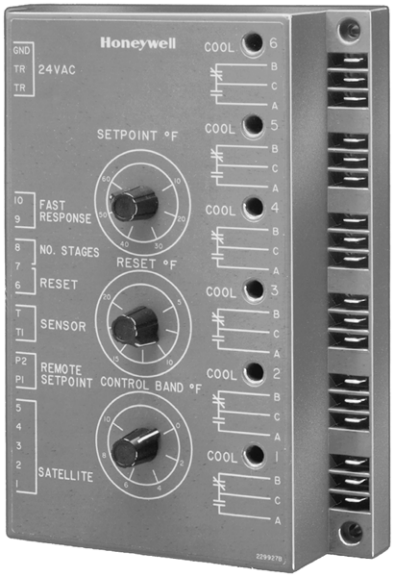
Honeywell

W7100G Discharge Water Temperature Control

PRODUCT DATA



FEATURES

- **Up to six stages of cooling provided.**
- **Expandable system up to 10 cooling stages using a W7101.**
- **Advanced proportional plus integral microprocessor control algorithm minimizes droop.**
- **Soft start to minimize compressor cycling during system start up.**
- **Adjustable minimum on/off timing and time delay between stages of either 30 or 60 seconds.**
- **Adjustable setpoint from 10 to 110°F (-12 to 43°C).**
- **Adjustable reset differential from 5 to 20°F (3 to 11K).**
- **Adjustable control band from 0 to 10°F (0 to 6K).**
- **Reset signal from either an outdoor air or space sensor.**
- **C7170 sensor can be used for sensing water temperature.**
- **LED show which stages of cooling are energized.**

APPLICATION

The microprocessor-based W7100G Discharge Water Temperature Control maintains an average discharge water temperature for reciprocating chiller applications, by staging on and off compressors or unloaders as required. The W7100 can provide up to 10 stages of cooling using a W7101 Satellite Sequencer.

Contents

SPECIFICATIONS

W7100G Model Features:
- 6 stage cooling, controls reciprocating chillers.
- W7101 satellite expansion to 10 cooling stages.
- Adjustable setpoint.

Dimensions: See Fig. 1.

Electrical Ratings:
Input Voltage and Frequency (terminals TR-TR):
At 60 Hz: 20 to 30 Vac.
At 50 Hz: 20 to 26.4 Vac.
Power Consumption:
Device: 12 VA at 24 Vac and 50 to 60 Hz.
On/Off Stages (Cool 1 through 6): See Table 1.

Table 1. Power Consumption On/Off Stages (Cool 1-6).

Contact	Voltage (Vac)	Inrush (VA)	Running (VA)
N.O.	24	240	60
N.C.	24	75	30
N.O.	120/240	750	75
N.O.	120/240	240	40

Switching: Spdt relays.

Wiring Terminals: 1/4 in. quick-connect.

Sensor Input Signal (See Fig. 2):
Positive temperature coefficient: 4.8 ohms/°F (2.6 ohms/°C).
Resistance: 3484 ohms at 77°F (25°C).

Number of Stages Input:
Resistor value (across terminals 7 and 6) to determine number of ON/OFF stages. (See Table 2).

Temperature Ratings:
Ambient: -40°F to +150°F (-40°C to +66°C).
Shipping: -30°F to +150°F (-34°C to +66°C).

Humidity Rating: 5 to 90 percent RH noncondensing.

Mounting: Four mounting holes in base. Use No. 6 screws (not provided).

Approvals:
Underwriter's Laboratories Inc. Component Recognized.

Additional System Components:
C7170A1010 Discharge Water Sensor: senses discharge water temperature, provides input to W7100G sensor terminals T and T1.
Transformer (required): Provides 24 Vac power for all components of the W7100G control system. (Size transformer to match system load.)

