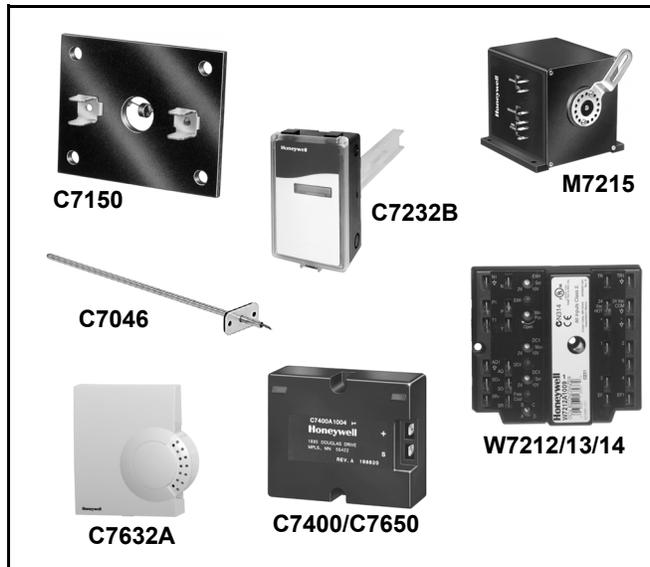


## Solid State Economizer System

(CONSISTING OF: C7046C DISCHARGE AIR SENSOR OR C7150B MIXED AIR SENSOR, C7232 OR C7632 CARBON DIOXIDE SENSOR, C7400A SOLID STATE ENTHALPY SENSOR OR C7650 SOLID STATE TEMPERATURE SENSOR, M7215 DAMPER ACTUATOR AND W7212, W7213 OR W7214 SOLID STATE ECONOMIZER LOGIC MODULE)

### PRODUCT DATA



### FEATURES

*C7046C Discharge Air Sensors have probe lengths of 8 in. (203 mm) and nominal sensor resistance of 3000 ohms at 77°F (25°C).*

- **No setting or calibration required.**
- **Solid state components not affected by dust or dirt.**
- **Fast reacting.**
- **Rugged aluminum insertion probe.**

*C7150B Mixed Air Sensor is used with the M7215 Damper Actuator to sense mixed or discharged air in rooftop packaged air conditioning equipment.*

- **No setting or calibration required.**

*C7232 and C7632 DCV Sensors are stand-alone carbon dioxide (CO<sub>2</sub>) sensors for use in determining ventilation necessity with heating ventilation and air conditioning (HVAC) controllers. They measure the CO<sub>2</sub> concentration in the ventilated space or duct. They are used in HVAC systems to control the amount of fresh outdoor air supplied to maintain acceptable levels of CO<sub>2</sub> in the space.*

- **C7232 models available with LCD that provides sensor readings and status information.**
- **Non-Dispersion-Infrared (NDIR) technology used to measure carbon dioxide gas.**
- **Gold-plated sensor provides long-term calibration stability.**
- **Device provides voltage output based on CO<sub>2</sub> levels.**
- **C7232 models available with SPST relay output.**
- **Used for CO<sub>2</sub> based ventilation control.**
- **Automatic Background Calibration (ABC) algorithm based on long-term evaluation reduces required typical zero-drift check maintenance.**
- **C7632 has fixed 0 to 10 Vdc from 0 to 2000 ppm. No adjustments are necessary.**

*(Continued)*

### APPLICATION

The Solid State Economizer System provides an economical method of providing cooling air by incorporating outdoor air in the first stage of cooling in heating, ventilating and air conditioning (HVAC) systems. The Solid State Economizer System consists of the C7046 Discharge Air Sensor, C7150 Mixed Air Sensor, C7232 or C7632 Demand Control Ventilation (DCV) Sensor, C7400A Enthalpy Sensor or C7650 Dry Bulb Temperature Sensor, M7215 Damper Actuator, and W7212 Solid State Economizer Logic Module.

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*C7400A Solid State Enthalpy Sensor and C7650A Solid State Temperature Sensors are used with the W7212 Solid State Economizer Logic Module to allow using outdoor air as the first stage of cooling in HVAC systems.*

- **C7400A senses and combines temperature and humidity of outdoor air (heat index).**
- **C7650A senses dry bulb temperature only.**
- **Long-lasting, solid state sensing element is accurate and stable over time.**
- **When enthalpy/temperature of outdoor air increases, the outdoor air damper closes to a preset minimum position.**
- **When enthalpy/temperature of outdoor air is low, the outdoor air damper opens to reduce the building cooling load.**
- **Provides 4 to 20 mA output signal to the Economizer Logic Modules; setpoint is located on economizer control.**
- **Maximum economizer savings is achieved with two C7400A Enthalpy Sensors connected to one Economizer Logic Modules for differential enthalpy changeover control.**

*M7215 Damper Motors are 25 lb-in. spring return damper actuators that provide modulating control of economizer systems, ventilation dampers and combustion air dampers used in residential or commercial HVAC equipment.*

- **M7215 Damper Motors provide modulating control of economizer dampers from a 2-10 Vdc controller.**
- **Quiet, high efficiency drive motor.**
- **High impact, glass-fiber reinforced plastic case is rugged, lightweight and corrosion resistant.**
- **Provides 2-10 Vdc output signal proportional to the shaft position.**

*W7212 Economizer Logic Modules are used with C7232 Demand Control Ventilation (DCV) Sensors, and solid state C7400 Enthalpy Sensors or C7650 Dry Bulb Temperature Sensors to proportion outdoor and return air dampers for control of free cooling in commercial HVAC equipment.*

- **Operates from thermostat and DCV sensor to provide a totally integrated control system.**
- **Solid state control package provides accurate, reliable and stable control.**
- **Mounts on M7215 Motor or ductwork.**
- **Control can be tempered by DCV and fan cycling.**
- **Used with Honeywell actuators.**

- **Combines minimum and DCV maximum damper position potentiometers with compressor staging.**
- **Relay functions with solid state enthalpy or dry bulb changeover control.**
- **Terminals included for switching between Occupied and Unoccupied operation.**
- **Terminals included for connecting optional S963B1128 Remote Potentiometer for remote minimum damper position control.**
- **LED indicates when free cooling is available.**
- **LED indicates when module is in DCV mode.**
- **LED indicates when exhaust fan contact is closed.**
- **W7213 is used with heat pump B terminal.**
- **W7214 is used with heat pump O terminal.**

#### **IMPORTANT**

*Specifications given in this publication do not include normal manufacturing tolerances. Therefore, this unit may not exactly match the listed specifications. Also, this product is tested and calibrated under closely controlled conditions and some minor differences in performance can be expected if those conditions are changed.*

### **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.



### **CAUTION**

**Electrical Shock or Equipment Damage Hazard.  
Can shock individuals or short equipment circuitry.**

Disconnect power supply before installation.

#### **IMPORTANT**

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

## **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:

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Minneapolis, Minnesota 55422-4386

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# C7046C Discharge Air Sensors

## SPECIFICATIONS

Intended for use as a discharge sensor in rooftop applications.

**Dimensions:** See Fig. 1.

**Mounting:** Integral mounting flange requiring two No. 8 screws.

**Sensing Element:** Carbon type, thermistor-resistor element.

**Maximum Ambient Temperature:** 250°F (121°C).

**Operating Temperature Range:** 40 to 150°F (4 to 66°C).

**Wiring Connections:** 6 in. (152 mm) leadwires.

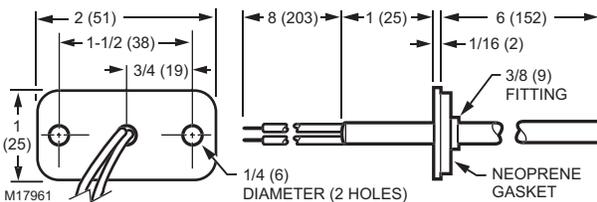
### Performance Characteristics:

Reaction Time Constant with Air Approach Velocity of 500 ft/min (2 m/sec): 60 seconds.

### Resistance/Temperature (NTC):

Nominal Resistance: 3000 ohms at 77°F (25°C).

Nominal Sensitivity: 70 ohms per degree F (124 ohms per degree C) at midrange.



**Fig. 1. C7046C Air Temperature Sensor dimensions in in. (mm).**

NOTE: Sensor probe diameter is 1/4 in. (6 mm).

## INSTALLATION

The sensor assembly (see Fig. 1) consists of an aluminum sensor probe (element housed internally) with attached flange that can be mounted on a flat duct or plenum surface, or in a 2 in. by 4 in. (51 by 102 mm) junction box using two No. 8 screws. Connections to the sensor are made through two 6 in. (152 mm) leadwires.

### Location

The sensor should be located in the air duct or plenum where it will sample an average air temperature. Avoid locations where air stratification can cause sensing errors.

