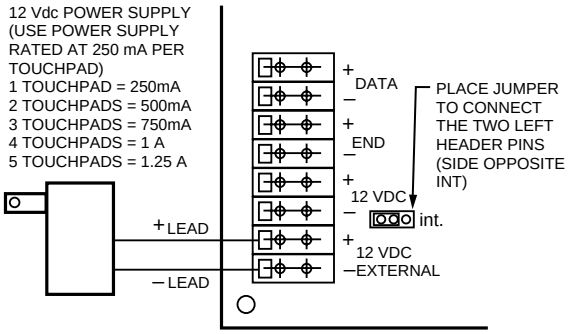
Fig. 27—Wiring three S321A Touchpads to the W180A Controller.



HBUS WIRING NOTES:
1. USE 6-CONNECTOR, 3 TWISTED PAIR SHIELDED CABLE, 18 GAUGE.
2. IF POWER IS RUN IN SEPARATE CABLE, DATA CABLE CAN BE 24 GAUGE AS SHOWN, DISTANCE LESS THAN 400 FT. [120 M].
3. POWER CABLING = 2.8V DROP AT MAXIMUM LOAD.
4. GROUND DATA CABLE SHIELD TO ENCLOSURE CHASSIS.
5. DO NOT EXTEND YELLOW OR GREEN WIRES COMING FROM TOUCHPADS WITH A SINGLE WIRE. ONLY CONNECT DATA LINES DIRECTLY AS SHOWN ABOVE.

M8170

Fig. 28. Auxiliary power wiring for wiring more than three S321A Touchpads to the W180A Controller.

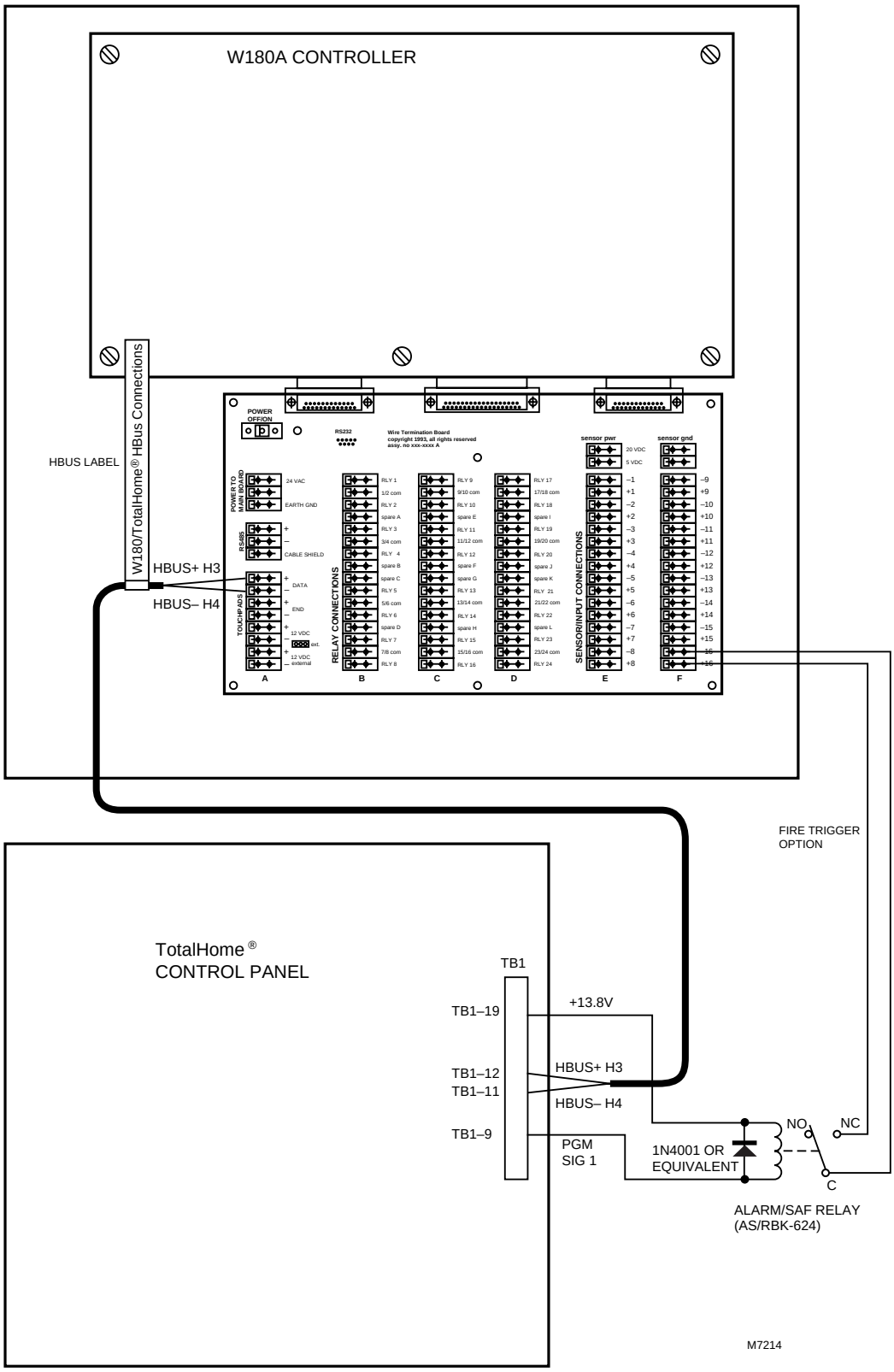


SAMPLE POWER SUPPLIES:
-ALTRONIX SMP3 POWER SUPPLY (2.5 A)
-AlarmSaf ASPS1 (1.0 A)

WIRING NOTES:
1. DISCONNECT POWER SUPPLY BEFORE BEGINNING INSTALLATION.
2. AN EXTERNAL POWER SUPPLY IS REQUIRED WHEN CONNECTING MORE THAN THREE S321A TOUCHPADS TO ONE W180A CONTROLLER.
3. USE ANY 12 Vdc REGULATED OR UNREGULATED PLUG-IN OR STANDARD SECURITY SYSTEM AUXILIARY POWER SUPPLY.

M7215

Fig. 29. Wiring between TotalHome® and W180A Controller.

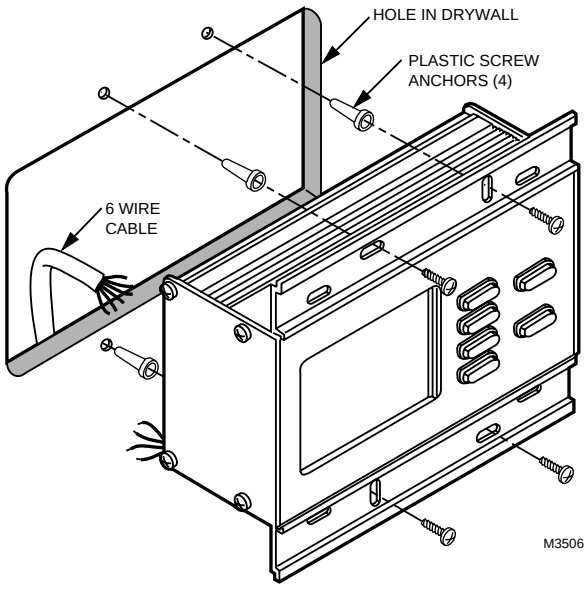


— Drywall without junction box (Fig. 30):

a. Make sure that the location chosen is clear of studs and other possible obstructions behind the drywall.
b. Place the back of the Touchpad on the wall at the selected location and use it as a stencil to outline the area of drywall to be cut out
c. Cut the opening for the S321A Touchpad.
d. Place the Touchpad in the opening and mark the locations for the four mounting screws using the *outer* four mounting holes.
e. Use a 3/16 in. [5 mm] drill bit to drill the four starter holes for the plastic screw anchors.
f. Install the four plastic screw anchors in the starter holes.
g. Run the 6-wire connecting cable from the drywall cutout to the advance zoning controller, leaving a minimum of 3 in. [76 mm] of wire exposed in the cutout for connection to the Touchpad.
h. Connect the four Touchpad signal and power wires to the 6-wire connecting cable (red wire for input power, black wire for common, green and yellow wires for signals) using wire nuts (Figs. 26 and 27). If more than three Touchpads are being wired to the W180A Controller, see Fig. 28 for auxiliary power wiring. If required, connect the wiring between TotalHome® System and W180 System (Fig. 29).
i. Mount the Touchpad in the drywall, using the screws provided.
j. Position the trim ring on the Touchpad (note the UP reference on the rear surface of the trim ring) and snap it onto the Touchpad.

4. Wire the Touchpad as shown in the job drawings and Fig. 47.

Fig. 30—Mounting S321A Touchpad in drywall.



HIGH LIMIT CONTROLLER

NOTES:

1. Locate the high limit controller where it will be exposed to average air temperature in the duct.
2. Do not locate the high limit controller near hot pipes and cooling coils.
3. To support the bulb in the duct, use Bulb Holder No. 107324A (supplied with the adjustable differential model; order separately for the fixed differential model).

Install and wire the T675A Temperature Controller as follows:

1. Mount the controller case as follows:
   a. Remove the cover.
   b. Use the case as a template and mark three screw-hole locations on the mounting surface.
   c. Punch or drill the holes.
   d. Secure the T675A to the mounting surface with the screws provided.
2. Install the sensing bulb in the duct as follows:
   a. Drill a hole in the duct wall large enough to admit the sensing bulb in the holder.
   b. Using the holder as a template, mark and drill holes for the bulb holder mounting screws (Fig. 31).
   c. Break off the bulb holder to the desired length Fig. 32).

      NOTE: The holder should be long enough to hold the sensing bulb in freely circulating air, away from the duct wall.

   d. Neatly coil any excess capillary tubing at the controller or bulb holder.
   e. Place the capillary tubing in the bulb holder channel and pinch together the top edges of the holder at each segment (Fig. 33).
   f. Insert the bulb and bulb holder into the duct through the drilled hole (Fig. 31).
   g. Secure the bulb holder to the duct wall with the screws provided.

Wire the T675A according to the instructions provided with the heating or cooling system and Fig. 34.

Fig. 31—T675A Temperature Controller mounting.

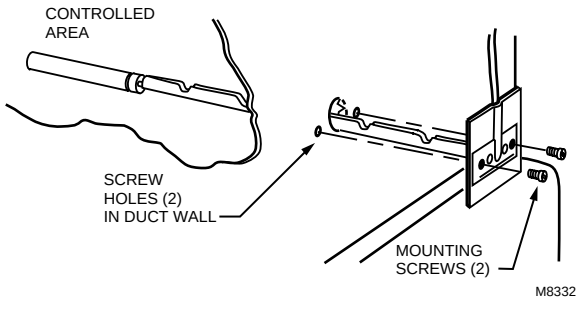


Fig. 32—Shortening the bulb holder.

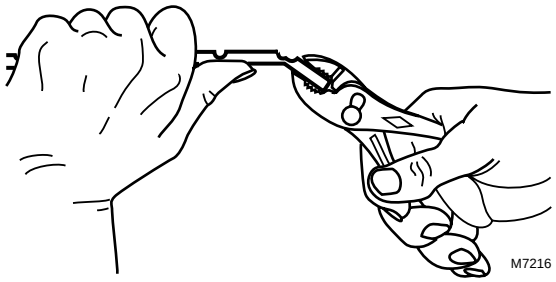


Fig. 33—Securing the bulb to the bulb holder.