Accessories:
T7047C1025 Remote Temperature Sensor: Discharge water temperature reset from controlled space.
S96381037 Reset Setpoint Potentiometer: Use one or more T7047C1025 with S963B1037.
C7031G1016 Outdoor Air Sensor: Reset of discharge water from outdoor air temperature.
C7170A1010 Discharge Water Temperature Sensor: Senses discharge water temperature for input to W7100G.
W7101A1003 Satellite Sequencer: Adds up to 4 ON/OFF stages of cooling to W7100 switching capability.
121371A Copper Immersion Well: Required for C7170A Immersion Sensor.
121371E Stainless Steel Immersion Well Required for C7170A Immersion Sensor.
107406 Heat Conduction Compound: Required for minimum thermal lag.
AT72D1683 System Transformer: 40 VA, 120 Vac.
AT87A1106 System Transformer: 50 VA, 120/208/240 Vac.
AT88A1005 System Transformer: 75 VA, 120 Vac.
AT88A1021 System Transformer: 75 VA, 208/240 Vac.
4074EDJ Resistor Kit and Test Plug: Used in controller checkout.
4074EFV Resistor Kit for W7100G System Configuration: Used to select number of stages controlled.

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number.

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 Home and Building Control Sales Office (check white pages of your phone directory).
2. Home and Building Control Customer Relations
Honeywell, 1885 Douglas Drive North
Minneapolis, Minnesota 55422-4386

In Canada—Honeywell Limited/Honeywell Limitée, 35 Dynamic Drive, Scarborough, Ontario M1V 4Z9.
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.

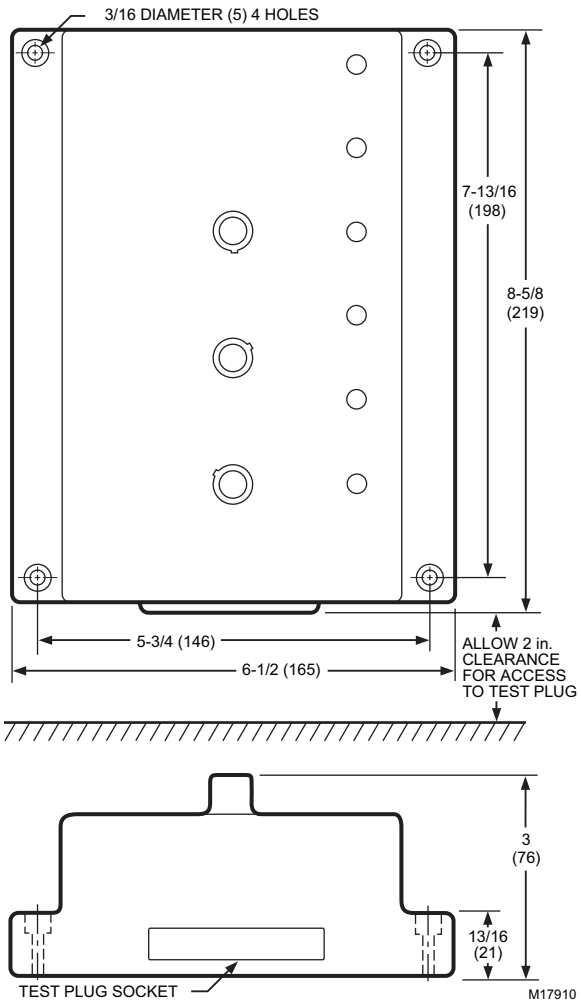


Fig. 1. W7100 Discharge Air or Water Controller mounting dimensions in in. (mm).

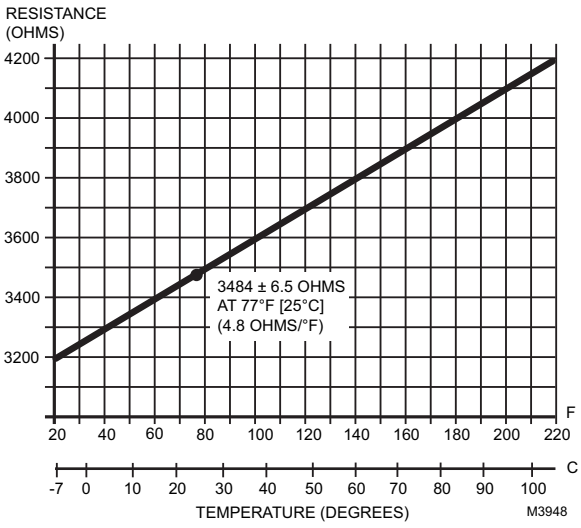


Fig. 2. Variation of C7170 Sensor resistance as compared to temperature.

INSTALLATION

When Installing this Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

WARNING: This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the Instructions Manual, may cause interference with radio communication. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case, users at their own expense will be required to take whatever measures may be required to correct the interference. Any unauthorized modification of this equipment may result in the revocation of the owner's authority to continue its operation.