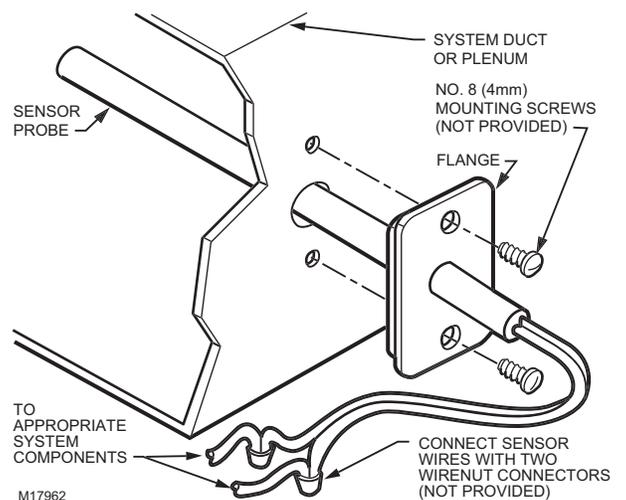
### Mounting

#### MOUNTING ON A FLAT DUCT OR PLENUM SURFACE (FIG. 2)

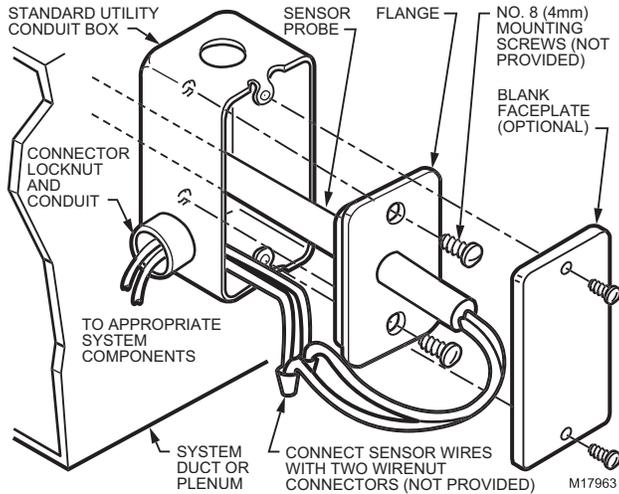
1. Cut a 3/8 in. (9.5 mm) hole in the duct or plenum surface at the desired location.
2. Insert sensor probe into the duct or plenum until the flange rests against the duct or plenum wall.
3. If necessary, use the flange as a template to mark and drill two holes for No. 8 mounting screws.
4. Fasten the sensor to the duct or plenum surface with two No. 8 sheet metal screws (not provided).

#### MOUNTING IN A JUNCTION BOX (FIG. 3)

1. Cut a 3/8 in. (9.5 mm) hole in the duct or plenum surface at the desired location.
2. Remove the center rear knockout from the junction box and insert the sensing probe through the knockout with the flange flat against the outlet box.
3. Using the flange as a template, mark and drill two holes in the junction box and the duct or plenum surface for No. 8 mounting screws.
4. Insert sensor probe through both the junction box knockout and the 3/8 in. (9.5 mm) hole drilled in the duct or plenum and fasten the junction box and sensor to the duct or plenum surface.



**Fig. 2. Mounting C7046 Air Temperature Sensor on a flat duct or plenum surface.**



**Fig. 3. Mounting C7046 Air Temperature Sensor in a junction box.**

## WIRING

### CAUTION

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

### 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.

### IMPORTANT

1. All wiring must agree with applicable codes, ordinances and regulations.
2. Do not mount sensor in incorrect environment.
3. Wire according to the applicable controller instructions.
4. Erratic temperature readings from a sensor can be caused by improper wiring practices. These must be avoided to assure proper operation:
  - Avoid poor wiring connections.
  - Avoid intermittent or missing building earth ground.
  - Do not mount sensor in incorrect environment.

Connect low voltage wiring from the sensor to the appropriate system component terminals using solderless connectors. See Fig. 3.

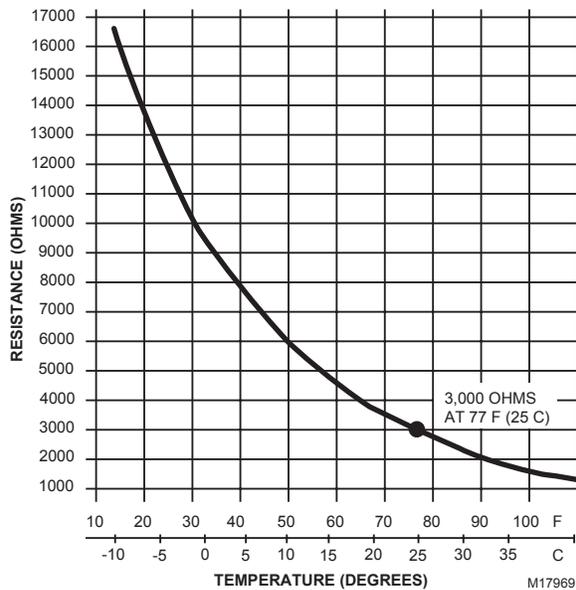
## OPERATION

The C7046C Air Temperature Sensors consist of a thermistor sensing element mounted in a tubular probe. They are applied at various locations throughout single zone and multizone duct systems. The negative temperature coefficient (NTC) characteristic of the thermistor element causes its resistance to decrease as the sampled air temperature increases. This resistance shift is balanced with other system sensor signals by appropriate system logic panels to stabilize system control.

## CHECKOUT

Allow the C7046 Air Temperature Sensor to soak in the air moving through the duct or plenum for a minimum of five minutes before taking a resistance measurement.

1. Disconnect the sensor leadwires from the associated system components.
2. Connect an ohmmeter across the leadwires.
3. Assure nominal resistance measurements are in accordance with the resistance/temperature curves shown in Fig. 4.
4. Reconnect sensor leadwires to associated system components.
5. Check operation of the complete control system.



**Fig. 4. C7046C Sensor resistance vs. temperature.**

# C7150B Mixed Air Sensor

## SPECIFICATIONS

**Models:** See Table 1.

**Dimensions:** See Fig. 5.

**Mounting Arrangement:**

Integral mounting flange that requires No. 8 screws.

NOTE: The C7150B1004 requires four No. 8 screws; the C7150B1046 requires two No. 8 screws.

**Ambient Temperature Ratings:**

Maximum: 250°F (121°C).

Operating Range: -40 to 110°F (-40 to 43°C).

Shipping Range: -30 to 150°F (-34 to 66°C).

**Wiring Connection:** 1/4 in. (6 mm) quick-connects.

NOTE: The C7150B1046 includes 4 in. lead wires with connector for W7340 compatibility.

Table 1. C7150B Models.

Model	Nominal Resistance at 77°F (25°C)	Nominal Sensitivity <sup>a</sup> at midrange
C7150B1004	3000 ohms	70 ohms per °F (124 ohms per °C)
C7150B1046	10K ohms	234 ohms per °F (415 ohms per °C)

<sup>a</sup> Negative Temperature Coefficient (NTC).

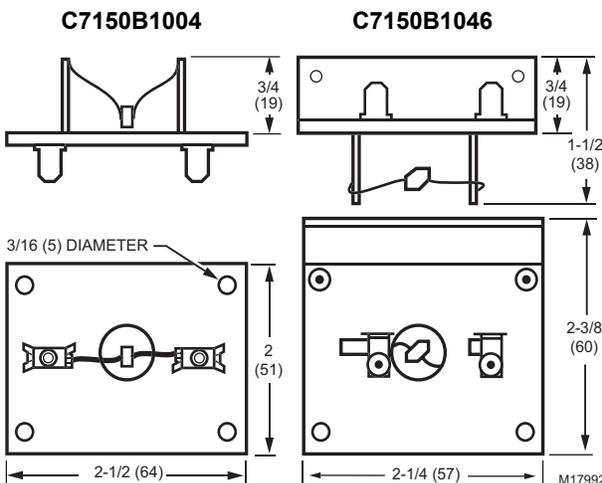


Fig. 5. C7150B approximate dimensions in in. (mm).

## INSTALLATION

1. Install on a mounting bracket (not included) inside the mixed air or discharge air duct using No. 8 mounting screws and nuts. (See Fig. 6).

NOTE: When mounting, ensure that terminals do not touch metallic conductive surfaces.

2. Wire using 1/4 in. (6 mm) female quick-connect terminated wires from C7150B to control inputs.

NOTE: For C7150B1046, splice additional wiring as needed between sensor and connector.

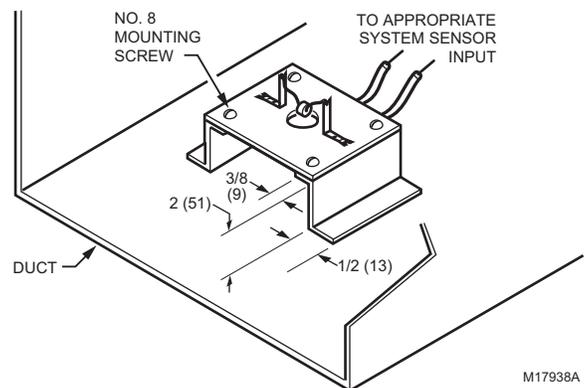


Fig. 6. Mounting C7150B [C7150B1004 shown].

NOTE: Fig. 6 displays bracket (not included) and suggested bracket dimensions in in. (mm).

## OPERATION

The C7150B Air Temperature Sensor consists of a thermistor sensing element mounted on a phenolic board. It is applied in ventilation duct systems. The thermistor element negative temperature coefficient (NTC) characteristic causes its resistance to decrease as the sampled air temperature increases. This resistance change is used as a control system sensor to regulate discharge air temperature in a W973 Single Zone System or damper position of the M7215A Motor (either directly, or through the Economizer Logic Module).

## CHECKOUT

Allow the C7150B Sensor to soak in the air moving through the duct for a minimum of 5 minutes before taking a resistance measurement:

1. Disconnect sensor leadwires from associated system components.
2. Connect an ohmmeter across the leadwires.

3. Nominal resistance measurements should be in accordance with the resistance/temperature curves shown in Fig. 7 and 8.
4. Reconnect sensor leadwires to associated system components.
5. Check operation of the M7215A Motor, W973 System, or the Economizer Logic Module.

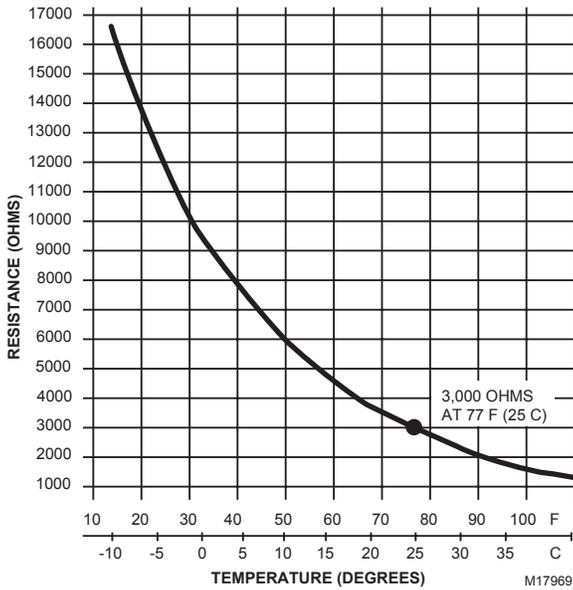


Fig. 7. C7150B1004 Sensor resistance temperature.