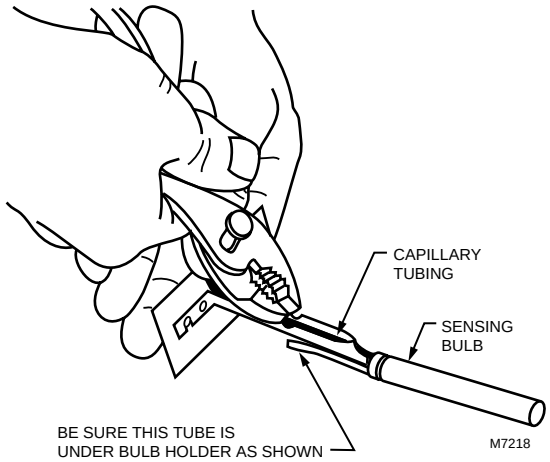
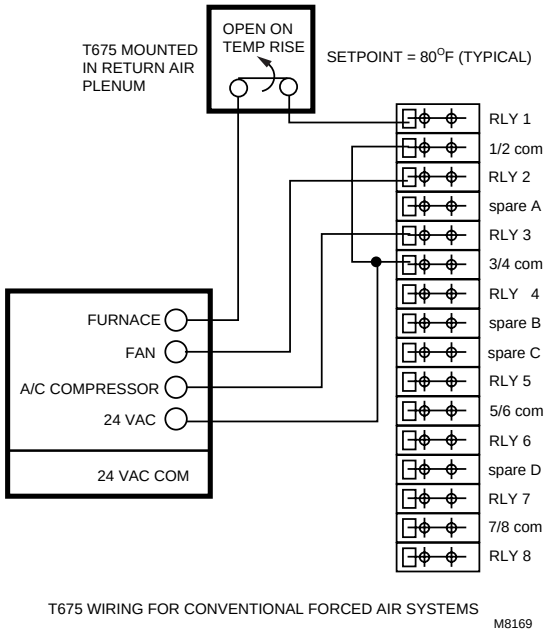


Fig. 34—Typical T675A Temperature Controller wiring.



SENSORS

Temperature Sensors

CAUTION

Disconnect the power supply before making wiring connections to prevent electrical shock or equipment damage.

NOTES:

1. Check the ratings given in the instructions and on the product to make sure the product is suitable for the application.
2. After installation is complete, check out the operation as provided in these instructions.

198212CA OUTDOOR TEMPERATURE SENSOR

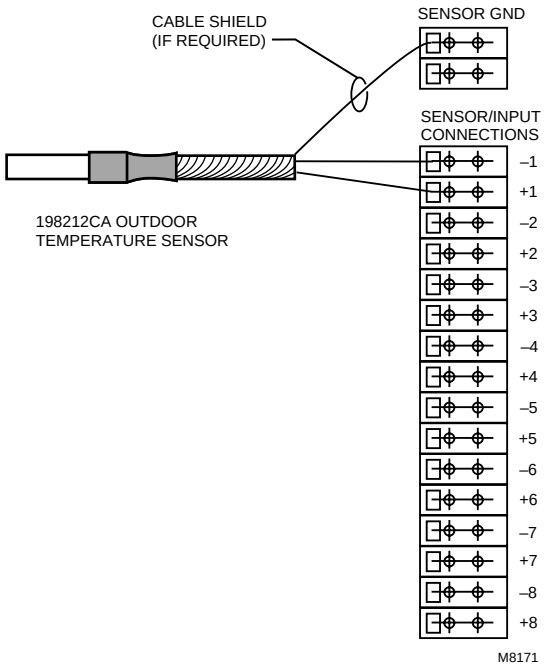
NOTES:

1. Locate the sensor where it will not be subject to tampering.
2. Locate the sensor away from exhausts and direct sunlight that may affect the temperature reading. A typical location would be under the roof overhang on the least sunny side of the building.
3. Use a 107323A Sun Shield, if desired.
4. All wiring must agree with local codes, ordinances, and regulations.
5. Do not route temperature sensor wiring:
   a. With building power wiring.
   b. Next to control conductors.
   c. Near electric motors.
   d. Near welding equipment.
   e. Near ballast of gas-bulb lighting power transformer.
6. Improper shield grounding or bad connectors can cause erratic readings.

Install and wire 198212CA Outdoor Temperature Sensors as follows:

1. Mark the area on the wall where the sensor or sun shield will be mounted.
2. Wire the sensor as shown on the job drawings and Fig. 35.
3. Mount the sensor to the wall or in the sun shield.

Fig. 35—Typical 198212CA Outdoor Temperature Sensor wiring.

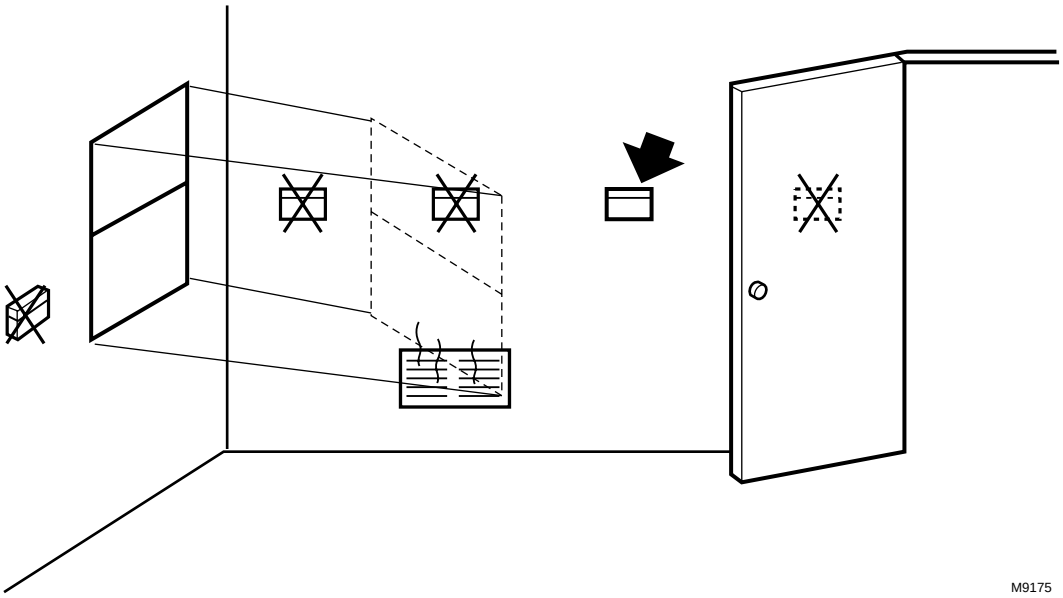


C7130A WALL MOUNT TEMPERATURE SENSOR

NOTES:

1. Locate the sensor where it will not be subject to tampering.
2. Locate the sensor on an inside wall about 5 ft [1.5m] above the floor.
3. Make sure the wire run between the sensor and the controller is 300 ft [91m] or less.
4. Make sure there is good air circulation at average temperature at the location. Avoid the following locations because they can introduce errors in temperature sensor measurements (Fig. 36):
   a. Hot areas caused by:
      1) Concealed pipes or ducts.
      2) Drafts from fireplaces or other heat sources.
      3) Convection or radiant heat from the sun or electrical equipment.
   b. Cold areas caused by:
      1) Concealed pipes or ducts.
      2) Drafts from windows and doors.
      3) Unheated areas on the other side of the wall location.
   c. Dead air areas:
      1) Behind doors, furniture, and curtains.
      2) In corners and alcoves.

Fig. 36—C7130A Wall Mount Temperature Sensor mounting location.



Install and wire C7130 Wall Mount Temperature Sensors as follows:

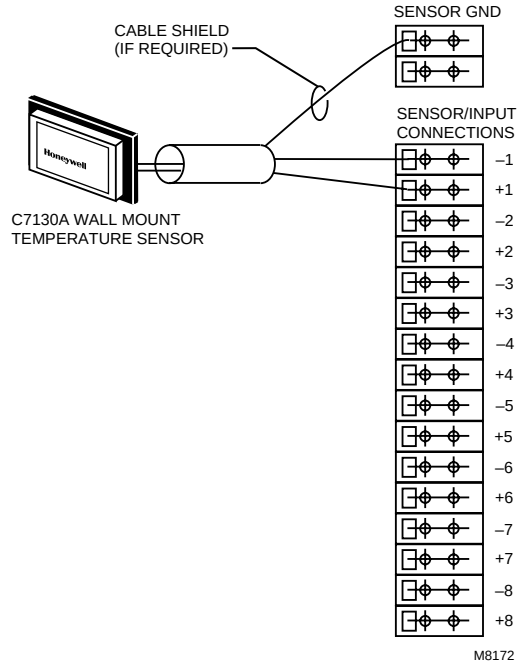
1. Mark the area on the wall where the sensor or conduit box will be mounted.
2. Wire the sensor as shown on the job drawings and Fig. 37.

NOTES:

a. All wiring must agree with local codes, ordinances, and regulations.
b. Do not route temperature sensor wiring:
   1) With building power wiring.
   2) Next to control conductors.
   3) Near electric motors.
   4) Near welding equipment.
c. Improper shield grounding or bad connectors can cause erratic readings.

3. Mount the sensor to the wall or conduit box.

Fig. 37—Typical C7130A Wall Mount Temperature Sensor wiring.



C7180A FLUSH MOUNT TEMPERATURE SENSOR

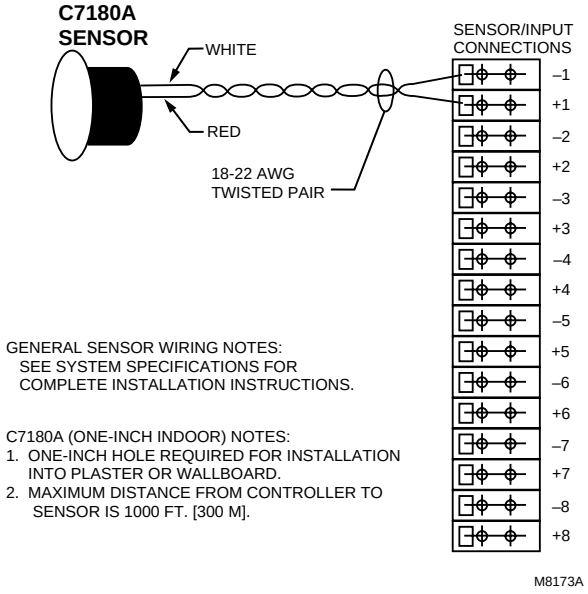
NOTES:

1. Locate the sensor where it will not be subject to tampering.
2. Locate the sensor on an inside wall about 5 ft [1.5m] above the floor.
3. Make sure the wire run between the sensor and the controller is 1000 ft [300m] or less.
4. Make sure there is good air circulation at average temperature at the location. Avoid the following locations because they can introduce errors in temperature sensor measurements:
   a. Hot areas caused by:
      1) Concealed pipes or ducts.
      2) Drafts from fireplaces or other heat sources.
      3) Convection or radiant heat from the sun or electrical equipment.
      4) Outside walls.
   b. Cold areas caused by:
      1) Concealed pipes or ducts.
      2) Drafts from windows and doors.
      3) Unheated areas on the other side of the wall location.
      4) Outside walls.
   c. Dead air areas:
      1) Behind doors, furniture, and curtains.
      2) In corners and alcoves.

Install and wire C7180A Flush Mount Temperature Sensors as follows:

1. Drill a one-inch hole for installation into plaster or wallboard.
2. Wire the sensor as shown in the job drawings and Fig. 38.
3. Press the sensor body into the hole until the sensor fits snugly.

Fig. 38—C7180A Flush Mount Temperature Sensor typical wiring.



T7660A/T7660B SPACE TEMPERATURE SENSOR

NOTES:

1. All wiring must conform to local codes, ordinances, and regulations.
2. Do not run space sensor wiring in the same conduit with ac wires.
3. The maximum distance between the space sensor and the controller is 300 ft [91m] using 18 AWG thermostat wire. To reduce noise on the sensor wires, use shielded cable with the shield connected to ground on the controller only.
4. Mount the space sensor on an inside wall approximately 54 in. [1372 mm] from the floor (or where specified) where it is exposed to the average space temperature.
5. Do not mount the space sensor on an outside wall or a wall containing water pipes or air ducts near the space sensor.
6. Avoid locations that are exposed to discharge air from registers or radiation from lights, appliances, or the sun.

Install and wire T7660A/T7660B Space Temperature Sensors as follows:

1. Mount the space sensor mounting plate on a wall, mullion (1-7/8 in. [48 mm] wide minimum), or electrical box (Fig. 39 and Table 10).