⚠ CAUTION

Electrical Shock or Equipment Damage Hazard. Can shock individuals or short equipment circuitry.
Disconnect power supply before installation.

⚠ CAUTION

Equipment Damage Hazard.
Compressor stage ON/OFF times less than four minutes can damage the compressor.
Add external time delay relay(s) to W7100G output stages to turn compressors on and off (See Fig. 3).

IMPORTANT

All wiring must agree with applicable codes, ordinances and regulations.

Location and Mounting

Choose a location for the W7100G controller that is not exposed to the weather and where controls, connections and the diagnostic analyzer socket are accessible.

Mount the controller with four No. 8 screws through the mounting holes in the base. See Fig. 1.

Mount the C7170A Sensor in the discharge water line using the selected Immersion Well and heat-conductive compound.

Mount auxiliary control system components, such as remote potentiometers, reset sensors. etc., according to instructions packed with the individual units.

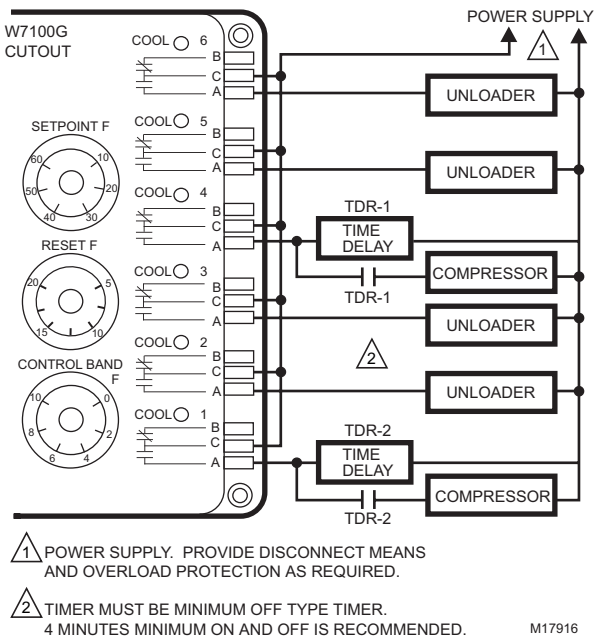


Fig. 3. Wiring W7100G using minimum on and minimum off timer(s) on compressor stages.

Wiring

W7100G wiring and hookup diagram is shown in Fig. 4.

⚠ CAUTION

Erratic System Operation Hazard.
Failure to follow proper wiring practices can introduce disruptive electrical interference (noise).

Keep wiring at least one foot away from large inductive loads such as motors line starters, lighting ballasts, and large power distribution panels.

Shielded cable is required in installations where these guidelines cannot be met.

Ground shield only to grounded controller case.

Changing Number of Controlled Stages

A fixed resistor is installed across the number of stages input (terminals 7 and 8). The resistor value tells the W7100G how many stages of cooling are to be controlled. This affects the control behavior and determines how many stages the W7100G will turn on and off.

A resistor is initially installed by the factory (600ohm) on terminals 7 and 8 (see Table 2). This corresponds to the value for controlling a 6-stage cooling system. If the system being installed has more or fewer stages of cooling, this resistor must be changed to the value shown in Table 2. The new value represents the actual number of cooling stages operating under the control of the W7100G. This includes any stages on a W7101A sequencer connected to the W7100G control.

Connecting Additional Stages

Control of up to 4 additional stages of ON/OFF cooling can be added by using a W7101A Satellite Sequencer to the W7100G system as shown in Fig. 4.