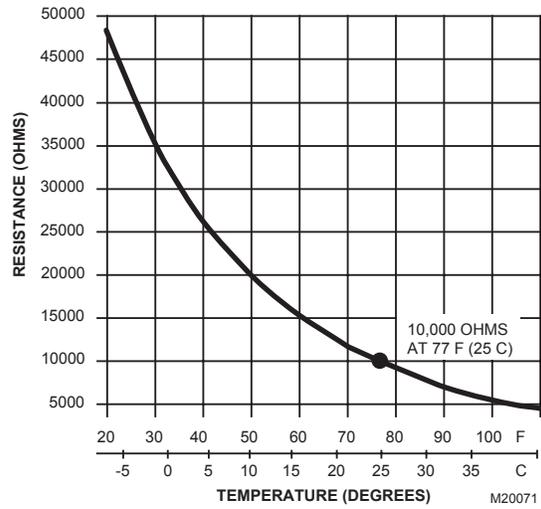


Fig. 8. C7150B1046 Sensor resistance temperature.

# C7232 DCV Sensors

## SPECIFICATIONS

**Models:** C7232 Sensor and Controller. A stand-alone carbon dioxide (CO<sub>2</sub>) sensor with two jumper-adjustable outputs (one analog and one spst relay).

C7232A: Wall mount model.

C7232B: Duct mount model.

**NOTE:** Models are available with or without a 4-digit LCD that indicates the current CO<sub>2</sub> concentration.

### Dimensions:

C7232A: See Fig. 9.

C7232B: See Fig. 10.

### Sensor Performance Ratings:

Response Time: 2 min.

Carbon Dioxide Sensor:

Operation: Non-dispersive infrared (NDIR).

Sampling: Diffusion.

Range: 0 to 2000 ppm  $\pm 5\%$  and  $\pm 50$  ppm.

Annual Drift: 20 ppm (nominal).

### Electrical Ratings:

Power Supply: 24 Vac  $\pm 20\%$ , 50/60 Hz (Class 2).

Maximum Power Consumption: 3W.

Peak Current (at 20 ms): 600 mA.

Relay:

Configuration: Shipped N.O. (reconfigure with software.)

Contact Rating: 1A at 50 Vac/24 Vdc.

Minimum Permissible Load: 1 mA at 5 Vdc.

Linear Analog Output:

Voltage: 0/2-10 Vdc (resistive load greater than 5000 ohms).

Current: 0/4-20 mA (resistive load less than 500 ohms).

### Outputs (Jumper Adjustable, see Table 3):

Analog: 0-10 Vdc (Default: 2-10 Vdc, 500 to 1500 ppm).

Relay: Normally Open Spst (Default: Close at 800 ppm).

### Ambient Ratings:

Temperature:

Operating: +32°F to +122°F (0°C to +50°C).

Storage: -4°F to +158°F (-20°C to +70°C).

Relative Humidity (non-condensing): 0 to 95 percent.

**CO<sub>2</sub> Pressure Dependence:** 1.4% change in reading per 1 kPa deviation from 100 kPa.

### Connections:

Wiring:

C7232A: 20-gauge cable with six 8 in. leadwires.

C7232B: 20-gauge cable with six 6 in. leadwires.

### Mounting:

C7232A: Vertical surface with standard single-gang junction box.

C7232B: Sheet metal duct with a sampling tube.

**Automatic Background Calibration (ABC) default:** On.

### Approvals:

CE.

Underwriters Laboratories Inc. Listed, File No. E4436.

cUL.

C7232B: Flammability Rating, UL94-5V.

C7232A: NEMA1.

C7232B: NEMA3.

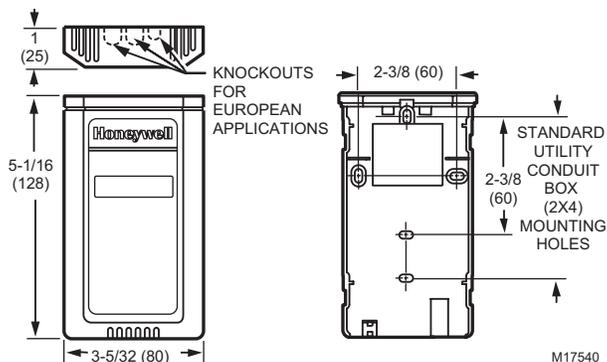


Fig. 9. C7232A dimensions in in. (mm).

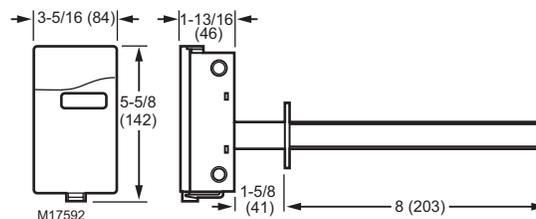


Fig. 10. C7232B dimensions in in. (mm).

## INSTALLATION



### CAUTION

**Health Hazard.**

**Improper use can create dangerous situations.**

Use in application for sensing carbon dioxide only. For life-safety applications, this device can function only as a secondary or lesser device.



### CAUTION

**Electrical Shock or Equipment Damage Hazard. Can shock individuals or short equipment circuitry.**

Disconnect power supply before installation.

## CAUTION

**Equipment Damage Hazard.**  
Electrostatic discharge can short equipment circuitry.

Ensure that you are properly grounded before handling the unit.

## C7232A Cover Removal/Replacement

### C7232A Cover Removal (see Fig. 11)

1. Remove button head socket cap screw and set it aside.
2. Insert the head of a small screwdriver into the slot at the center and near the top of the cover.
3. Gently pull the handle down toward the bottom of the device until a small gap between the subbase and the cover appears.
4. Remove the screwdriver and pull the cover straight down until it meets a stop.
5. Pull the cover straight off the subbase.

### C7232A Cover Replacement

1. Feed the wires through the opening in the subbase.
2. Place the cover, with a small gap at the top, flat on top of the subbase.
3. When the cover rests flat on the subbase, slide it straight up until it latches in place.

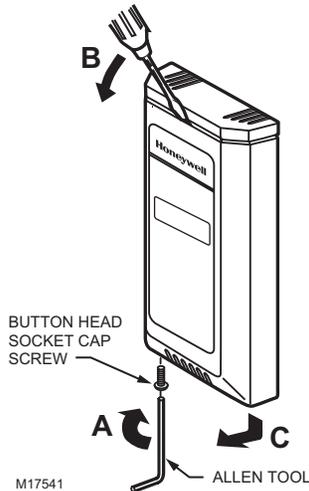


Fig. 11. C7232A cover removal.

## Location and Mounting

C7232 Sensors mount directly on the wall, sheet metal duct, or a panel. When planning the installation, allow enough clearance for maintenance and service. Mount the sensor in a well-ventilated area.

NOTES: Do not install the sensor where it can be affected by:  
— drafts or dead spots behind doors and in corners.  
— air from ducts.

### Wall Mounting

The C7232 Wall Mount models can be mounted using two or four screws:

1. Remove C7232 cover.
2. Mount the subbase to the wall using washers and two or four screws (not supplied) appropriate for the wall material.

NOTE: When mounting on a junction box, see Fig. 12.

3. Replace the cover.

### Duct Mounting (see Fig. 13)

1. Place gasket on aspiration tube.

#### IMPORTANT

*Ensure largest tab at tube control end is at the top.*

2. Insert tube into duct; attach using screws and washers.

#### IMPORTANT

*Leakage into the duct or the C7232 box cover from the room will skew the sensor readings. Ensure the box cover and duct seal completely.*

3. Place o-ring on tube end; mount the control to the tube.

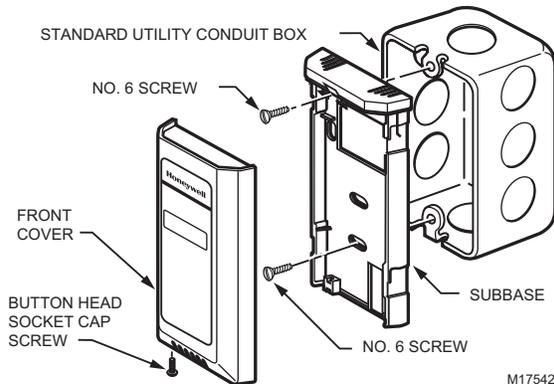


Fig. 12. Junction box mounting (C7232A).

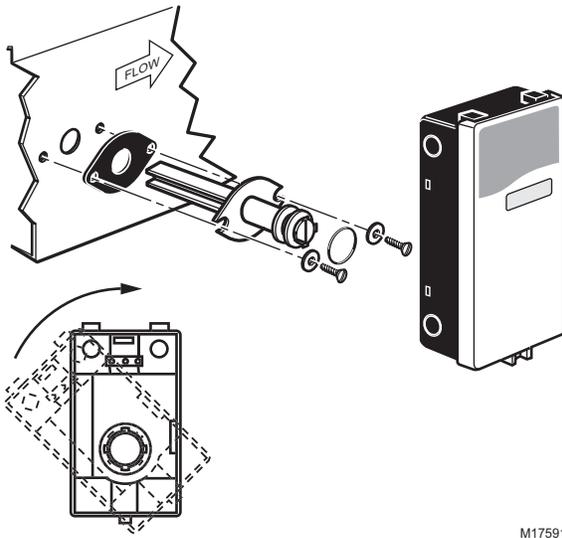


Fig. 13. Duct mounting (C7232B).

## WIRING

The factory ships the device with the output default settings shown in Tables 3 and 4. Set the jumpers and wire the device (see Table 2 and Fig. 14).

### ! CAUTION

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

### ! CAUTION

**Equipment Damage Hazard. Electrostatic Discharge Can Short Equipment Circuitry.**  
Ensure that you are properly grounded before handling the unit.