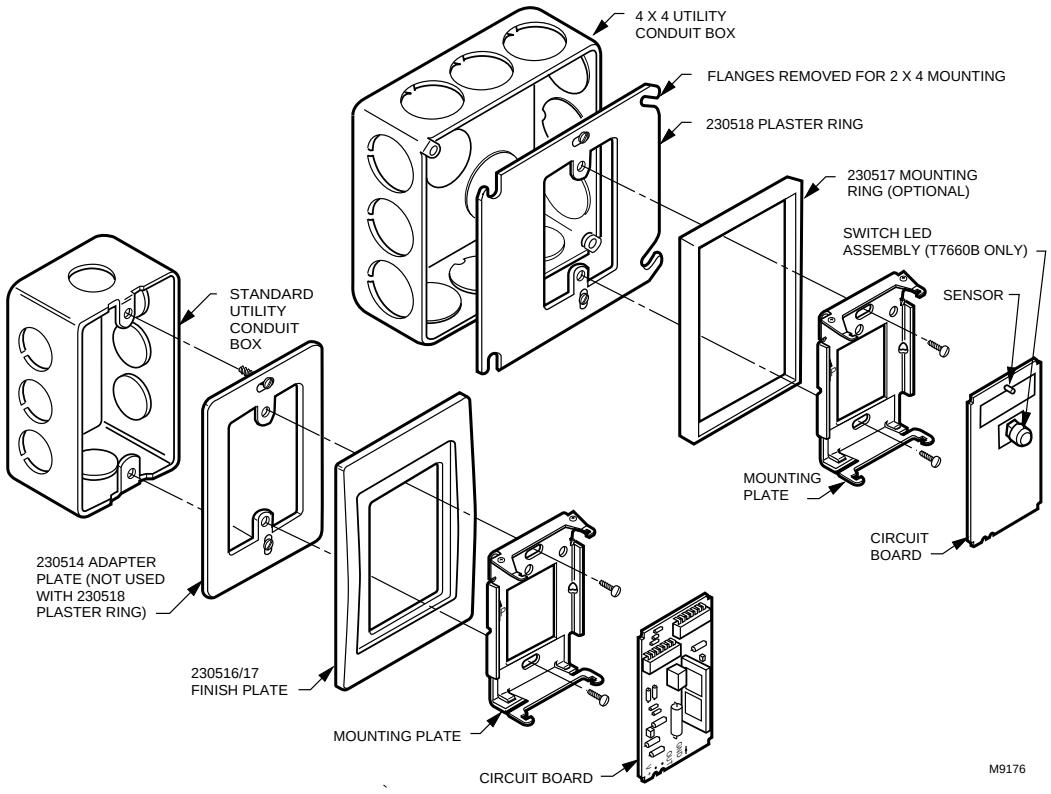
TABLE 10—MOUNTING ACCESSORIES.

Type of Mounting	230514 Adapter Plate	230515/16* Finish Plate	230517 Black Mounting Ring
Direct to wall	—	—	—
2 x 4 inch electrical box	X	X	—
2 x 4 inch electrical box with 230518 Plaster Ring	—	Optional	Optional †
4 x 4 inch electrical box with mud ring	X	X	—
4 x 4 inch electrical box with 230518 Plaster Ring	—	Optional	Optional †

*230515 Black.
230516 Beige.

†Required only when plaster ring standoff extends from wall surface.

Fig. 39—T7660A/T7660B Space Temperature Sensor mounting.



2. Wire the sensor as shown in the job drawings and Figs. 40 through 42.

3. Mount the space sensor circuit board on the mounting plate (Fig. 43).

4. Mount the cover on the mounting plate (Fig. 44).

Fig. 40—T7660A Space Temperature Sensor terminal connections.

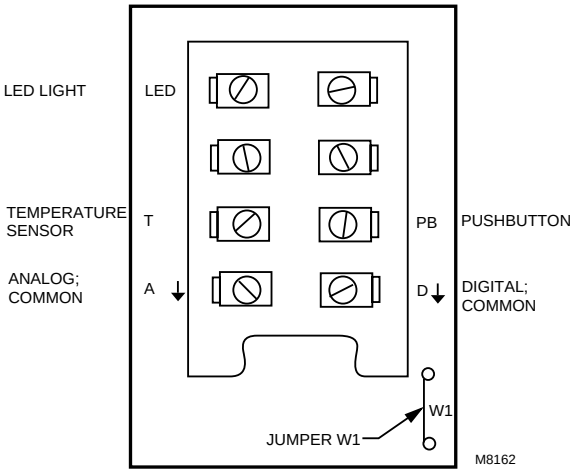


Fig. 41—Typical T7660A Space Temperature Sensor wiring.

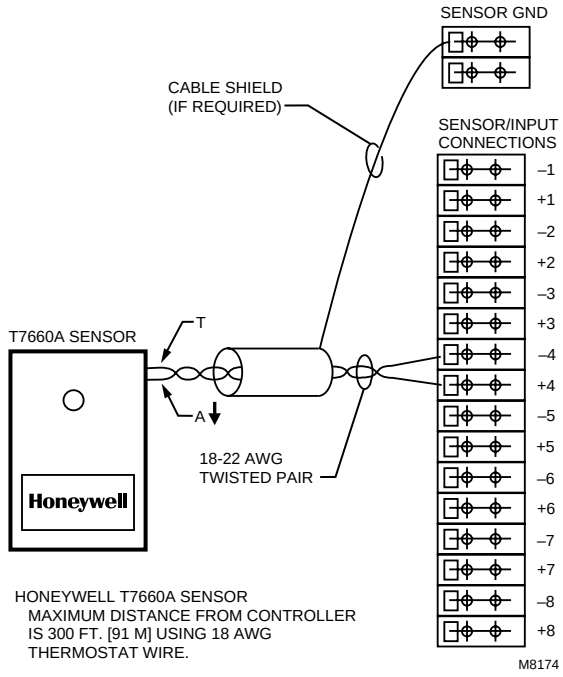


Fig. 42—Typical T7660B Space Temperature Sensor wiring.

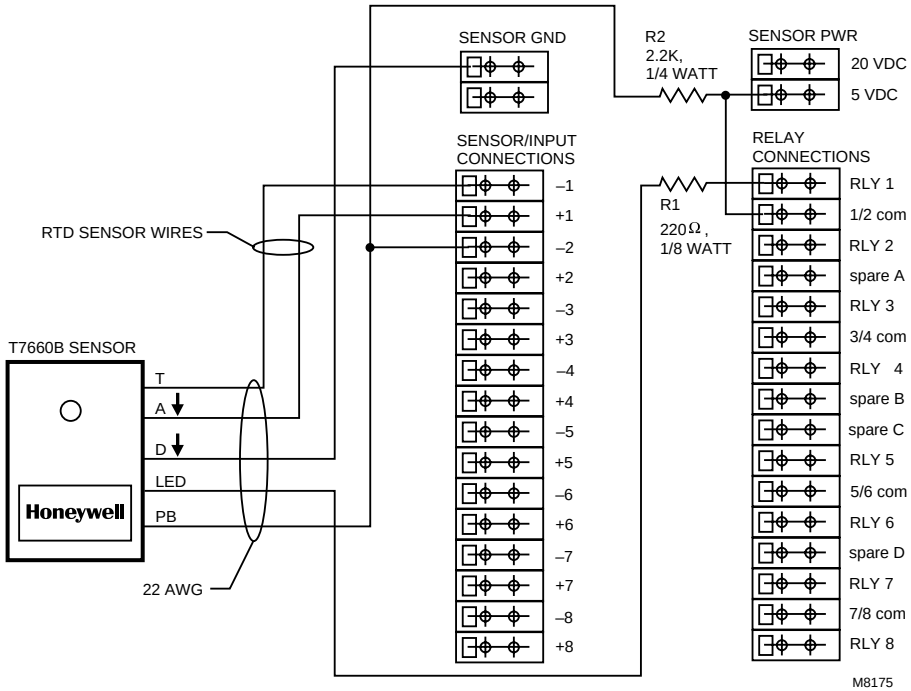


Fig. 43—Mounting the T7660A/T7660B Space Temperature Sensor circuit board on the mounting plate.

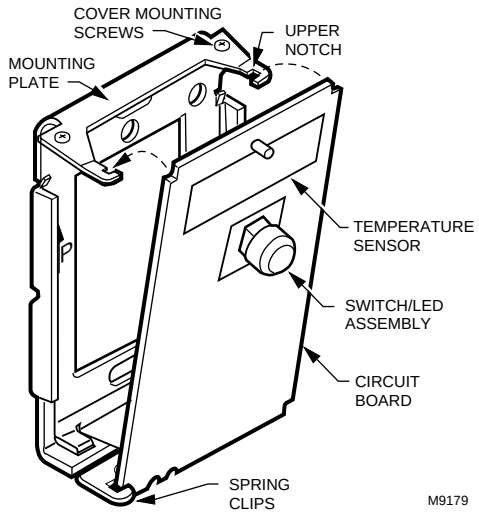
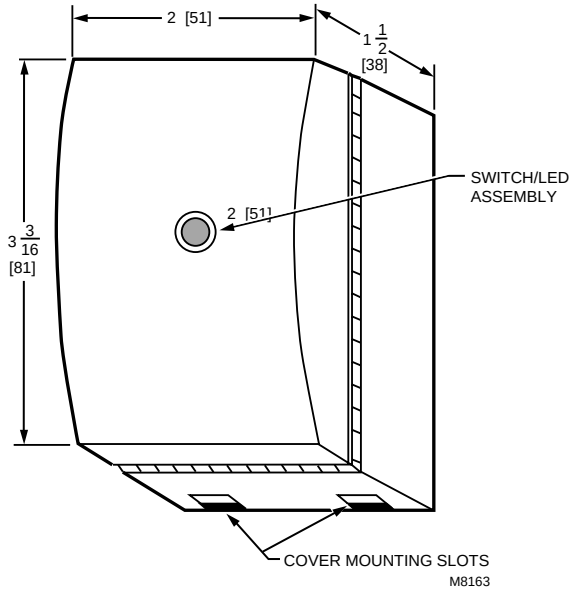


Fig. 44—Mounting the T7660A/T7660B Space Temperature Sensor cover.



C7600C Solid State Humidity Sensor

CAUTION

Disconnect the power supply before making wiring connections to prevent electrical shock or equipment damage.

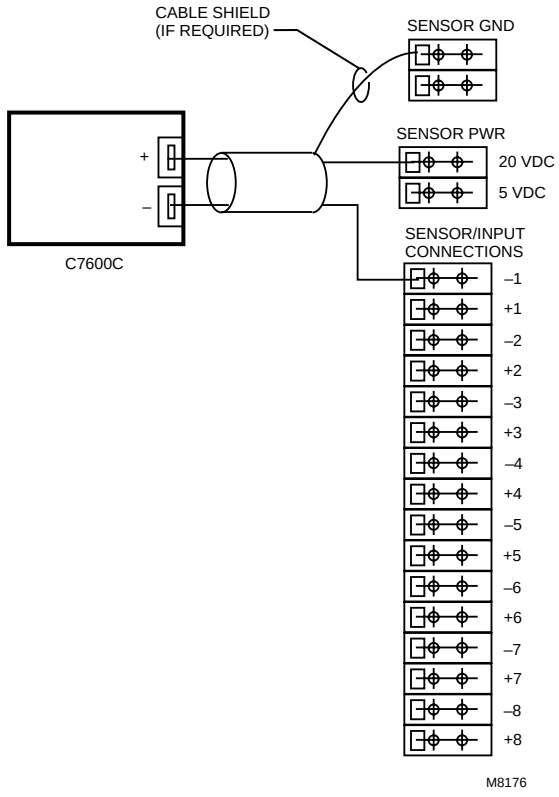
The sensor may be installed in any position in a duct or outdoors.

NOTES:

1. Check the ratings given in the instructions and on the product to make sure the product is suitable for the application.
2. Locate the sensor:
   a. Where there is a minimum of 500 ft/min airflow.
   b. Locate the sensor where it is exposed to freely circulating air, but protected from rain and direct sunlight.
   c. Locate the sensor away from traffic areas, on an inside wall, at least 3 ft (1m) from an outside wall and 54 in. (1.4m) from the floor.