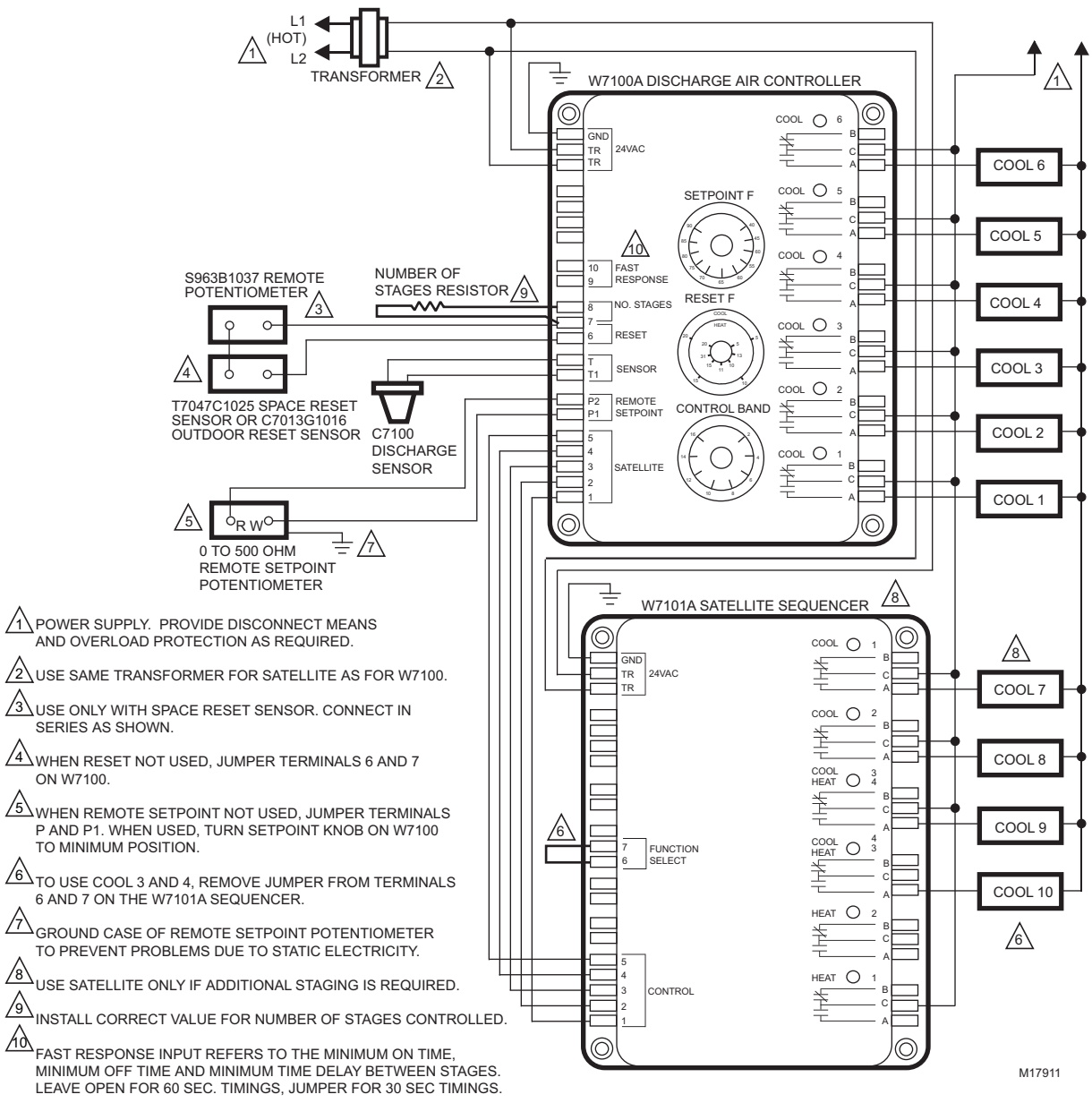
The fixed resistor value across the W7100G terminals 7 and 8 (Table 2) must agree with the total number of cooling stages controlled by the W7100G and W7101A satellite. See W7101 specification sheet, Form 63-2119, for additional details.

Table 2. Input Resistance for Number of Controlled Stages.

Total Number of Cooling Stages	Resistance ±1% Across Terminals 7 and 8[a] (Ohms)	4074EFV Bag Assembly Wire Colors[b]
1 (W7100 only)	100	Blue
2 (W7100 only)	200	Red
3 (W7100 only)	300	Yellow
4 (W7100 only)	400	Brown
5 (W7100 only)	500	Green
6 (W7100 only)	600	Shipped with Control
7 (W7100,W7101A)	700	Orange
8 (W7100,W7101A)	800	White
9 (W7100,W7101A)	900	Violet
10 (W7100,W7101A)	1000	Black

[a] Use 1/8W resistors.

[b] 4074EFV Bag Assembly available separately.



1. POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. USE SAME TRANSFORMER FOR SATELLITE AS FOR W7100.
3. USE ONLY WITH SPACE RESET SENSOR. CONNECT IN SERIES AS SHOWN.
4. WHEN RESET NOT USED, JUMPER TERMINALS 6 AND 7 ON W7100.
5. WHEN REMOTE SETPOINT NOT USED, JUMPER TERMINALS P AND P1. WHEN USED, TURN SETPOINT KNOB ON W7100 TO MINIMUM POSITION.
6. TO USE COOL 3 AND 4, REMOVE JUMPER FROM TERMINALS 6 AND 7 ON THE W7101A SEQUENCER.
7. GROUND CASE OF REMOTE SETPOINT POTENTIOMETER TO PREVENT PROBLEMS DUE TO STATIC ELECTRICITY.
8. USE SATELLITE ONLY IF ADDITIONAL STAGING IS REQUIRED.
9. INSTALL CORRECT VALUE FOR NUMBER OF STAGES CONTROLLED.
10. FAST RESPONSE INPUT REFERS TO THE MINIMUM ON TIME, MINIMUM OFF TIME AND MINIMUM TIME DELAY BETWEEN STAGES. LEAVE OPEN FOR 60 SEC. TIMINGS, JUMPER FOR 30 SEC TIMINGS.

Fig. 4. Connections for W7100G 10-stage cooling, with W7101 Satellite Sequencer, discharge sensor, reset sensor(s) and remote setpoint potentiometer.

OPERATION

Chiller System Description (Fig. 5)

Chiller systems are used to provide cold water for many types of end uses. The cold water may be piped to many air handling units located throughout a building. These units then provide cooling and ventilation for individual zones throughout that building. Chillers are also used to supply cold fluid for a variety of process applications. In either case, precise discharge water temperature control is desired.

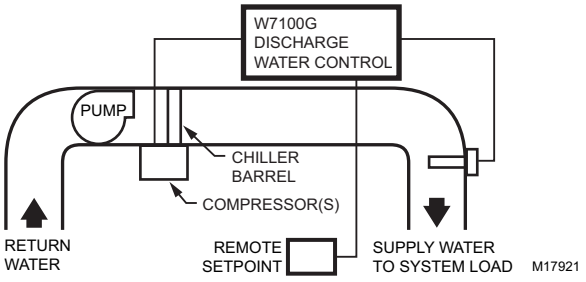


Fig. 5. Chiller system.

Discharge Water Temperature Control Operation

The W7100G uses an integrating control band concept to provide close, stable temperature control in discharge water chiller systems. The control band concept matches required operating capacity to chiller load, while the integral action minimizes the offset from the control setpoint which normally occurs in proportional-only type controllers.

The control band setting is centered on the discharge waters setpoint (see Fig. 6). The control band setting is adjustable from 0 to 10°F (0 to 6°C). This adjustment is used to stabilize system operation.

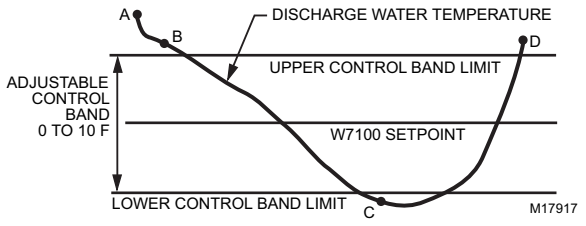


Fig. 6. Discharge water control algorithm operation.

A description of how chiller control stages operate follows:

1. Using Fig. 6 and beginning at point A, the discharge water temperature is above the upper control band limit and the minimum OFF time has elapsed (selectable either 30 or 60 seconds, using fast response input).
2. The W7100 first stage energizes.
3. At point B, the discharge water temperature is still above the upper control band limit.
4. If the minimum time between stages has elapsed (selectable), the next highest cooling stage energizes.
5. At point C, the discharge water temperature has fallen below the lower control band.
6. If the minimum ON time has elapsed for that stage, the highest stage that is on shuts off.
7. This sequence continues until the cooling demand increases (point D) at which time stages sequence ON in the same manner as before.
8. As a rule, any time the discharge water temperature:
   a. is above the upper control band limit, a stage turns on.
   b. falls below the lower control band limit, a stage turns off.

Reset of Discharge Water Temperature

Industrial Applications

Reset of discharge water temperature is not recommended in a W7100G industrial application, because loads on industrial applications typically require a constant temperature fluid for cooling. Check industrial process manufacturers for specific details.

Environmental Applications

In order to save additional energy under lighter loading conditions, it may be desirable to change or reset the discharge water temperature setpoint based on either space or outside air temperatures. Reset has proved itself on hot water boilers as an energy saving opportunity. These same energy saving techniques can also be applied to chillers, to more evenly match system capacity with system load.