### IMPORTANT

1. All low voltage connections to this device must be 24 Vac Class 2.
2. All wiring must comply with applicable local codes, ordinances and regulations.

Table 2. C7232 Wiring Connections (see Fig. 14).

Wire Color	Designation	Function
Red	G+	24 Vac Hot
Black	G0	24 Vac Common
Yellow	OUT1	Analog Output Signal
Brown	M	Analog Output Common
Orange	NO	Relay Output Normally Open
Green	COM	Relay Output Common

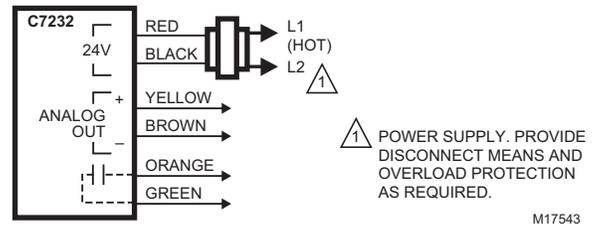


Fig. 14. Wiring the C7232.

## OPERATION

### Input Signal

The C7232 Sensors have an adjustable range. These ranges are determined by the SW1 and SW2 jumper settings (see Table 3).

Table 3. CO<sub>2</sub> Range Jumper Settings

SW1	SW2	AN (ppm)	Relay <sup>a</sup> (ppm)
On	On	0 to 1000	1000
On	Off	0 to 2000	1200
Off <sup>b</sup>	On <sup>b</sup>	500 to 1500	800
Off	Off	500 to 2000	1200

<sup>a</sup> When the level reaches this value, the contacts close; when the level drops 100 ppm below this value, the contacts open.

<sup>b</sup> Setting when shipped from the factory.

### Output Signal

The output signal can be adjusted for 0/2-10Vdc or 0/4-20mA (see Table 4).

Table 4. Output Signal Jumper Settings

AN	OUT	
	0-100%	20-100%
Voltage	0-10Vdc	2-10Vdc
Current	0-20 mA	4-20 mA

### NOTES:

- On duct models, remove the screw holding the board in place to view jumper settings on reverse. (See Fig. 15.)
- The CO<sub>2</sub> settings and the output signal settings are independent of each other. 0-100% and 20-100% are simply markings for the OUT jumper settings on the sensor (to differentiate between the two voltage and the two current ranges) and do not refer to or alter the ppm range chosen.

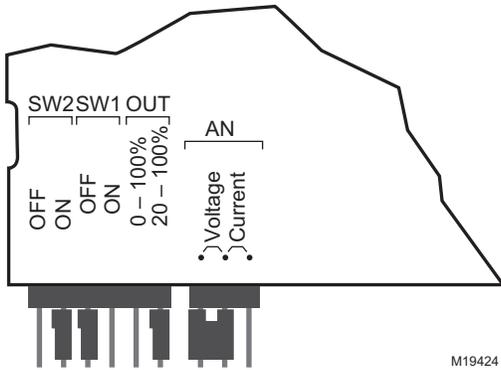


Fig. 15. C7232 default jumper settings.

**EXAMPLE**

For a CO<sub>2</sub> setting of 0-2000 ppm and a voltage output of 0-10 Vdc, the output would be as shown in Table 5 (arbitrary points along the analog curve).

Table 5. 0-10 Vdc Output Example.

CO <sub>2</sub> Level (ppm)	0	200	400	600	800	1000	1200	1400	1600	1800	2000
Voltage Output (Vdc)	0	1	2	3	4	5	6	7	8	9	10

For a CO<sub>2</sub> setting of 0-2000 ppm and a voltage output of 2-10 Vdc, the output would be as shown in Table 6 (arbitrary points along the analog curve).

Table 6. 2-10 Vdc Output Example.

CO <sub>2</sub> Level (ppm)	0	250	500	750	1000	1250	1500	1750	2000
Voltage Output (Vdc)	2	3	4	5	6	7	8	9	10

**CALIBRATION**

Typically, calibration is unnecessary. No calibration kits are available. However, if CO<sub>2</sub> gas can be purged from the sensor chamber using a general gas purge device, the sensor can be rezeroed:

**IMPORTANT**

*Any CO<sub>2</sub> present during calibration skews the sensor zero level resulting in incorrect CO<sub>2</sub> level reports.*

1. Once the sensor stabilizes, use a screwdriver to connect the two MENU soldering pads.
2. The display should indicate CAL.
3. Execute the zero calibration by connecting the two ENTER soldering pads.
4. The display should return to providing the measured CO<sub>2</sub> level.

**CHECKOUT**

Perform a quick test of the unit with the unit powered:

1. Stand close to the unit and breathe air into the sensor.
2. Check the CO<sub>2</sub> level registered by the controller to ensure a strong rise.
3. When connected to a damper in a ventilation system, the controller typically signals an increase in air flow.

# C7400A Solid State Enthalpy Sensor

## SPECIFICATIONS

**Dimensions:** See Fig. 16.

**Output Signal:** 4 to 20 mA current signal increases from 4 mA to 20 mA as enthalpy decreases.

**Ambient Temperature Ranges:**

Operating: 32°F to +125°F (0°C to +52°C).  
 Shipping: -40°F to +150°F (-40°C to +66°C).

**Maximum Power Consumption:** 0.50 VA at 24 Vdc.

**Supply Voltage:** 12 to 40 Vdc.

**Electrical Connections:**

Two 1/4 in. (6 mm) quick connect terminals.

**Approvals:**

Underwriters Laboratories Inc. Flammability Rating: UL94-5V.

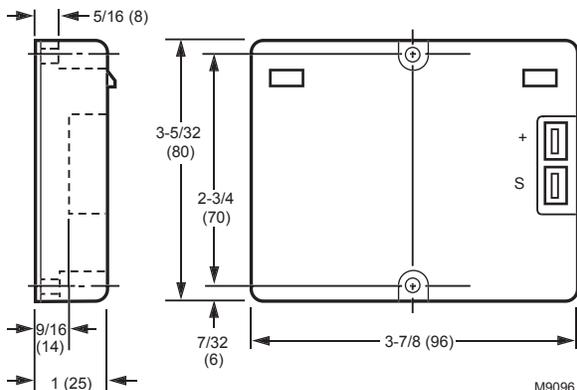


Fig. 16. Approximate dimensions of C7400A Solid State Enthalpy Sensor in in. (mm).

## INSTALLATION

### Location

**IMPORTANT**

When selecting the location, make sure the C7400A Solid State Enthalpy Sensor is not exposed to rain, snow or direct sunlight.

**NOTES:**

- The C7400A Sensor can be mounted in any position. However, the sensor must be installed where it is exposed to freely circulating air, but protected from rain, snow and direct sunlight.
- Differential enthalpy control requires two C7400A Sensors. Mount one sensor in the outdoor intake duct, the other in the return air duct.
- The C7400A Sensor is designed to operate in 500 ft/min. minimum airflow.

## OPERATION

The C7400A Solid State Enthalpy Sensor is used with a solid state economizer logic module and damper actuator to proportion an outdoor air damper in a ventilation system.

Each enthalpy control setpoint (A, B, C, and D) combines temperature and humidity conditions, resulting in the control curve shown in Fig. 34. When the enthalpy of the outdoor air is below (left of) the appropriate curve, the outdoor air damper can proportion open on a call for cooling. If the outdoor enthalpy rises above (right of) the control curve, the outdoor air damper closes to the minimum position.

NOTE: Curves illustrate reset in temperature control point due to changes in relative humidity.

For differential enthalpy, turn the control setpoint to D (fully clockwise ↻):

- If outdoor air enthalpy is lower than return air enthalpy, the outdoor air damper proportions open on a call for cooling.
- If outdoor air enthalpy is higher than return air enthalpy, the outdoor air damper closes to minimum position. Differential enthalpy control provides energy savings and increased comfort by using the air with the lowest enthalpy.
- If outdoor air enthalpy and return air enthalpy are equal, the outdoor air damper proportions open on a call for cooling.

NOTE: The relationship between the C7400A Sensor output current and relative humidity is shown in Fig. 17.

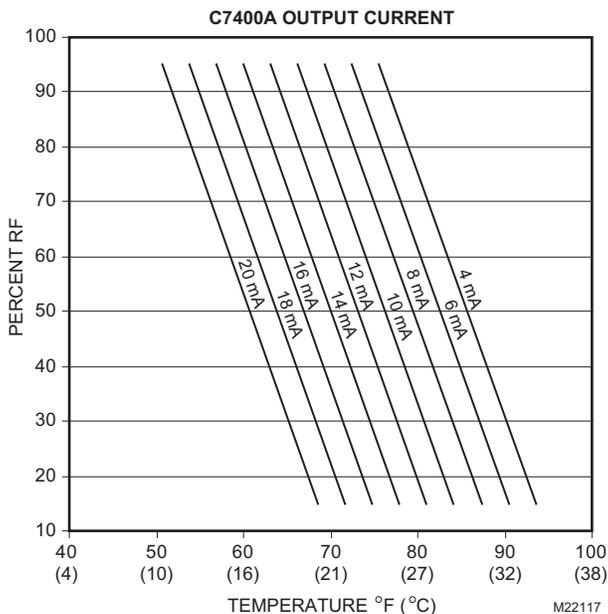


Fig. 17. C7400A Sensor output current vs. rh.

# C7632A DCV Sensors

## SPECIFICATIONS

**Models:** C7632 Sensor and Controller. A stand-alone carbon dioxide (CO<sub>2</sub>) sensor with one 0-10 Vdc analog output.  
 C7632A: Wall mount model.  
 C7632B: Duct mount model.

**Dimensions:**  
 C7632A: See Fig. 9.  
 C7632B: See Fig. 10.

**Ambient Ratings:**  
 Temperature:  
 Operating: +32°F to +122°F (0°C to +50°C).  
 Storage: -4°F to +158°F (-20°C to +70°C).  
 Relative Humidity (non-condensing): 0 to 95 percent.