Mount and install the C7600C Solid State Humidity Sensor as described in the instructions furnished by the manufacturer. Wire the C7600C Solid State Humidity Sensor as shown in the job drawings and Fig. 45.

Fig. 45—Typical C7600C Solid State Humidity Sensor wiring.



DAMPERS

CAUTION

Do not attempt to turn the damper shaft by hand or with a wrench because this will damage the actuator.

D635 Zone Dampers

NOTES:

1. Install the motor in any location except where acid fumes or other harmful vapors might attack the metal parts of the actuator or in atmospheres of escaping gas or other explosive vapors.
2. Choose a location for the damper/actuator that allows enough clearance for servicing (Fig. 46).
3. Mount the ML6161 Actuator with the motor shaft in any position so the motor is flush with the damper housing. Failure to do so can cause unbalanced gear wear and result in premature failure. In the event the motor cannot be mounted flush against the damper housing, add a spacer or washer between the mounting tab and the damper housing.

Install the D635 Damper as follows:

1. Cut and remove enough ductwork into which the damper can be inserted.
2. Insert and secure the damper into the ductwork.
   NOTE: The damper must be kept at the full 90° setting for proper system operation.
3. Wire the ML6161 Actuator as shown in the job drawings and Fig. 47.

WARNING

Disconnect power supply before wiring to prevent electrical shock or equipment damage.

NOTES:

1. All wiring must comply with local electrical codes, ordinances and regulations.
2. The voltage and frequency of the transformer used with the ML6161 must correspond to the characteristics of the power supply and motor.

Fig. 46—Damper clearance.

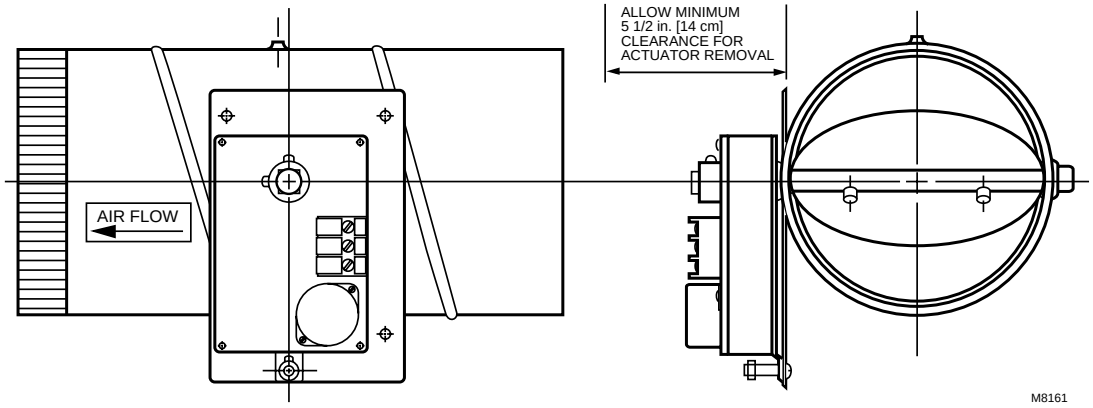
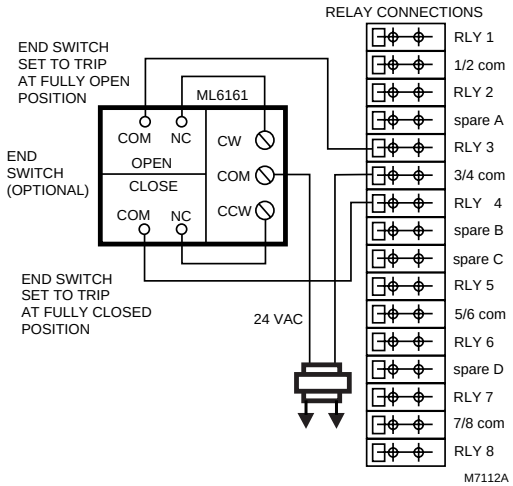


Fig. 47—ML6161 typical wiring with optional end switch.



Rectangular Dampers

CAUTION

1. To prevent damage to the damper or keep it from moving through its full range, do not distort the damper shape, or put screws or anything else into the damper.
2. Ensure the high limit setting is 200° F [93° C] or lower. Higher settings can damage the electric actuator.

NOTES:

1. Install AOBD and AOBD-BM dampers in squared air ducts. Frame misalignment jams damper blades.
2. Secure AOBD and AOBD-BM dampers by inserting screws in the sides of the damper, not on the top or bottom.

3. Applications in air ducts wider than 30 inches require multiple dampers and damper mounting tracks (Fig. 48).
4. In multiple damper applications, do not weld dampers together.
5. Do not weld dampers to air ducts or damper mounting tracks.
6. When securing dampers with sheet metal screws, refer to the installation instructions. Improper use of sheet metal screws can damage damper blades and the electric actuator.
7. Mount each damper for easy accessibility and servicing after installation.
8. Dampers can be mounted in any position.
9. Properly support, tape, and insulate the dampers and duct.
10. For retrofit applications or other special purposes, use register dampers. Note that the design of the register dampers prevents them from being positioned as precisely as the round type.

AOBD DAMPERS

Install AOBD dampers as follows:

1. Cut a 3 in. [76 mm] opening in one side of the air duct at the location selected. Ensure the opening is cut fully to the top and bottom air duct seams (Fig. 49).

2. Slide the AOBD into the air duct. Ensure the electric actuator is mounted toward the top of the air duct.

3. For small air duct sizes (smaller than 20 x 8, 18 x 10, 16 x 12), secure the AOBD mounting plate to the air duct with sheet metal screws provided.

4. For large air duct sizes (20 in. x 8 in., 18 in. x 10 in., 16 in. x 12 in., and larger), secure the mounting plate to the air duct with sheet metal screws provided. Then secure the back of the AOBD as shown in Fig. 50. If the back of the AOBD cannot be reached, install two mounting tracks as shown in Fig. 40.

5. For air duct sizes longer than 30 inches, use multiple dampers and install mounting tracks in the air ducts (Fig. 48).

6. Wire the AOBD as shown on the job drawings and Fig. 19.

Fig. 48—Installing damper mounting tracks.

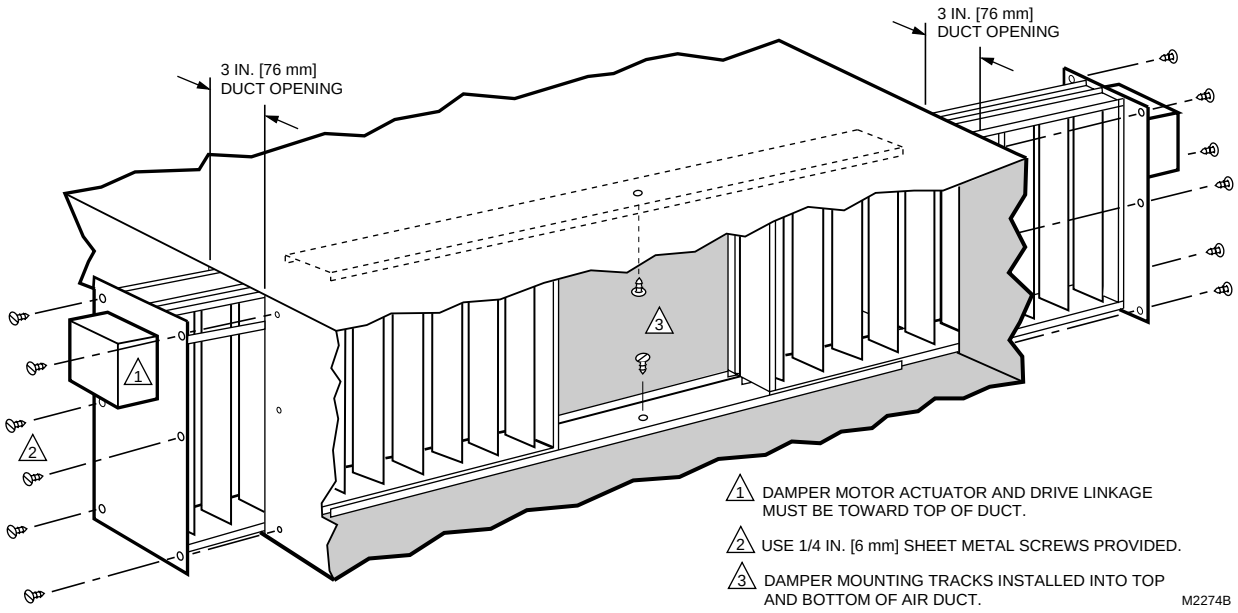


Fig. 49—Installing automatic opposed blade dampers.

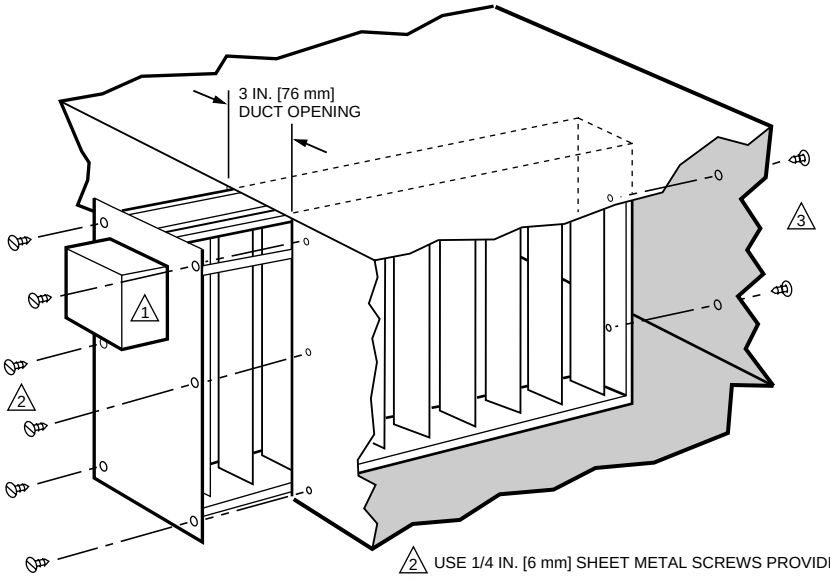
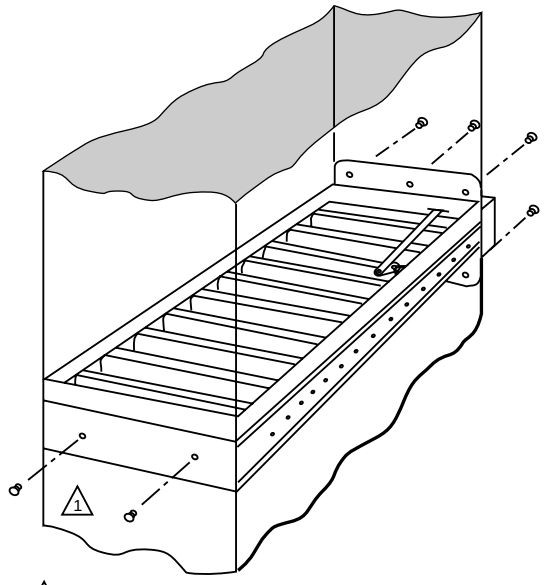


Fig. 50—Securing back of automatic opposed blade dampers to air duct.