Reset from Space Temperature

A chiller that is being used to chill water for single or multiple air handling units can be made more efficient by resetting the discharge water temperature up as the average space temperature goes below a space temperature setpoint.

In order to accomplish this, space sensors (such as T7047C1025) are strategically located in the building to measure average space temperature. It is recommended that at least 4 sensors be installed and wired to provide a signal proportional to the average space temperature. The setpoint of the reset potentiometer should be set at the lowest desired cooling temperature of the building. See Fig. 7 for space reset operation (algorithm). See Fig. 8 for wiring details.

As the average space temperature drops below the setpoint of the reset sensors, the W7100G discharge temperature setpoint is reset upward by an adjustable amount. Maximum reset occurs when the average space temperature is 3°F (1.7°C) below the setpoint of those sensors. At this time, the W7100G setpoint will be fully reset.

In reset applications where high humidity can be a concern, an outdoor air thermostat can be installed to override the reset function. In lieu of outdoor air override an indoor space humidistat can also be used. See Fig. 8 for wiring diagrams.

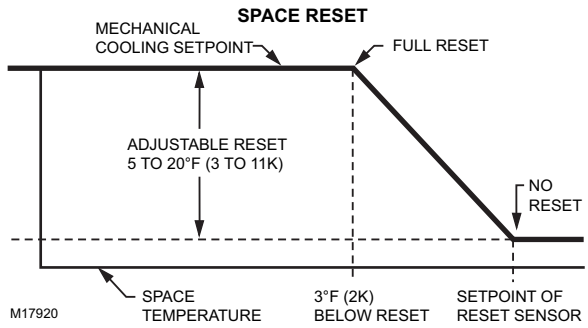


Fig. 7. Space reset algorithm.

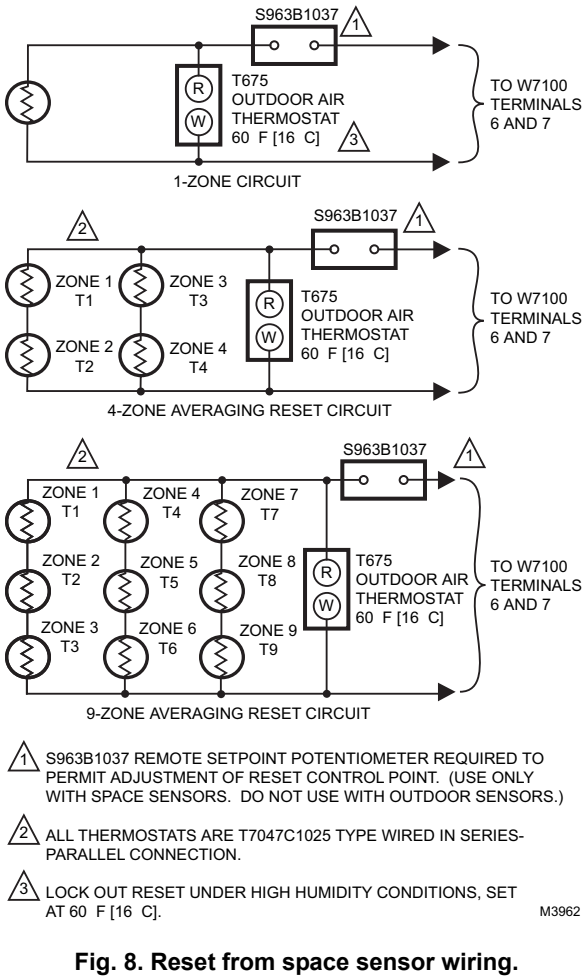


Fig. 8. Reset from space sensor wiring.

Outdoor Resets

Outdoor reset can be employed as an alternative to space reset (C7031G1016). The advantages to outdoor reset are that it is simple to apply with a minimum of field wiring. The disadvantage is that outdoor air temperature can have little effect on internal cooling load. This is best seen in the common area of a large shopping mall, where the major cooling loads are from solar heat, people and lighting.

In applications where outdoor temperature does have a major effect on the cooling load of a building, outdoor reset can have the same advantages as space reset. Fig. 9 shows the outdoor air reset operation (algorithm).