**Automatic Background Calibration (ABC) default:** On.

**Electrical Ratings:**  
 Power Supply: 24 Vac ±20%, 50/60 Hz (Class 2).  
 Maximum Power Consumption:  
 Average: 1W.  
 Peak: 2W.  
 Peak Current (at 20 ms): 300 mA.  
 Linear Analog Output: 0-10 Vdc.

**Mounting:**  
 C7632A: Vertical surface with standard single-gang junction box.  
 C7632B: Sheet metal duct with a sampling tube.

**CO<sub>2</sub> Pressure Dependence:** 1.6% change in reading per 1 kPa deviation from 100 kPa.

**Output:** Analog: 0-10 Vdc, 0-2000 ppm (fixed).

**Sensor Performance Ratings:**  
 Response Time: 2 min.  
 Carbon Dioxide Sensor:  
 Operation: Non-dispersive infrared (NDIR).  
 Sampling: Diffusion.  
 Range: 0 to 2000 ppm (fixed).  
 Annual Drift: ±10 ppm (nominal).  
 Accuracy: ±(30 ppm+2%) at normal temperature/pressure.

**Wiring Connections:**  
 C7632A: Terminal block.  
 C7632B: 20-gauge cable with three 6 in. leadwires.

**Approvals:**  
 CE.  
 Underwriters Laboratories Inc. Listed, File No. E4436.  
 cUL.  
 C7632B: Flammability Rating, UL94-5V.  
 C7632A: NEMA1.  
 C7632B: NEMA3.

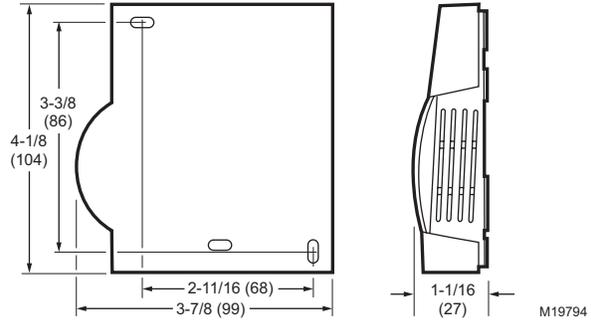


Fig. 18. C7632A dimensions in in. (mm).

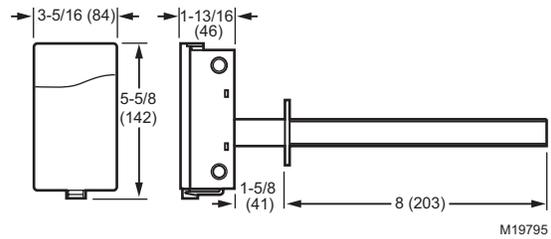


Fig. 19. C7632B dimensions in in. (mm).

## INSTALLATION



### CAUTION

**Health Hazard.**  
 Improper use can create dangerous situations. Use in application for sensing carbon dioxide only. For life-safety applications, this device can function only as a secondary or lesser device.



### CAUTION

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



### CAUTION

**Equipment Damage Hazard.**  
 Electrostatic discharge can short equipment circuitry.  
 Ensure that you are properly grounded before handling the unit.

## C7632A Cover Removal/Replacement

The cover of the C7632A is fixed by a latch on the underside of the unit.

**C7632A Cover Removal (see Fig. 11)**

1. Unless the device is mounted, hold the base using the wiring hole and/or the perforated vent.
2. Depress the tab on the underside of the device.
3. Swing the cover away from the base.
4. Lift cover from base.

**C7632A Cover Replacement**

1. Place top cover tab over the ridge along the base top.
2. Swing the cover down.
3. Press the lower edge of the case to latch.

**Location and Mounting**

C7632 Sensors mount directly on the wall, sheet metal duct, or a panel. When planning the installation, allow enough clearance for maintenance and service. Mount the sensor in a well-ventilated area.

NOTES: Do not install the sensor where it can be affected by:

- drafts or dead spots behind doors and in corners.
- air from ducts.

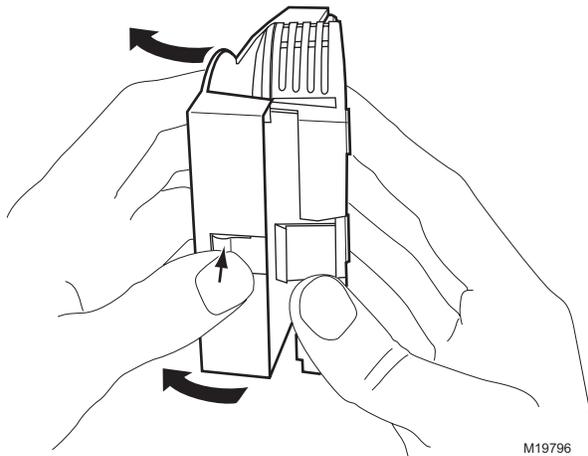


Fig. 20. C7632A cover removal.

**Wall Mounting (C7632A)**

Mount the C7632A to the wall as follows:

1. Remove the C7632 cover.
2. Mount the device in a vertical position.
3. Mount the subbase directly on a wall using the type of screws (not supplied) appropriate for the wall material.
4. Replace the cover.

**Junction Box Mounting (Fig. 12)**

Mount the C7632A to a junction box as follows:

1. Attach the wallplate using only the top screw.
2. Remove the C7632 cover.
3. Place the subbase on the wallplate hook.
4. Mount the subbase and wallplate to the junction box using the lower screw.
5. Replace the cover.

**Duct Mounting (see Fig. 13)**

1. Place gasket on aspiration tube.

**IMPORTANT**

*Ensure largest tab at tube control end is at the top.*

2. Insert tube into duct; attach using screws and washers.

**IMPORTANT**

*Leakage into the duct or the C7632 box cover from the room will skew the sensor readings. Ensure the box cover and duct seal completely.*

3. Place o-ring on tube end; mount the control to the tube.

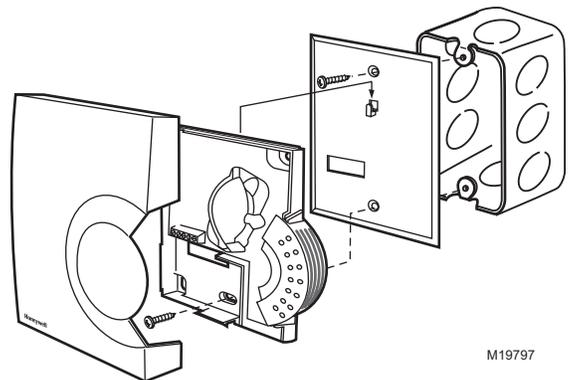


Fig. 21. Junction box mounting (C7632A).

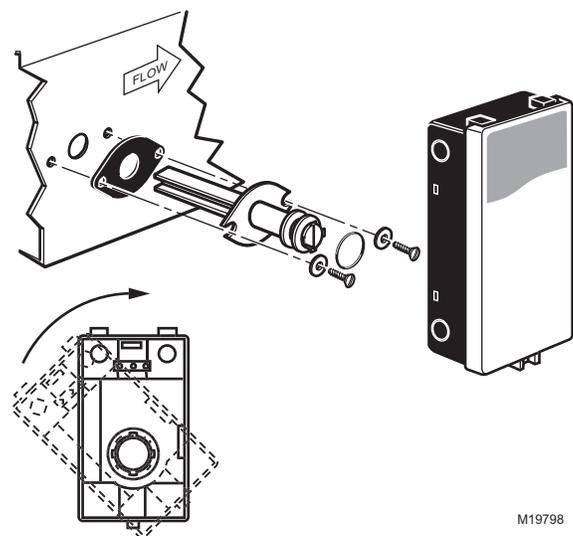


Fig. 22. Duct mounting (C7632B).

**WIRING (FIG. 14)****CAUTION**

**Electrical Shock or Equipment Damage Hazard.**  
Can shock individuals or short equipment circuitry.

Disconnect power supply before installation.

# CAUTION

**Equipment Damage Hazard.**  
**Electrostatic Discharge Can Short Equipment Circuitry.**

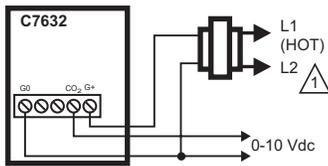
Ensure that you are properly grounded before handling the unit.

## IMPORTANT

1. All low voltage connections to this device must be 24 Vac Class 2.
2. All wiring must comply with applicable local codes, ordinances and regulations.

Table 7. C7632 Wiring Connections (see Fig. 14).

Designation	C7632B Wire Color	Function
G+	Red	24 Vac
G0	Black	Common
CO <sub>2</sub>	Brown	Analog Output Signal



⚠ POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

M19799

Fig. 23. Wiring the C7632.

## Output (Table 5)

Table 8. 0-10 Vdc Output Signal.

CO <sub>2</sub> Level (ppm)	0	200	400	600	800	1000	1200	1400	1600	1800	2000
Voltage Output (Vdc)	0	1	2	3	4	5	6	7	8	9	10

## CALIBRATION

Typically, calibration is unnecessary. No calibration kits are available. However, if CO<sub>2</sub> levels can be brought to a desirable level, the sensor can be reset using either zero or background calibration:

### IMPORTANT

- With zero calibration, all CO<sub>2</sub> present during calibration skews the sensor zero level.
- Using background calibration, practical operation (with a higher than zero level set) can be obtained.

## Zero Calibration

1. Remove the sensor cover and set it aside.
2. Apply a steady flow of CO<sub>2</sub>-free gas at 0.1 to 0.5 liter per minute into the gas inlet tube located on the gold sensor.
3. Execute calibration by shorting the proper two soldering pads (see Fig. 24).

NOTE: The device should now provide accurate output.

4. Check the output signal. (See Checkout section.)
5. Reinstall the device.

## Background Calibration

1. Remove the sensor cover and set it aside.
2. Ventilate the area and reduce occupancy to lower the CO<sub>2</sub> levels.
3. Maintain a reasonable proximity from the sensor to avoid breathing on it, thus skewing calibration accuracy.
4. Keep the sensor in this environment for three to four minutes.
5. Execute calibration by shorting the proper two soldering pads (see Fig. 24).