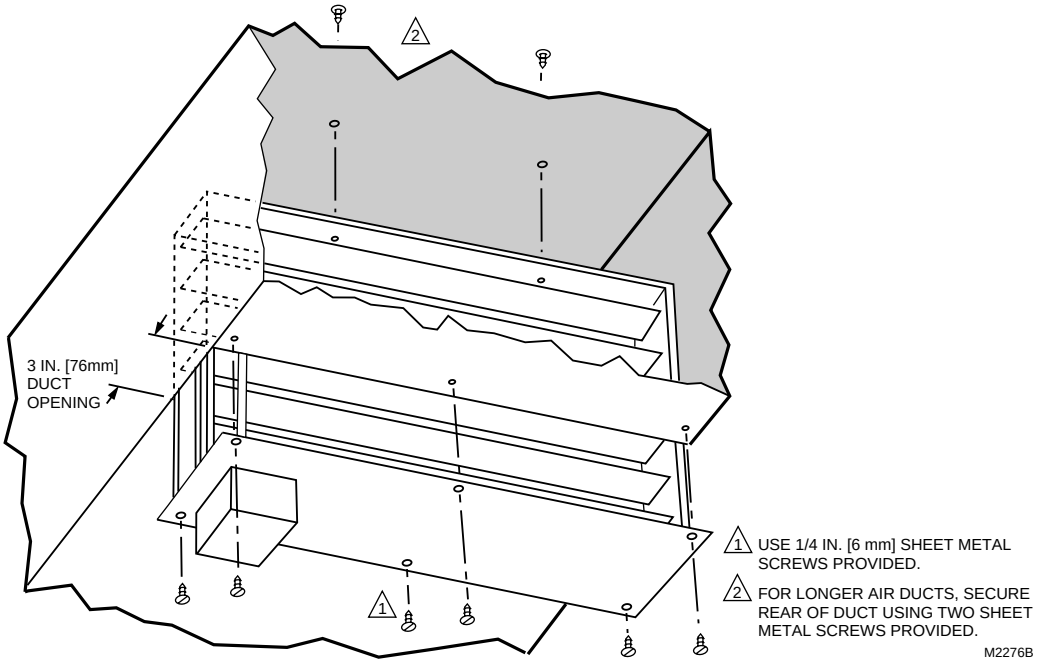


AOBD-BM DAMPERS

Install AOBD-BM dampers as follows:

1. Cut a 3 in. [76 mm] opening in the bottom or top of the air duct at the location selected. Ensure the opening is cut fully to the air duct seams on each side (Fig. 51).
2. Slide the AOBD-BM into the air duct.
3. Secure the AOBD-BM mounting plate to the air duct using the sheet metal screws provided.
4. Wire the AOBD-BM as shown on the job drawings.

Fig. 51—Automatic opposed blade damper-bottom mount installation.



Checkout and Test

NOTES:
1. Use the W180M software to easily monitor the system status.
2. See the W180 Zone Control System Owner's Manual, form 69-0770, for operating information on the S321A Touchpad.
3. See Appendix A: Troubleshooting section for troubleshooting information.

Before operating the system, perform the following checks and tests:

1. Verify that all wiring is securely connected to the correct terminals.

2. Verify that the temperature displayed on the Touchpad for each sensor is within range and reasonable for the site conditions.

3. Verify that the humidity reading displayed on the Touchpad for the humidity sensor is within range and reasonable for the site condition.

4. Verify that each alternate fuel device operates within the specifications stated in the literature for the device.

5. Verify that each piece of HVAC equipment operates properly as follows:

a. Dampers and fans:
   1) Disable the heating/cooling equipment and manually turn On the fans. Verify fan operation.
   2) Set the System Mode to Auto and use the override function to change the setpoint in each zone, one at a time.
      a) Verify that the damper opens and closes appropriately.
      b) If using a PC on site, use the W180M Software at the PC to check that dampers are positioned as shown on the monitor screen. Dampers may also be positioned manually to assist in system checkout.
   3) Enable the heating/cooling equipment from step 1) and verify that the equipment operates according to the setpoints set at each Touchpad.
   4) Verify operation at each of the Auto/Heat/Cool settings. Use the override function to create a demand, if necessary.

b. Hydronic valves:
   1) Use the override function to change a setpoint in each zone, one at a time.
      a) Verify that the circulation pump turns On and that the temperature in that zone changes.
      b) If using a PC on site, use the W180M Software at the PC to check that the valve is open or closed.

2) Verify that the heating and cooling equipment operates according to the setpoints set at each Touchpad.
3) Verify operation at each of the Auto/Heat/Cool settings. Use the override function to create a demand, if necessary.

SENSORS

Check out the sensors as follows:

1. Check the shield ground (if used) on wiring (zero resistance to ground). Replace if necessary.
2. Check the connectors at both ends of the wiring for proper connection. Tighten or replace if necessary.
3. Check the sensor for correct installation.
4. Verify proper readings at the S321A Touchpad and installation monitor screen.
5. *T7660B only:*
   a. Push and hold the override button for one second. The LED should light to indicate override.
   b. Push again and hold. The LED should go Off.

DAMPERS

CAUTION

Do not check operation by shorting across the terminals of the system controls.

Damper Checkout

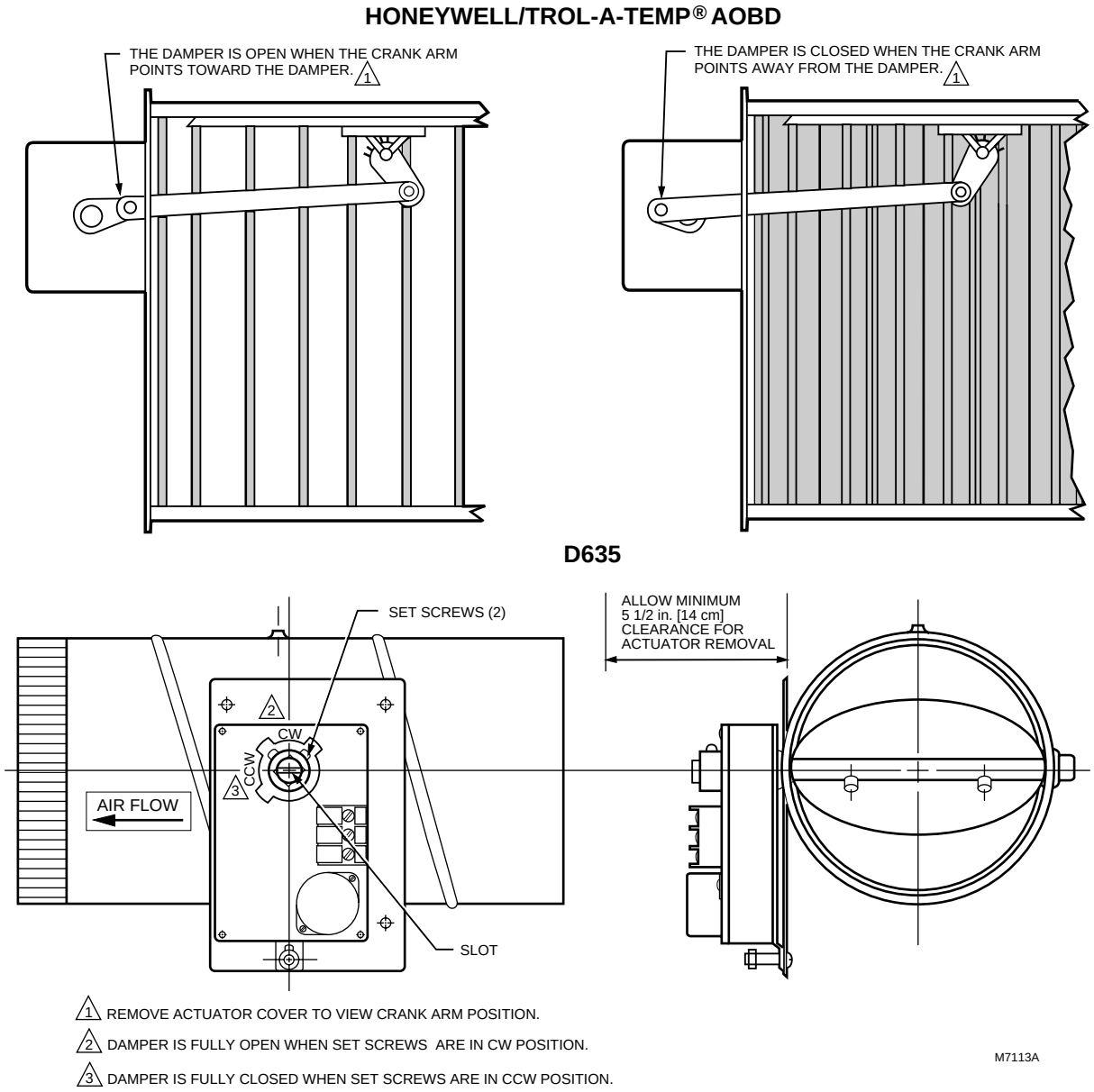
Checkout the D635 Damper/ML6161 Actuator as follows:

1. Disconnect the devices from the W180A Controller.
2. Apply 24 volts across the appropriate common cw (clockwise) terminals; verify that the damper opened. It takes 90 seconds for the damper to run a full cycle. If the damper opened, go to step 3; otherwise, go to step 4.
3. Apply 24 volts across the appropriate common ccw (counterclockwise) terminals; verify that the damper closed. If the damper opened, this procedure is completed; otherwise, go to step 4.
4. If the damper did not function properly, check that the damper blade is not obstructed. If the damper blade can move freely, replace the ML6161.

Checkout the AOBD Damper as follows:

1. Disconnect the devices from the W180A Controller.
2. Apply 24 Vac between Terminals 1 and 4 for 15 seconds and then remove the 24 Vac.
3. Apply 24 Vac between Terminals 1 and 6 for 15 seconds and then remove the 24 Vac.
4. Verify that the damper is fully closed (Fig. 52).
5. Reapply 24 Vac between Terminals 1 and 4 for 15 seconds.
6. Verify that the damper is fully open.
7. If the damper did not function properly, check that the damper blade is not obstructed. If the damper blade can move freely, replace the damper.

Fig. 52—Determining damper position.



W180 SYSTEM CHECKOUT USING A TOUCHPAD

Check out the W180 System using a Touchpad as follows:

Heating

1. Set Mode to Heat for the HVAC system being checked.
2. Set all zone setpoints except one to 10 degrees F [6 degrees C] below the zone temperature.
3. Set the zone setpoint from step 2 to 10 degrees F [6 degrees C] above the zone temperature.
   - — The furnace should start after the expiration of the switchover time or minimum off time.
   - — The fan should start after a short delay.
   - — Visually verify that the damper(s) or valve(s) for the selected zone opens fully.
4. Set one of the remaining zone setpoints to 10 degrees F [6 degrees C] above the zone temperature.
   - — The zone damper should open.
5. Set the same zone setpoint to 10 degrees F [6 degrees C] below the zone temperature.
   - — The zone damper should close.
     NOTE: Depending on the minimum airflow requirements, the damper may not fully close.
6. Repeat steps 4 and 5 for all remaining zones.
7. Set the setpoint for the first zone worked on to 10 degrees F [6 degrees C] below the zone temperature.
   - — The furnace should stop immediately.
   - — The fan should stop after a short delay.
8. Return to the correct profile and mode setting.

Cooling

CAUTION

Do not operate cooling equipment when the outdoor air temperature is below 50° F [10° C]. See the manufacturer's recommendations.

1. Set Mode to Cool.
2. Set all zone setpoints except one to 10 degrees F [6 degrees C] above the zone temperature.
3. Set the zone setpoint from step 2 to 10 degrees F [6 degrees C] below the zone temperature.
   - — The cooling equipment and fan should start following the expiration of the switchover time or minimum off time.
   - — Visually verify that the damper(s) for the selected zone open fully.
4. Set one of the remaining zone setpoints to 10 degrees F [6 degrees C] below the zone temperature.
   - — The zone damper should open.
5. Set the same zone setpoint to 10 degrees F [6 degrees C] above the zone temperature.
   - — The zone damper should close.
     NOTE: Depending on the minimum airflow requirements, the damper may not fully close.
6. Repeat steps 4 and 5 for all remaining zones.
7. Set the setpoint for the first zone worked on to 10 degrees F [6 degrees C] above the zone temperature.
   - — The cooling equipment and fan should stop immediately.
8. Return to the correct profile and mode setting.