As the outdoor air temperature rises above 70°F (21°C), the W7100G discharge water temperature setpoint is reset downward. The reset amount is adjustable and it continues until the outside air temperature reaches 90°F (32°C). At this point, the discharge water temperature is being controlled at the W7100G setpoint.

The outdoor air temperature reset strategy should only be employed where outdoor air temperature has a major effect on the building cooling load.

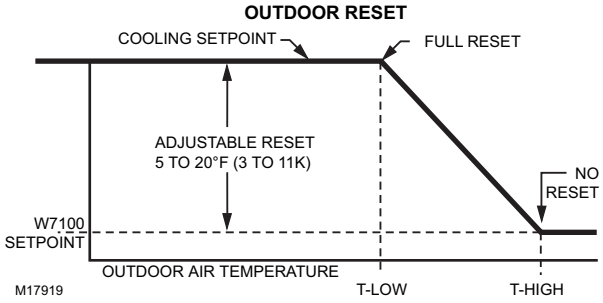


Fig. 9. Outdoor reset schedule using C7031G1016.

W7100 LED Operation

The W7100 has one LED for each staged output. The LED on the W7100 lights simultaneously as that stage relay energizes. With the LED not lit, the stage cannot energize. When the relay stage energizes, the normally closed contacts open, and the normally open contacts close.

Reset Modifications

While the outdoor air and the indoor air reset algorithms are software imbedded, it is possible to modify the outside air reset start and stop temperatures. To do this, a resistor must be placed in parallel with the outside air sensor (Rp) and a resistor must be placed in series with the outside air sensor (Rs). See Fig. 10.

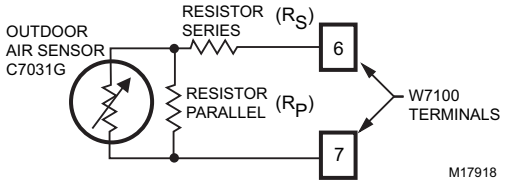


Fig. 10. Reset modification schematic wiring diagram.

Use Table 3 to select the point at which no W7100 setpoint reset will occur (T-High), and the point at which the W7100 will be fully reset (T-Low). The resistor values for series (Rs) and parallel (Rp) resistors are at the intersection of T-High and T-Low. Indicated resistor values are standard resistors and can be purchased at any local electronics store.

NOTE: Only the outdoor air reset can be modified in the above described manner.

Table 3. Reset Modification Resistor Selection Chart

T-High (no reset)		T-Low (full reset)					
		75	70	65	60	55	50
100	Rp	14.7K	7.68K	5.36K	4.22K	3.48K	3.01K
	Rs	196	324	432	511	576	634
95	Rp	—	14.7K	7.68K	5.36K	4.22K	3.57K
	Rs	—	187	316	412	499	562
90	Rp	—	0	14.7K	7.68K	5.49K	4.22K
	Rs	—	0	178	309	412	499
85	Rp	—	—	—	14.7K	7.87K	5.49K
	Rs	—	—	—	169	301	402
80	Rp	—	—	—	—	15.0K	7.87K
	Rs	—	—	—	—	158	294
75	Rp	—	—	—	—	—	15.0K
	Rs	—	—	—	—	—	147

NOTE: Resistors shown are standard values for 1/8W, 1%, metal film resistors.

SETTINGS AND ADJUSTMENTS

Setpoint Knob

HVAC Applications

Typical setpoints for HVAC applications range from 50 to 55°F (10 to 13°C). These setpoints can change due to many factors, including desired space temperature, required/desired humidity conditions, etc.

Industrial Process Applications

Consult process unit manufacturer for recommended settings.

Reset Knob

HVAC Applications

Reset recommended for 5 to 10°F (3 to 6°C), depending on desired maximum space temperature and space humidity requirements. Higher discharge water temperature can result in higher space temperature and humidity depending on outside air temperature and humidity, or internal latent and sensible heat load.

Industrial Process Applications

Reset is not recommended for these applications. However, check with process manufacturer for other recommendations.

Control Band Knob

Set for desired control band. Increasing the control band slows down the W7100 response, and increases the temperature deviation. Lowering the control band speeds up the W7100 response, while decreasing the temperature deviation from setpoint.

The control band setpoint should be as narrow as possible without causing hunting or rapid cycling. If instability, hunting, or rapid cycling occurs, widen the control band setpoint.