NOTE: The device should now provide accurate output.

6. Check the output signal. (See Checkout section.)
7. Reinstall the device.

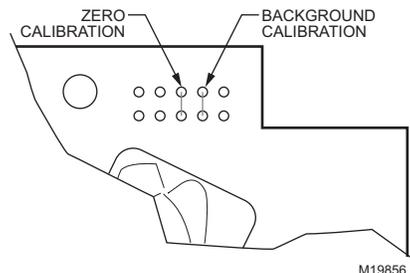


Fig. 24. C7632 calibration pads.

## CHECKOUT

Perform a quick test of the unit with the unit powered:

1. After calibration:
  - a. Check output signal immediately following proper calibration (with minimum environmental change):
    - (1) Proper zero calibration: 0 Vdc.
    - (2) Typical background calibration: 2 Vdc. Depending on ambient CO<sub>2</sub> level, range: 1.75 to 2.5 Vdc.
  - b. If the output is incorrect, repeat calibration procedure.
  - c. Otherwise, continue with checkout.
2. Stand close to the unit and breathe air into the sensor.

NOTE: When connected to a damper in a ventilation system, breathing on the sensor typically signals an increase in air flow.

3. Check the output to ensure a strong rise in CO<sub>2</sub> level.

# C7650A Solid State Temperature Sensor

## SPECIFICATIONS

**Dimensions:** See Fig. 25.

**Case:** Duct mount.

**Temperature Sensing Element:** Thermistor.

**Output Signal:**

10 to 20 mA current signal; increases from 10 mA to 20 mA as temperature decreases.

**Operating Ambient Temperature Range:**

+40°F to +100°F (+4°C to +38°C).

**Shipping Temperature Range:**

-40°F to +150°F (-40°C to +66°C).

**Maximum Power Consumption:** 0.45 VA.

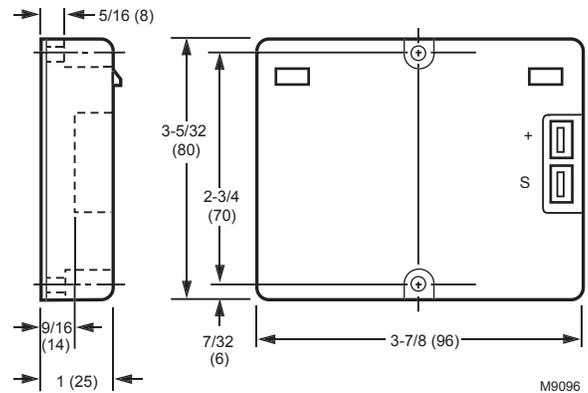
**Supply Voltage:** 15 to 23 Vdc.

**Electrical Connections:**

Two 1/4 in. (6.5 mm) quick connect terminals.

**Approval:**

Underwriters Laboratories Inc. Flammability Rating: UL94-5V.



**Fig. 25. C7650A Thermistor Temperature Sensor Dimensions in in. (mm).**

## INSTALLATION

### Location

The C7650A Temperature Sensor can be mounted in any position; however, the sensor must be installed where it is exposed to freely circulating air, but protected from rain and direct sunlight.

The C7650A is designed to operate in 500 ft/min minimum airflow.

### Control Dial Setting

Control setpoint scale is located on the logic module. Control points A, B, C, D are field selectable; use A, B, C, D control points for temperature sensing.

# M7215 Damper Motors

## SPECIFICATIONS

25 lb-in. (2.8 N•m) torque, foot-mounted spring-return damper motor with 2-10 Vdc feedback signal. Accepts 2-10 Vdc control signal.

**Dimensions:** See Fig. 26.

**Electrical Ratings:**

Supply Voltage: 24 ±6 Vac 50/60 Hz.

Power Consumption:

24 Vac, 60 Hz: 8.7 VA.

24 Vac, 50 Hz: 8.4 VA.

**Torque:**

Lift and Hold: 25 lb-in. (2.8 N•m).

Spring Return: 25 lb-in. (2.8 N•m).

Breakaway: 40 lb-in (4.5 N•m).

**IMPORTANT**

*Never use motor continuously at the breakaway torque rating.*

**NOTE:** NOTE: Breakaway torque available to overcome occasional large loads such as a seized damper.

**Stroke:**

Travel: 90°.

Timing:

Driving: 86 ±5 seconds.

Spring Return: 13 ±5 seconds.

**Motor Rotation (Viewed From Shaft End):**

Closed Position: Limit of clockwise rotation.

Open Position: Limit of counterclockwise rotation.

Crank Arm Rotation Limits: See Fig. 27.

Shipped with shaft in closed position.

**Ambient Ratings:**

Temperature:

Operating: -25°F to +125°F (-32°C to +52°C).

Storage: -30°F to +150°F (-34°C to +66°C).

Humidity: 5 to 95 percent relative humidity, noncondensing.

**Terminal Connections:** 1/4 in. (6 mm) quick-connect terminals mounted on motor.

**Shaft:** Single-ended drive shaft with crank arm supplied.

**Reliability:**

Full-Stroke Cycles: 60,000.

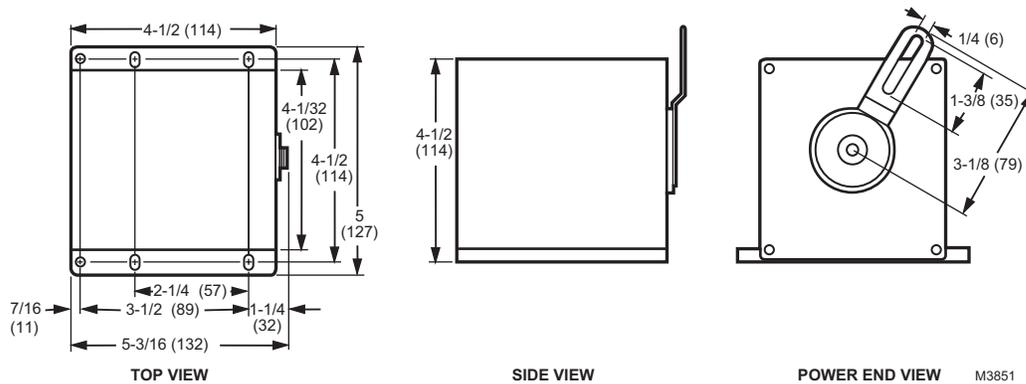
Repositions: 1,500,000.

**Approvals:**

Underwriters Laboratory Inc.:

Flammability Rating: UL94-5V.

Component Recognized: File No. E4436, Guide No. XAPX2, Vol. 9, Section 1, 7-25-83.



**Fig. 26. M7215 Damper Motor dimensions in in. (mm).**

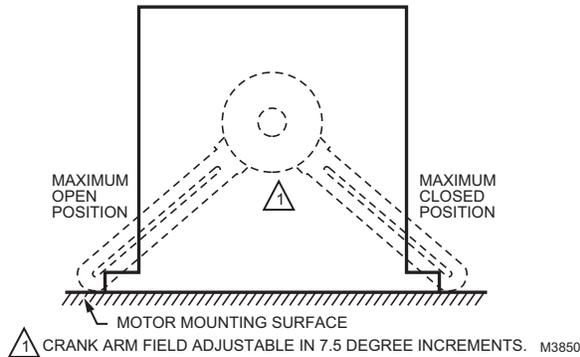


Fig. 27. Limits of crank arm rotation.

## INSTALLATION



### CAUTION

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



### CAUTION

**Personal Injury Hazard.**  
**Spring-return assembly can release.**  
 Leave end covers attached to the motor.

## Location and Mounting

Locate motor as close as possible to the equipment to be controlled. Refer to Fig. 26 for mounting dimensions.

1. Mount motor with the shaft horizontal to ensure maximum life.

NOTE: Operation in other positions is possible when required by the application.

2. Remove crank arm (secured with two screws) from the motor hub.

### IMPORTANT

*Position crank arm on hub so it does not strike motor mounting surface during any portion of full stroke. See Fig. 27.*

3. Reposition the crank arm to accommodate specific damper requirements.

NOTE: Crank arm position is adjustable in eight degree increments.

4. Reconnect crank arm to the motor hub.
5. If there is an excess length of linkage rod, cut it to size. Make necessary minor adjustments until desired operation is obtained.
6. Tighten all nuts and set screws.

## WIRING



### CAUTION

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

The M7215 Damper Motor accepts input from a 2-10 Vdc controller. The motor can be checked out either directly or by using a controller.

### IMPORTANT

1. If necessary, release one of the previously tightened linkage connections to prevent damage.
2. Check for proper operation, making sure that the linkage does not bind and that the motor travels smoothly throughout its cycle from fully open to fully closed.

NOTES: This motor checkout assures that:

1. The motor operates the load.
2. The motor responds properly to the controller.
3. There is no linkage binding or motor stalling at any point of travel.
4. If questions arise regarding this product, contact your distributor or local Honeywell representative.

## DIRECT CHECKOUT

1. Mount the motor for the required application.
2. Check the damper position and make sure 24 Vac is present across TR and TR1.
3. Apply 10 Vdc to IN+ and IN- to move damper to the opposite position. The motor should drive the damper.
4. If the motor does not run, verify that the motor and crank arm are properly installed for either clockwise or counterclockwise rotation.
5. If installation is correct, but the motor does not run, replace the motor.

## CONTROLLER CHECKOUT

1. Adjust controller setpoint to call for cooling. Observe the motor.
2. If the damper is closed, it should begin to open.
3. If the damper remains closed, move controller setpoint farther below room temperature.
4. If the damper still does not move, check for the presence of 24 Vac in the input.
5. If 24 Vac is present and motor does not operate, reverse controller leadwires to determine if device was miswired.
6. If the wiring is correct and 24 Vac is present on the input terminals but the motor does not run, replace the motor.