W180 SYSTEM CHECKOUT USING A PC

Check out the W180 System using a PC as follows:

1. Verify that communication was established between the PC and the W180A Controller.
2. Verify that the proper configuration was downloaded to the W180A Controller and is running.
3. Turn On the fan using the PC and verify that the fan turned On.
4. Manually open each damper to 100 percent using the PC. Confirm that each damper opened by feeling the airflow through the duct vent.
5. Manually close each damper (one at a time) using the PC. Confirm that each damper closed by feeling the absence of or minimal airflow through the duct vent.

Program the System

Refer to the W180 Zone Control System Programmer's Manual, form 69-0761, to program the W180 System.

Appendix A: Troubleshooting

TABLE 11—W180A CONTROLLER.

Problem	Solution
No functions work.	1. Verify power is properly connected. 2. Verify the dc power connections and polarity. 3. Observe the LED on the motherboard. During normal operation, the LED flashes once per second. a. If the LED does not flash, check the power connections. b. If the LED flashes two times per second, no application has been loaded. 4. Verify all cable connections between the W180A Controller chassis and the wire termination board. 5. Verify that all relay cards are seated properly. 6. Verify that the relay cards are installed with the components facing to the right.

TABLE 12—S321A TOUCHPAD.

Problem	Solution
No display.	1. Verify there is 12 Vdc between the red and black wires at the S321A Touchpad. 2. Readjust the contrast setting. See the S321A Touchpad Specification, form 63-0104, for more information. 3. Replace the S321A Touchpad and reset the system.
Keys do not work.	1. Verify that the W180A Controller is operating (LED is flashing once per second). 2. Verify the connection and the wiring between the S321A Touchpad and W180A Controller. 3. Replace the S321A Touchpad and reset the system.
Incorrect displays/ screens.	1. Verify that the correct application was downloaded into the W180A Controller. 2. Interrupt power to the W180A Controller and the S321A Touchpad. Reconnect the power and wait two to three minutes for the proper application to be displayed.
Touchpad does not respond to the W180A	1. Turn off power to the W180A Controller. 2. Remove five screws to expose the W180 motherboard. 3. Turn on power to the W180A Controller and monitor the two LEDs located under the relay card on the right side. a. If the LEDs do not flash, the EEPROM above the LEDs is inserted incorrectly or the W180A is not communicating and must be replaced. b. If the LEDs only flash together at the same time, the W180A is sending data to the Touchpad, but the Touchpad is not sending data to the W180A. Verify that the H3 and H4 wiring is correct. NOTE: If the LEDs flash together most of the time, but occasionally flash out of unison, the W180A and Touchpad are communicating correctly.

TABLE 13—HIGH LIMIT CONTROLLER.

Problem	Solution
Heating equipment not operational.	1. Verify the limit controller setpoint does not interface with normal return air temperatures. 2. Make sure the device is mounted in an area of the return air that is not subject to temperature extremes (for example, attics, garages, and unconditioned crawl spaces).

TABLE 14—TEMPERATURE SENSORS.

Problem	Solution
Reading wrong temperature.	1. Verify that there are no inductive loads nearby. 2. Verify that nothing is covering the sensor. 3. Verify that there is not a heating or cooling source nearby. 4. Verify that all connections are secure. 5. Verify the zoning assignments. 6. If equipped, check the override button. 7. Verify that the W180A Controller is operating (LED is flashing once per second). 8. Verify the wiring between the sensor and the W180A Controller. 9. Replace the sensor.
No temperature reading.	1. Verify that the W180A Controller is operating (LED is flashing once per second). 2. Verify that all connections are secure. 3. Verify the wiring between the sensor and the W180A Controller. 4. Replace the sensor. 5. Verify that the sensor input is working by inserting a 3.3K resistor between the input + and –. This should give a reading of about 43° F (C7130A and T7660A/T7660B) and 71° F (C7180A).

TABLE 15—DAMPERS.

Problem	Solution
No airflow when damper should be open or air-flow when the damper is closed.	1. Verify that the damper is open/closed as required. NOTE: The D635 damper is bidirectional and takes 90 seconds to fully open or close. AOBD dampers are unidirectional and take 15 seconds to complete a cycle. They must complete a cycle before another cycle can begin. 2. Verify that 24 Vac is present at the damper. 3. Verify that the damper is wired properly and verify the zone assignment. 4. Verify that the W180A Controller is operating (LED is flashing once per second). 5. Verify that the relay cards are seated properly. 6. Verify that there are no obstructions at the damper. 7. Verify that there is not a hole in the duct. 8. Verify that the actuator operates. 9. Verify that the gear box, crank arm, and/or collar are functional. 10. Replace the damper.
Damper makes squeaking or scratching sounds.	1. Verify that the damper is not out of round or square. 2. Verify that the damper blade is secure in the shaft. 3. Verify that the shaft is in the collar. 4. Verify that there is not water in the drive mechanism. 5. Verify that there is nothing between the damper and duct.
Noisy air flow.	Insulate around the duct where the noise is heard.

TABLE 16—VALVES.

Problem	Solution
Valve does not open or close.	1. Verify that the W180A Controller is operating (LED is flashing once per second). 2. Verify that the valve is wired to the correct relay output. 3. Verify that the relay output is configured properly. 4. Verify that the relay cards are seated properly. 5. Verify that there are no obstructions at the valve. 6. Replace the valve.

Appendix B: Worksheets

Two worksheets are available to aid in programming the W180A Controller:

— HVAC Configuration Form: Used to gather data regarding individual HVAC Systems. Complete one HVAC Configuration Form for each HVAC System. An HVAC System can be any one of the following:
  • Furnace, A/C, and Fan supplying conditioned air by dampers to one or more zones.
  • Heat Pump supplying conditioned air by dampers to one or more zones.
  • Boiler/Circulation Pump supplying hot water heat by valves to one or more zones.
  • An electric baseboard heater controlled through a 24 Vac relay.

— Homeowner Lifestyle Worksheet: Used to determine the schedules for the Profiles based on the preferences of the customer.

HVAC CONFIGURATION FORM

Complete as follows:

1. File Name. Enter a name for this job site (8 characters max). This must be the same for each HVAC System on a job site.

2. Enter the Customer Name and Customer Address. This must be the same for each HVAC System on a job site.

3. Enter the HVAC System Name. This can be any name that best describes the HVAC System. (System #1, Lower Level, West Wing, etc.)

4. Enter the HVAC System Description (1 Stage Cool, 2 Stage Heat Pump, Furnace with 2-Stage A/C, Radiant Heating, etc.)

5. For each piece of equipment, enter the:
   a. Name. This can be any name that best describes the equipment.
   b. Type. This describes the equipment function (Fan, Furnace, Elec Heat, A/C Unit, Heat Pump [Compressor], Reversing Valve, Circ Pump, Other).
   c. Used For. This specifies the actual condition in which the equipment should be activated.
      — Heating: Activates the equipment when the stage is calling for heat.
      — Cooling: Activates the equipment when the stage is calling for cool.
      — Normal: Activates the equipment in connection with the Heat or Cool selection for normal operating conditions.
      — Alternate Alt Fuel: Activates the equipment in connection with the Heat or Cool selection for operation in alternate fuel conditions. An alternate fuel condition is when the outside temperature is below (for heat) or above (for cool) the Outside Temperature for Use of Alt Equipment setting.
      — Overrun: Activates the equipment when the stage is in the fan Overrun mode.
   d. Used for Stages (1, 2, or 3). This specifies the equipment function for each stage of heating or cooling.

6. For each stage, enter the Stage attributes:
   a. Emergency Heat: If checked, all heating equipment defined in this stage will be used during manual system override to Emergency Heat mode in place of the first stage heat pump equipment in heating.
   b. Fan Overrun Time (minutes):
      — Heating: The length of time in minutes the fan defined for this stage is active following a call for heating. Min: 2; Max: 30; Default: 2.
      — Cooling: The length of time in minutes the fan defined for this stage is active following a call for cooling. Min: 2; Max: 30; Default: 2.
   c. Minimum Off Time (minutes):
      — Heating: The length of time in minutes that must expire following a call for heating before another call may begin. Min: 3; Max: 30; Default: 3.
      — Cooling: The length of time in minutes that must expire following a call for cooling before another call may begin. Min: 3; Max: 30; Default: 3.
   d. Outdoor Temp for Lockout (°F):
      — Heating: The outdoor temperature that, when exceeded, will lock out calls for heating. Min: 10° F; Max: 99° F; Default: 90° F.
      — Cooling: The outdoor temperature that, when exceeded, will lock out calls for cooling. Min: 10° F; Max: 99° F; Default: 50° F.
   e. Outdoor Temp for Alt Fuel Equip:
      — Heating: When the actual outdoor temperature is below this value, any heating equipment set up during configuration as Alternate—Heat will be activated in place of the equipment defined as Normal—Heat. Min: 10° F; Max: 99° F; Default: 40° F.
      — Cooling: When the actual outdoor temperature is above this value, any cooling equipment set up during configuration as Alternate—Cool will be activated in place of the equipment defined as Normal—Cool. Min: 10° F; Max: 99° F; Default: 90° F.
   f. Differential (Δ° F offset from 1st Stg):
      — Heating: The number of degrees below setpoint the average zone demand must exceed before this stage is activated.
        Stage 1: Min: 0° F; Max: 20° F; Default: 0° F.
        Stage 2: Min: Stage 1 + 1° F; Max: 20° F; Default: 4° F.
        Stage 3: Min: Stage 2 + 1° F; Max: 20° F: Default: 6° F.
      — Cooling: The number of degrees above setpoint the average zone demand must exceed before this stage is activated.

Stage 1: Min: 0° F; Max: 20° F; Default: 0° F.
Stage 2: Min: Stage 1 + 1° F; Max: 20° F; Default: 4° F.
Stage 3: Min: Stage 2 + 1° F; Max: 20° F; Default: 6° F.

7. For each Zone Controlled on this HVAC System, enter the:
   a. Zone name (14 alphanumeric characters) (Living Room, Dining Room, Master Bedroom, etc.)
   b. Temperature Sensor Used (one per zone) (C7180, C7130, T7660A, or T7660B).
   c. T7660B Override Duration in hours and the heating and cooling Setpoints (if T7660B sensor is used).
   d. Dampers Used (D635 or AOBD)and Total Area (sq in.). If more then one damper is used per zone, sum the damper area for each and enter the total.
   e. Valves Used (NO or NC).
   f. Priority Zone check mark. This will cause the system to prioritize this zone when deciding how to satisfy simultaneous demands for heating and cooling.
8. Enter the Changeover time. This is the minimum length of time between system mode changes. Min: 10 min; Max: 100 min; Default: 10 min.
9. Enter the Minimum Aggregate Damper Opening:
   a. Heating: Minimum aggregate damper open area will never be lower than this setting in the heating mode. Dampers to zones not calling for heat will modulate partially open when the system demand alone does not provide adequate open damper area. Min: 35; Max: 100; Default: 35 (75 to 85% max cfm).
   b. Cooling: Minimum aggregate damper open area will never be lower than this setting in the cooling mode. Dampers to zones not calling for cooling will modulate partially open when the system demand alone does not provide adequate open damper area. Min: 25; Max: 100; Default: 25 (65 to 75% max cfm).
10. Enter the Anticipation Settings:
   a. Heating: For heating equipment. A value greater than 1 increases the equipment cycle rate; a value less than 1 decreases the equipment cycle rate. Min: 0.0; Max: 1.5; Default: 1.0. Recommended values:
      — Electric: 1.5.
      — Forced Air: 1.2.
      — Heat Pump: 1.0.
      — Hydronic/Radiant: 0.8.
   b. Cooling: For cooling equipment. A value greater than 1 increases the equipment cycle rate; a value less than 1 decreases the equipment cycle rate. Min: 0.0; Max: 1.5; Default: 1.0. Recommended values:
      — Cooling Compressor: 1.0.

HOMEOWNER LIFESTYLE WORKSHEET

Prior to filling out this form, verify that for each of the HVAC Systems there are adequate relay outputs and sensor inputs to satisfy the requirements. If not, reduce the number of zones.

Complete this form as follows:

1. Explain to the homeowner that you need to know the normal sequence of events in the house for each day of the week so that you can determine what the various Profiles are. Explain that a Profile is a part of the schedule entered into the W180A Controller that controls selected equipment in user-selected zones and times.