Fast Response Input

The W7100G has the capability of changing the timings between stages, the stage minimum ON timings and the stage minimum OFF timings.To do this, you must select which timing is desired (either 30 or 60 seconds):

— If you desire a 30 second delay, jumper terminals 9 and 10.
— If you desire a 60 second delay, leave terminals 9 and 10 open (unjumpered).

Number Of Stages

Select the proper resistor (see Table 2) that represents the total number of controlled stages. Place this resistor across terminals 7and 8 on the W7100G.

SYSTEM CHECKOUT

To field test the system, follow the steps detailed in Table 4. In order to complete this checkout, the following equipment is required:
— 4074EDJ Test Plug and Resistor Bag Assembly.
— 4074EFV Resistor Bag Assembly.
— Digital VOM meter.
— 195770A Test Plug.

Table 4. W7100G System Checkout.

Step	Action	Verification
1	Disconnect power from W7100.	Check for 0 Vac across W7100 TR and TR terminals.
2	Disconnect compressor and unloader line voltage power.	Check for 0 Vac at compressor and unloader contactors or relays.
3	Remove C7170A Sensor leads from W7100 and replace with 4074EDJ Bag Assembly 3400 ohm resistor (blue leads).	—
4	Remove from W7100 any jumper installed on the Fast Response Terminals (9 and 10).	—
5	Remove from W7100 terminals 6 and 7 all wires. Place a 4074EDJ Bag Assembly 1780 ohm resistor (red leads).	—
6	Jumper W7100 terminals P and P1.	—
7	Remove red plastic dust plug from W7100 bottom and install 195770A Test Plug in the revealed socket.	—
8	Set W7100 reset knob at 20°F (11K)	—
9	Set W7100 setpoint at 10°F (-12°C)	—
10	Connect 24 Vac power to the W7100 (TR and TR terminals)	Check for 24 Vac across W7100 TR and TR terminals.
11	Wait 15 seconds.	—
12	All W7100 stages should be energized	All red LED should be on.
13	Adjust W7100 setpoint to 60°F (16°C).	—
14	Wait 15 seconds.	—
15	All W7100 stages should be off.	All red LED should be off.
16	Remove 1780 ohm resistor from W7100 terminals 6 and 7.	—
17	Jumper W7100 terminals 6 and 7.	—
18	Adjust W7100 setpoint to 50°F (10°C)	—
19	Wait 15 seconds.	—
20	All W7100 stages should be energized.	All red LED should be on.
21	Disconnect power from W7100.	Check for 0 Vac across W7100 TR and TR terminals.
22	Reconnect all wiring as originally installed.	—
23	Remove 195770A Test Plug and install red plastic dust cover.	—
24	Reconnect W7100 power supply, close compressor disconnects, and place W7100 setpoints where desired.	System is now operational.

TROUBLESHOOTING (TABLE 5)

Table 5. W7100G Troubleshooting Guide.

Problem	Possible Cause	Corrective Action
Discharge temperature too high.	1. Integral setpoint not at minimum position when used with remote setpoint. 2. System malfunction.	1. Set integral setpoint at minimum position when using remote setpoint. 2. Consult HVAC manufacturer's equipment manual and/or building engineering requirements.
No cooling.	1. Shorted or open discharge sensor terminals T-T1. 2. Open reset terminals 6-7 interpreted as maximum reset. 3. Remote setpoint terminals P-P1 open. 4. System malfunction.	1. Correct the wiring. 2. Jumper terminals 6-7 or connect reset thermostat. 3. Jumper terminals P-P1 or connect remote setpoint potentiometer. 4. Consult HVAC manufacturer's equipment manual and/or building engineering requirements.
Short cycling.	1. Test plug left inserted in W7100 bottom. 2. System malfunction.	1. Remove test plug. 2. Consult HVAC manufacturer's equipment manual and/or building engineering requirements.

Honeywell

Home and Building Control
Honeywell
1985 Douglas Drive North
Golden Valley, MN 55422

Home and Building Control
Honeywell Limited-Honeywell Limitée
35 Dynamic Drive
Scarborough, Ontario
M1V 4Z9

Honeywell Asia Pacific Inc.
Room 3213-3225
Sun Hung Kai Centre
No. 30 Harbour Road
Wanchai
Hong Kong

Honeywell Europe S.A.
3 Avenue du Bourget
1140 Brussels
Belgium

Honeywell Latin American Region
480 Sawgrass Corporate Parkway
Suite 200
Sunrise FL 33325

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