# W7212, W7213, W7214 Logic Modules

## SPECIFICATIONS

For use with any Honeywell 2-10 Vdc actuator; includes DCV input; adjustable exhaust fan setpoint.

### NOTES:

- All models include a minimum damper position potentiometer, and setpoints for: enthalpy or dry-bulb, occupied/unoccupied control, DCV operation, and DCV maximum.
- Occupied/Unoccupied overrides minimum damper position setting when building is unoccupied.

**Dimensions:** See Fig. 28.

### Electrical Ratings:

Input Voltage: 24 Vac  $\pm$ 20%; 50/60 Hz (Class 2).  
 Nominal Power Consumption (at 24 Vac, 60 Hz): 11.5 VA.  
 Relay Contact Rating at 30 Vac (maximum power from class 2 input only): 1.5A run, 3.5A inrush.

### IMPORTANT

*All inputs and outputs must be 24 Vac Class 2.*

### Ambient Ratings:

Temperature: -40°F to +149°F (-40°C to +65°C).  
 Humidity: 5 to 95 percent rh (noncondensing).

### Inputs:

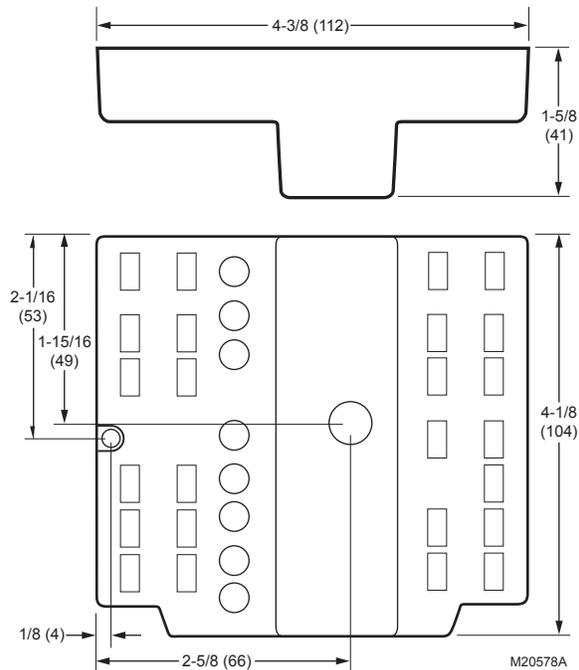
Enthalpy (C7400): 2-wire (18,20,22 AWG) connection.  
 Dry Bulb Temperature (C7650): 2-wire (18,20,22 AWG) connection.  
 Discharge Air (C7046): 2-wire (18,20,22 AWG) connection.  
 Mixed Air (C7150): 2-wire (18,20,22 AWG) connection.  
 DCV Sensor (C7232): 0/2-10 Vdc control signal;  
 100K ohm input impedance.

### Outputs:

Actuator Signal: 2-10 Vdc.  
 Minimum Actuator Impedance: 1K ohm.  
 Exhaust Fan: Contact closure.  
 24 Vac Out: 25 VA maximum.

### Approvals:

Underwriters Laboratories Inc.: UL873 listed.  
 Flammability Rating: UL94-5VB.  
 Plenum Rated.  
 CE.  
 C-tick.



**Fig. 28. Logic module dimensions in in. (mm).**

## INSTALLATION

### Location and Mounting

The logic modules mount on a sheet metal duct or panel. When planning the installation, allow enough clearance for maintenance and service (see Fig. 28 for dimensions). Mount device in a location protected from rain, snow, and direct sunlight. Secure device to sheet metal using the two supplied mounting screws, see Fig. 30.



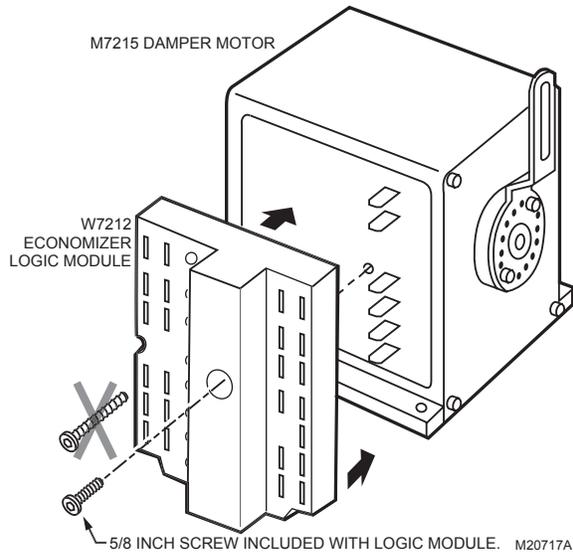
## CAUTION

**Equipment Damage Hazard.**

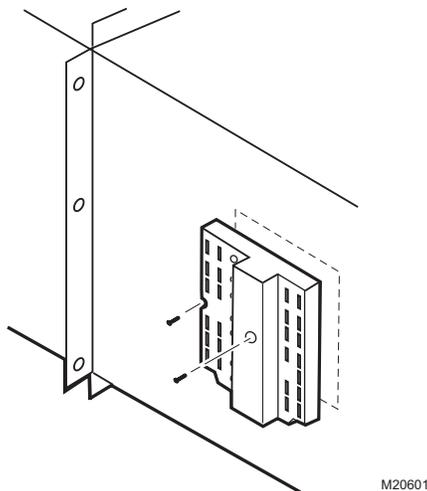
**Mounting screws longer than 5/8 in. can damage internal motor components.**

When mounting the module to an M7215 use only the included #6 5/8 in. thread-forming screw.

NOTE: See Fig. 31 for representative locations of connected system devices.



**Fig. 29. Direct mounting of module.**



**Fig. 30. Mounting the module on sheet metal.**

## WIRING

### ⚠ CAUTION

**Electrical Shock or Equipment Damage Hazard.**  
Can shock individuals or short equipment circuitry.

Disconnect power supply before installation.

#### IMPORTANT

1. All wiring must comply with applicable local codes, ordinances and regulations.
2. All device inputs and outputs must be 24 Vac Class 2.
3. Ensure proper polarity of sensor connections. Incorrect polarity negates the sensor signal.

### C7400 Enthalpy Sensor and C7650 Dry Bulb Temperature Sensor

W7212, W7213, W7214 Logic Modules accept signals from either the C7400 Enthalpy Sensor or the C7650 Dry Bulb Temperature Sensor. The wiring is the same for either sensor.

#### IMPORTANT

*When using differential sensing, both sensors must be of the same type (enthalpy or dry bulb).*

#### OUTDOOR AIR SENSING

1. Mount sensor in any orientation exposing it to freely circulating air while protecting it from rain, snow, and direct sunlight.
2. Connect it to the SO and SO+ terminals of the device.

#### RETURN AIR SENSING

1. Ensure differential enthalpy control has a second sensor in the return air duct.
2. Connect this sensor to the SR and SR+ terminals.

### Demand Control Ventilation

The DCV can be any sensor that provides a 0/2-10 Vdc output. The DCV modulates the outdoor damper to provide ventilation based on occupancy. The designer determines contaminants to monitor, selects appropriate sensor, determines the sensor threshold, and adjusts the DCV potentiometer accordingly. The DCV LED lights when the DCV signal is above setpoint. Mount the sensor according to the manufacturer specifications. If not available, use the following guidelines:

1. Mount sensor in an area with unobstructed air circulation.
2. Connect it to the AQ and AQ1 terminals of the W7212 (see Wiring section for details).
3. Adjust the DCV potentiometer setpoint to correspond to DCV voltage output at the threshold.

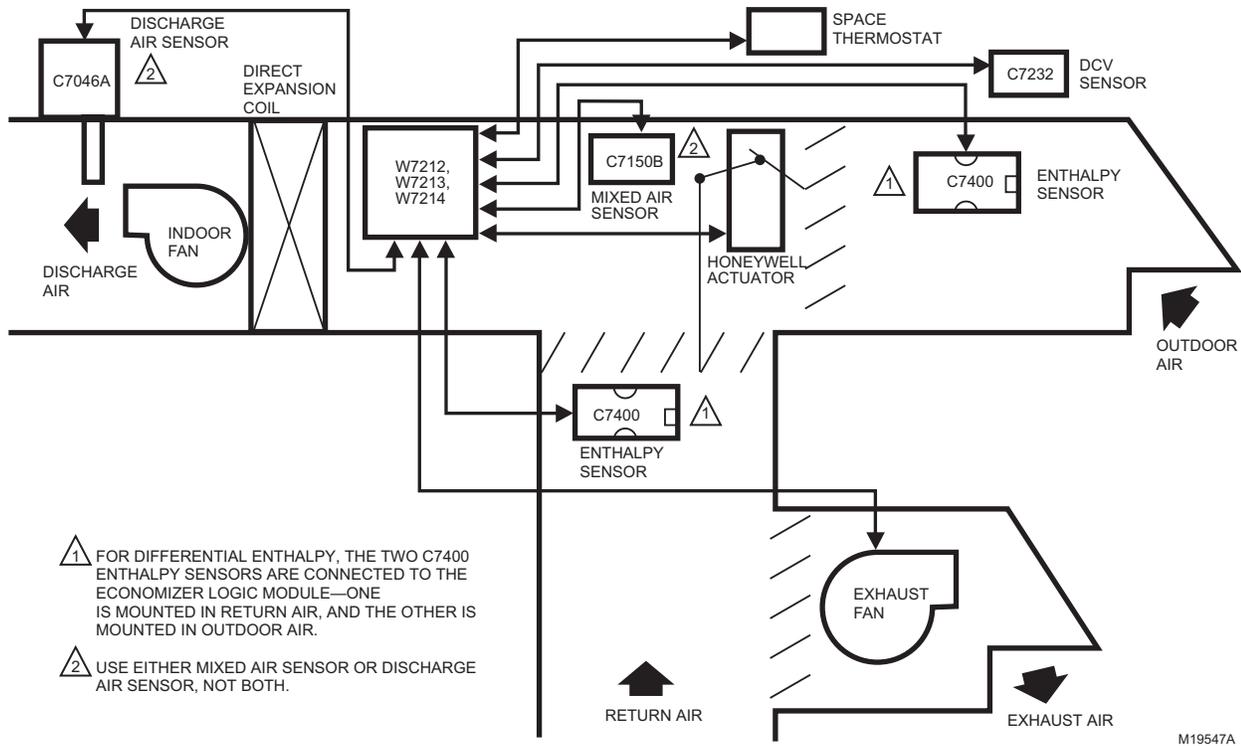


Fig. 31. Representative locations of connected economizer system devices.