2. Determine what zones are required and enter the Zone Names (14 alphanumeric characters maximum) on the form.

3. Enter the profile information beginning with Sunday. Determine what happens first (Profile Name—14 alphanumeric characters maximum), what time the event happens (Start Time), Days (day of the week) which rooms (Zones) are involved, and the heating and cooling setpoints (entered under the appropriate zone). For example, the parents get up at 7:00 AM and use the master bedroom, master bathroom, and kitchen. On the form you would enter Parents Awake (Profile Name); 6:50 AM (Start Time); S (Days); 72H, 70C (setpoints under the zones for the master bedroom, master bathroom, and kitchen).

4. Ask what event happens next. Determine what time it happens, which rooms (zones) are used, and the heating and cooling setpoints. Enter the information as required.

5. Enter the required information for each event that happens during the day.

6. Repeat steps 3 through 5 for each day of the week.

NOTE: Some profiles can be used on multiple days in those cases, indicate the days that the profile is used.

Homeowner Lifestyle Worksheet

W180 Zone Control System

Directions:
1. Provide Zone Names (up to 10), Profile Names (up to 20), and Start Times.
2. Indicate the desired heating and cooling setpoints.
3. Identify with a √ which zones are occupied for each profile.

Preferred Temperature Setpoints*

Occupied—Heating _____ Unoccupied—Heating _____

Occupied—Cooling _____ Unoccupied—Cooling _____

				Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10
No.	Profile Name	Start Time	Days										
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													

Example:

1	Wake	5:30 AM 7:00 AM	M-F Sat., Sun.	Living Room	Kitchen/Dining √	Den	Master Bath √	Master Bath 69/74*	Kid's Room √	Guest Room	Study	Rec Room	

*Setpoints can be different than "preferred setpoints;" see example.

Appendix C: HVAC System Basics

AIRFLOW CHARACTERISTICS

Air, when enclosed, pushes equally against all sides of a container. When an opening is provided in the container, air flows out of the container until the pressure inside and outside are equal. Air always flows from regions of higher pressure to regions of lower pressure. The greater the pressure differential, the faster the air flows.

In HVAC system design, the ratio of airflow pressure to total pressure is controlled to ensure that each room receives the right amount of air flow to supply the heating or cooling requirements. Total pressure has two components: static pressure and velocity pressure.

Static pressure is the pressure exerted by air against the sides of a container (in this case the duct). Static pressure is measured as the difference between duct pressure and atmospheric pressure, and can be positive or negative. In a forced-air heating/cooling system, static pressure is supplied by the blower. It is positive on the supply side and negative on the return side.

When the container has an outlet so that air flows, part of the static pressure is transformed into velocity pressure, which is the pressure exerted by the air in the direction of the airflow. Like static pressure, velocity pressure is measured as the difference between duct pressure and atmospheric pressure, but can only be positive. Velocity pressure correlates directly with air speed.

At any given point in the duct, static pressure and velocity pressure always equal total pressure. So if static pressure increases and total pressure remains the same, velocity pressure drops.

Total pressure is greatest at the face of the blower. As air moves through the duct system, total pressure drops. It is neutral once the air leaves the outlet and mixes with the room air, but negative in the return air ducts. Pressure is lost because of friction, leakage and turbulence. Friction is caused by moving air rubbing against the sides of the duct. Friction losses must be known to determine the blower capacity required to provide adequate air flow to each zone. Leakage should be minimal in a well-constructed duct system. Turbulence is increased whenever the duct changes size or direction; thus such changes should be kept to a minimum and should be gradual.

Some factors that affect air flow and pressure in an HVAC system are:

- *Duct size*. As the duct size increases, static pressure increases and velocity pressure decreases.
- *Transitions, angles, and rough surfaced ducts*. These all cause greater friction losses than straight, smooth ducts and thus cause pressure loss. To simplify calculations, these friction losses are measured as equivalent lengths of straight, smooth ducts.
- *Fan characteristics*. Blade efficiency, fan speed, and fan horsepower all affect the amount of pressure that can be supported.
- *Dampers*. When a damper with seals closes, the total pressure downstream matches the atmospheric pressure and the total pressure in the rest of the system increases. Manual dampers in each takeoff duct are adjusted after the system is installed to equalize the air distribution.
- *Register or grille design*. To the extent that the grille or register offers resistance to air flow, it adds to pressure drop. The primary considerations when choosing registers are *throw*—how far will the airstream move into the room before it dissipates; and *spread*—how much the airstream will fan out immediately after leaving the register.

ZONING

Purpose of Zoning

Zoning is a way of ensuring that each area of a home or building receives the right amount of heating or cooling. Zoning allows the occupant to independently control the temperature in each area of the home or building. If desired, all areas can be kept at the same temperature or each area can be adjusted for occupancy patterns and uses.

Zoning is particularly useful where normal heat distribution patterns result in uneven temperature control. For example, a building that is partly below grade can use zoning to eliminate uneven temperature control between the basement and the rest of the building. Large or sprawling buildings that might have long, unequal length duct runs can use zoning to equalize the delivery of conditioned air. Buildings with many large windows can use zoning to compensate for solar heat gain and radiation losses at night.

Zoning can add to comfort and possibly energy savings by keeping various zones at different temperatures. Temperature settings can be scheduled to fine-tune a zoned system to match usage patterns.

Zone Selection

Location, heat gain (loss), usage, and size are the primary considerations in defining zones. Rooms in a zone should be in the same area of the building. Also, they should have similar uses and occupancy patterns. Rooms that are subjected to heavy heat loads or heat loss because of large windows, exposure to prevailing winds, or other reasons should be zoned separately.

DUCT SYSTEMS

The basic duct system types are:

- Loop perimeter.
- Radial perimeter.
- Extended plenum.

Generally, systems with low outlets on outside walls are more suited to locations where heating is a primary concern, and systems with high outlets on either outside or inside walls are better choices where cooling is a primary concern.

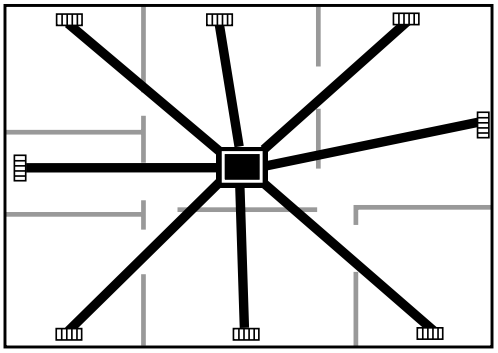
Loop Perimeter System

Zoning is not recommended for loop perimeter systems.

Radial Perimeter System

The radial perimeter system (Fig. 53) is also often used in single story slab construction. In areas where heating is of primary importance, ducts can be below the flow with low wall outlets. In areas where cooling is a primary concern, the heating/cooling equipment and ducts can be located in the attic with high sidewall outlets. The system is best used where the heating/cooling equipment is centrally located and all the runs can be about the same length. Because extra headroom is required where ducts must cross floor joists, this system is not as popular for basement applications.

Fig. 53—Radial perimeter system.



SYSTEM SIZING FOR FORCED AIR APPLICATIONS

The key to providing even, comfortable environmental control in any system, but especially in a zoned system, is choosing the best combination of duct size, mechanical equipment size, and fan size and type for the application. The necessary steps are summarized below and explained in greater detail in books on comfort conditioning system design such as the Air Conditioning Contractors of America Manual D, "Duct Design for Residential Winter and Summer Air Conditioning and Equipment Selection."

NOTE: Never undersize the ducts. Oversize to the next damper size.

1. Calculate the sensible winter heat loss and the summer heat gain, both sensible and latent, for each room.
2. Add the loads for each room to obtain the total system design load. In a zoned system, also add loads for each zone.
3. Calculate the design cfm for each room, each zone when the system is zoned, and for the system.
4. Choose heating and cooling equipment that meets the design load. Depending on the zone layout and anticipated occupancy patterns, it may be possible to select slightly smaller equipment for a zoned system. Make sure that the blower cfm is in the range of the design cfm.
5. Locate enough supply outlets in each room to cover the design heat loss/cooling gain and sketch the duct layout. Avoid angles and abrupt changes in duct size where possible.
6. Size the zone takeoff, branch ducts, and trunk to provide the required cfm to each room, remembering that velocity should not exceed 700 cfm in the main trunk and 600 cfm in each supply and that every run should have the same pressure loss.
7. Locate the return inlets; sketch the return runs; and repeat step 6 for the return system.
8. Choose outlet registers and inlet grilles to provide the desired air distribution pattern.
9. Include a return for every room; include two returns for rooms with three or more supplies.

DAMPER SELECTION

If at all possible, install dampers where they are accessible for service. Models are available for side or bottom insertion into existing rectangular ducts, for internal mounting as the ductwork is assembled, and for use with round ducts. The dampers can be mounted in any position, except side and internal mount models used in horizontal ducts must be mounted with the actuator toward the top of the duct to reduce operating friction and minimize dirt accumulation on the linkage.

Rectangular dampers are sized smaller to fit in the ductwork. Choose a damper the same nominal size as the duct. Round dampers are sized slightly smaller than the duct air inlet and slightly larger on the air outlet so they will slip in easily and be less likely to bind. Never force a damper into an undersized duct because the resulting pressure will cause the blades to bind. When necessary, install two rectangular dampers back-to-back; this application requires U-channel mounting tracks, available from Honeywell, to keep the damper stable under conditions of high velocity air flow. Mounting tracks are also required with rectangular dampers over 20 x 8 in. [508 x 203 mm], 18 x 10 in. [457 x 254 mm], and 16 x 12 in. [406 x 305 mm] unless they can be secured from both sides of the duct.

When an internally mounted motorized damper is used, install it just upstream from a register, or install the damper just ahead of a right angle to allow access for motor service.

Motorized dampers are usually installed close to the heating and cooling equipment. They can be installed in a divided plenum on a two-zone system; they must be downstream from the manual balancing dampers.

For humidification, use evaporative type or return air type humidifiers. Do not use spray or atomization type humidifiers installed in the furnace plenum or air supply duct.

SYSTEM SIZING FOR HYDRONIC/RADIANT HEATING APPLICATIONS

The key to providing even, comfortable environmental control in any system is choosing the best system type, valves, and other components for the application. The necessary steps are summarized below.

1. Size the piping for adequate water flow.
2. Size the system for adequate head pressure.
3. Determine the maximum valve operating temperature. The maximum operating temperature for motorized valves depends on the maximum ambient temperature at the valve location, and on the maximum fluid temperature.

Using the graph in Fig. 5, find the maximum valve operating temperature as follows (to find maximum ambient temperature for a valve when fluid temperature is known, reverse this procedure):

a. Measure ambient temperature at the valve and locate this temperature on the ambient temperature scale on the graph.
b. Draw a line from this ambient temperature, parallel with the fluid temperature scale, to the maximum fluid temperature line.
c. Draw a line from this point down to the fluid temperature scale to find maximum operating temperature. (Note the example, shown by the dashed line, in Fig. 54.)

4. Size the expansion tank.
5. Determine the elbow equivalents.
6. Determine the pipe flow resistances.
7. Determine the valve pressure drop. The pressure drop in psi [kPa], equivalent feet [meters] of pipe, or feet of water [kPa] can be calculated from Figs. 55 through 60 as follows:

a. Calculate the flow rate needed to heat the zone.
b. Determine the Cv [kV] rating of the motorized valve.
c. Select the graph corresponding to the Cv [kV] rating (Figs. 55 through 60).
d. Determine pressure drop across valve using procedure 1), 2), or 3).
   1) Pressure drop in psi [kPa].
      a) Locate the flow rate at the bottom of graph.
      b) Draw a line upward from the flow rate to the intersection of the curve.
      c) Draw a line from the curve intersection to the left edge of the graph to determine pressure drop in psi [kPa].
   2) Pressure drop in equivalent ft [m] of pipe.
      NOTE: Both 1/2 and 3/4 in. pipe conversion scales are available for this determination.
      a) Locate the flow rate at the bottom of graph.
      b) Draw a line vertically to top of the graph. Determine pressure drop for either 1/2 or 3/4 in. pipe.
   3) Pressure drop in ft of water [kPa].
      a) Locate the flow rate at the bottom of graph.
      b) Draw a line upward from the flow rate to the intersection of the curve.
      c) Draw a line from the curve intersection to the right edge of the graph to determine pressure drop in ft of water [kPa].

8. Determine the friction head for the system.
9. Size the pump or circulator.
10. Determine the piping arrangement (one-pipe, two-pipe, direct return, or two-pipe reverse return).
11. Determine the type of air removal vent to be used.
12. Determine if a pressure relief valve should be used.

VALVE SELECTION

Use Table 8 to choose the correct valve for the application based on the Cv rating determined during system sizing.

Fig. 54—Maximum temperature characteristics of valves with Class F motors.

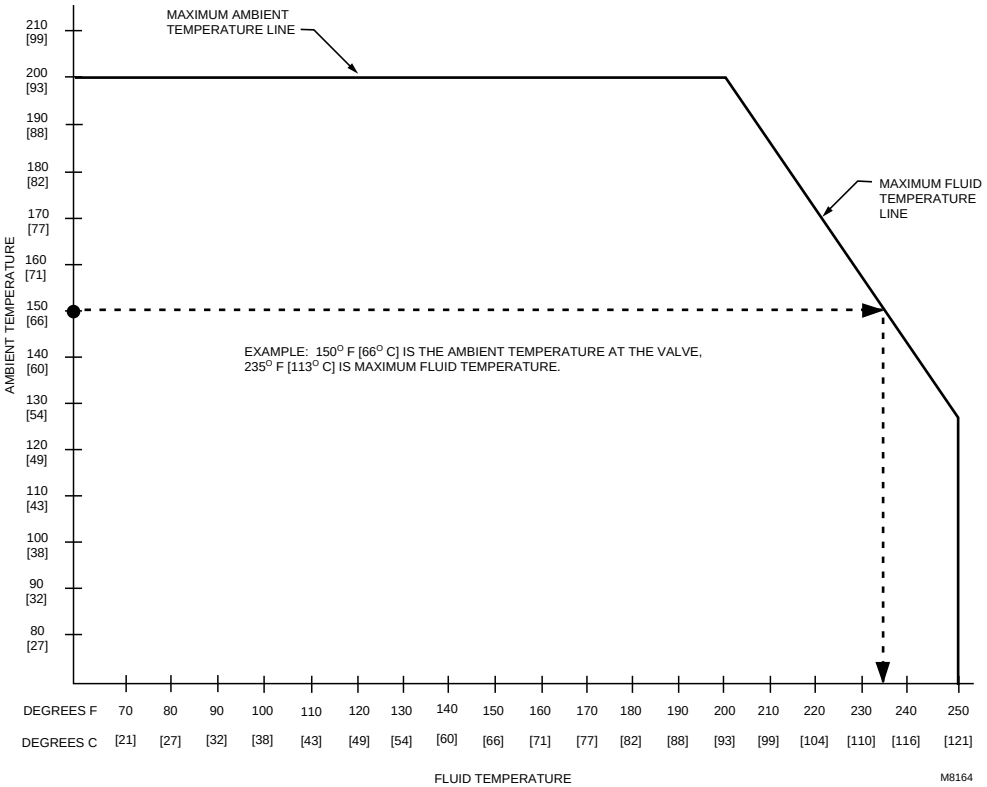


Fig. 55—Flow characteristics of 1 Cv [0.86 kV] valve.

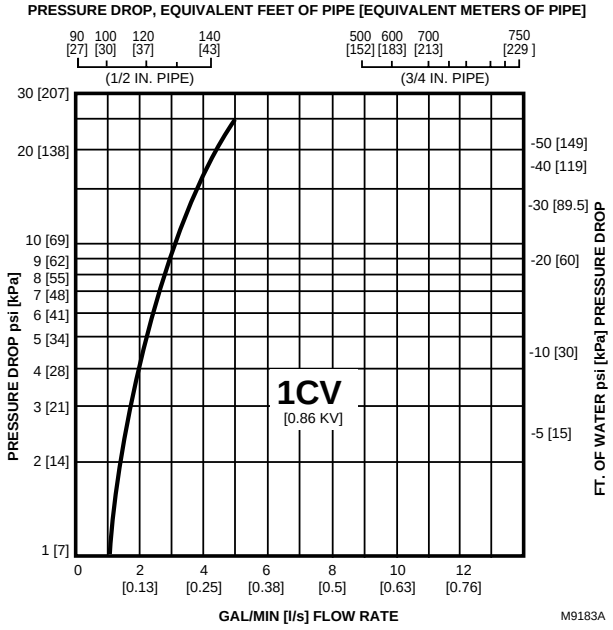


Fig. 56—Flow characteristics of V4043A model with 2.5 Cv [2.1 kV] rating and V4044A bypass port (B) with 2.5 Cv [2.1 kV] (reduced) rating.

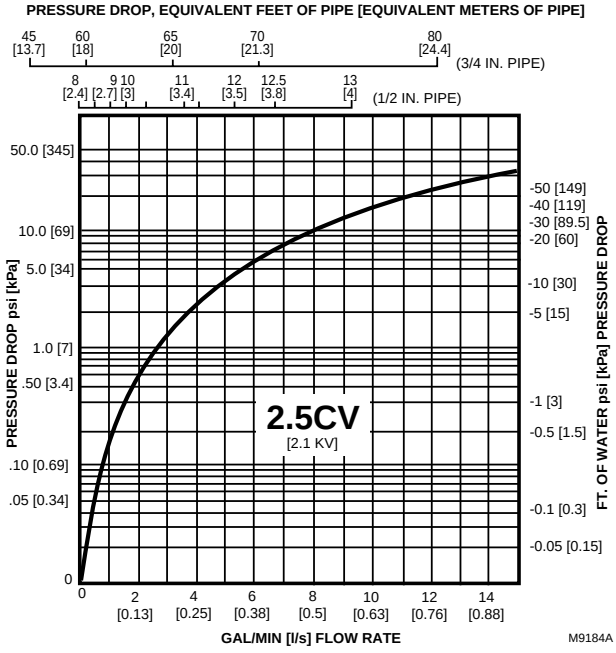


Fig. 57—Flow characteristics of 3.5 Cv [3.0 kV] valve.

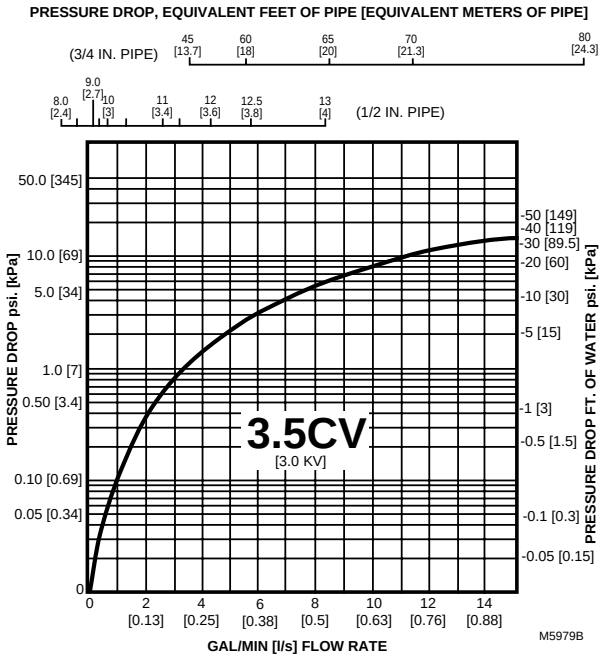


Fig. 58—Flow characteristics of 4 Cv [3.4 kV] valve.

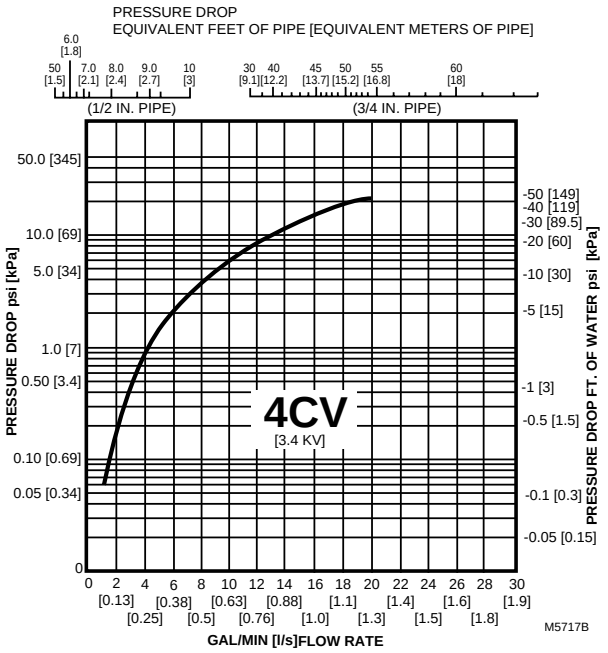


Fig. 59—Flow characteristics of 7 Cv [6.0 kV] valve.

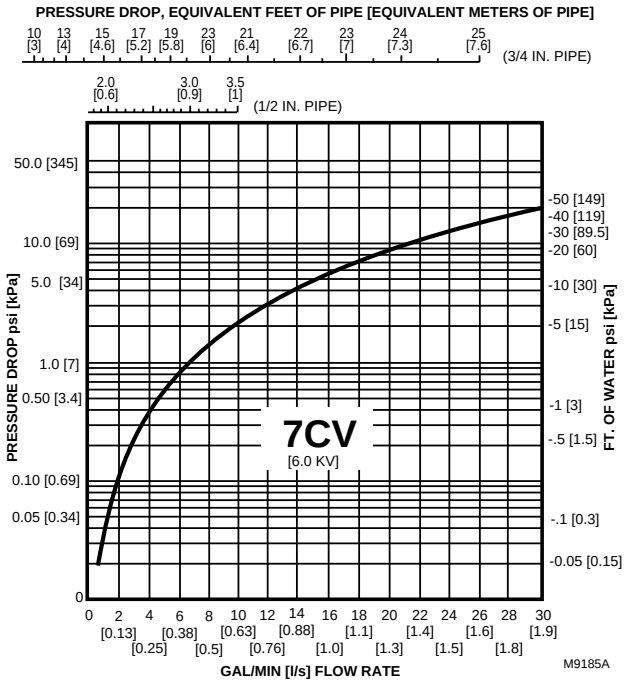
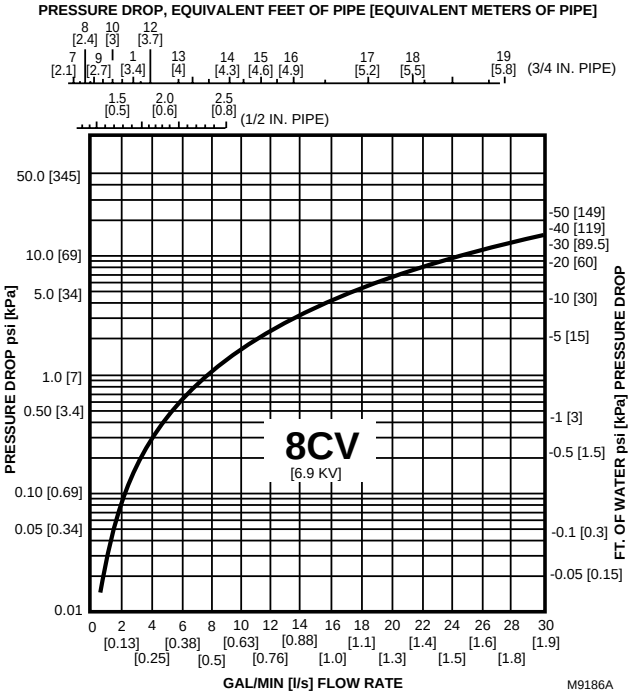


Fig. 60—Flow characteristics of 8 Cv [6.9 kV] valve.



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