## Optional Applications

### Heat Pump Changeover (W7213, W7214 only)

In heat pump applications, the controller must have control of the changeover valve. To provide the logic module with the information necessary for proper information, there must be a connection to the logic module O/B terminal. This terminal alerts the logic module as to when the system operates in cooling (the only time the economizer is used).

#### W7213 (CHANGEOVER TERMINAL B)

Connect the B terminal according to the following details:

- 24V power to B: System is in heating mode, free cool disabled.
- No power to B: System is in cooling mode, free cool available. Actuator operates according to W7213 Economizer logic. (See Table 9 for logic details.)

#### W7214 (CHANGEOVER TERMINAL O)

Connect the O terminal according to the following details:

- No power to O: System is in heating mode, free cool disabled.
- 24V power to O: System is in cooling mode, free cool available. Actuator operates according to W7214 Economizer logic. (See Table 9 for logic details.)

### Remote Minimum Position Control

Remote control of outdoor air dampers is desirable when requiring temporary additional ventilation. The addition of a S963B1128 Remote Potentiometer allows occupants to open or close the dampers beyond minimum position for modified ventilation. Connect the potentiometer as shown in Fig. 32.

### IMPORTANT

- The minimum position signal takes priority over the DCV maximum position signal. With DCV maximum set below the minimum, the logic module signals the actuator to maintain the minimum position.
- Freeze protection logic takes priority over all signals. For details, see the notes in the Adjusting Minimum and Maximum Positions section.

NOTE: For additional wiring applications, refer to the Design and Application Guide for Honeywell Economizers (form 63-8594).

The purpose of the economizer is to use outdoor air for cooling, whenever possible, to reduce compressor operation.

When wired as shown in Fig. 35, the logic module responds to the cooling thermostat signal. This system uses C7400 Solid State Enthalpy Changeover Sensor(s) or C7650 Dry Bulb Temperature Sensor(s). The C7400 responds to both dry bulb temperature and humidity, allowing use of outdoor air at higher temperatures for free cooling when humidity is low. The C7650 responds only to dry bulb temperature; use only in dry, arid climates.

The logic module functions as a true first stage of cooling providing maximum energy economy during the cooling cycle. It automatically locks out free cooling during heating; holding the outdoor air damper at the minimum position setting.

NOTE: When module is operating in Occupied mode, the minimum position is defined by the potentiometer. When the module is operating in Unoccupied mode, the minimum position is fully closed.

The logic module can operate as either a basic free cooling controller, or it can incorporate additional functions. Table 9 details the input/output (I/O) logic of the module.

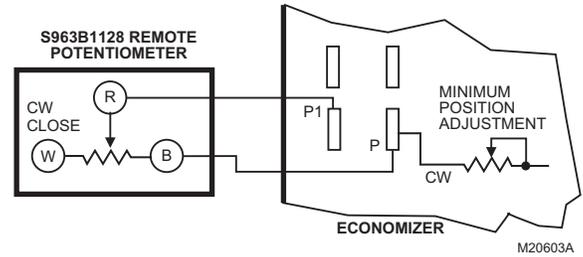


Fig. 32. S963B1128 Remote Potentiometer used with logic module for remote damper control.

Table 9. W7212 Economizer I/O Logic.

INPUTS					OUTPUTS			
DCV	Enthalpy <sup>a</sup>		Y1 <sup>b</sup>	Y2 <sup>b</sup>	Compressor		Damper	
	Outdoor	Return			1	2	Occupied <sup>c</sup>	Unoccupied <sup>c</sup>
Below set (DCV LED Off)	High (Free Cooling LED Off)	Low	On	On	On	On	Minimum position	Closed
			On	Off	On	Off		
	Low (Free Cooling LED On)	High	On	On	On	Off	Modulating <sup>d</sup> (between min. position and full-open)	Modulating <sup>d</sup> (between closed and full-open)
			On	Off	Off	Off		
Above set (DCV LED On)	High (Free Cooling LED Off)	Low	On	On	On	On	Modulating <sup>e</sup> (between min. position and DCV maximum)	Modulating <sup>e</sup> (between closed and DCV maximum)
			On	Off	On	Off		
	Low (Free Cooling LED On)	High	On	On	On	Off	Modulating <sup>f</sup>	Modulating <sup>g</sup>
			On	Off	Off	Off		

<sup>a</sup> For single enthalpy control, the module compares outdoor enthalpy to the ABCD setpoint.

<sup>b</sup> If both stages of cooling are off, the system is off and the damper is at:

- Minimum position if DCV is below setpoint and system is Occupied.
- Closed if DCV is below setpoint and system is Unoccupied.
- Modulating if DCV is above setpoint.

<sup>c</sup> Power at N terminal (relative to TR1) determines Occupied/Unoccupied setting:

- W7212: 24 Vac (Occupied), no power (Unoccupied).
- W7213, W7214: No power (Occupied), 24 Vac (Unoccupied).

<sup>d</sup> Modulation is based on the mixed air sensor signal.

<sup>e</sup> Modulation is based on the DCV signal.

<sup>f</sup> Modulation, based on the greater of DCV and mixed air sensor signals, between minimum position and either maximum position (DCV) or fully open (mixed air signal).

<sup>g</sup> Modulation, based on the greater of DCV and mixed air sensor signals, between closed and either maximum position (DCV) or fully open (mixed air signal).

NOTES:

- DCV and Free Cooling have setpoints and LED indications.
- For models with a B terminal (W7213):  
No power to B: cooling mode, free cool enabled. Module follows logic detailed above.  
24V power to B: heating mode, free cool disabled. Actuator drives to minimum position (closed when Unoccupied).
- For models with an O terminal (W7214):  
24V power to O: cooling mode, free cool available. Module follows logic detailed above.  
No power to O: heating mode, free cool disabled. Actuator drives to minimum position (closed when Unoccupied).

## SETTINGS AND ADJUSTMENTS

Potentiometers with screwdriver adjustment slots, located on device face, provide adjustments for several parameters (see Fig. 33 for locations on device):

- DCV setpoint.
- Minimum damper position.
- Maximum damper position.
- Enthalpy changeover.
- Exhaust setpoint.

### Demand Control Ventilation Setpoint

The logic module modulates the outdoor damper to provide ventilation based on the 0/2-10 Vdc DCV. With no cooling signal, the DCV overrides the outdoor air damper when ventilation requires outdoor air.

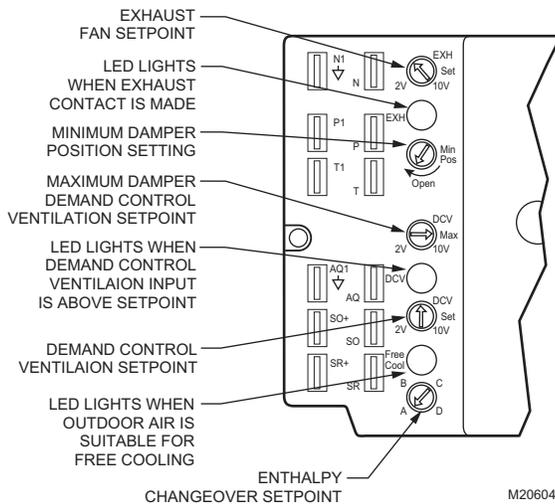


Fig. 33. Potentiometer and LED locations.

### Adjusting Minimum and Maximum Positions

The minimum position potentiometer maintains the minimum outdoor air flow into the building during occupied period. The DCV maximum position potentiometer allows the installer to limit the amount of outdoor air flow into the building when the DCV overrides the mixed air sensor. Setting the DCV maximum position of the damper prevents the introduction of large amounts of hot or cold air into the space.

#### IMPORTANT

*With the DCV maximum position set below the minimum position, the minimum position overrides the maximum position (negating most DCV functions of the logic module, as the damper cannot move).*

#### NOTES:

- When the mixed air sensor takes control, it overrides the DCV maximum position potentiometer.
- If the mixed air temperature drops to 45°F, the mixed air sensor overrides the DCV and fully closes the damper to protect from freezing the hot or chilled water coils. Control returns to normal once the mixed air temperature rises to 48°F.

### Minimum Position Adjustment

For detailed assistance in minimum position selection reference the Economizer Application Guide (form 63-8594) Ventilation section. The following provides basic guidelines for minimum position selection and adjustment:

#### IMPORTANT

*Adjust the minimum position potentiometer to allow the minimum amount of outdoor air, as required by local codes, to enter the building.*

NOTE: Make minimum position adjustments with at least a 10°F [6°C] temperature difference between outdoor and return air.

1. Calculate the appropriate mixed air temperature, see Equation 1.
2. Disconnect mixed air sensor from terminals T and T1.
3. Ensure that either the factory-installed jumper is in place across terminals P and P1 or, of remote damper position is required, that it is wired according to Fig. 32 and turned fully clockwise.
4. Connect 24 Vac across terminals TR and TR1.
5. Carefully adjust the potentiometer on the face of the device with a small screwdriver until the mixed air temperature reaches the calculated value.

NOTE: Ensure that the sensed air is well mixed.

#### Equation 1. Formula to aid minimum position adjustment.

$$(T_O \times OA) + (T_R \times RA) = T_M$$

Where:

- T<sub>O</sub> = Outdoor air temperature
- OA = Percent of outdoor air
- T<sub>R</sub> = Return air temperature
- RA = Percent of return air
- T<sub>M</sub> = Resulting mixed air temperature

#### IMPORTANT

*This procedure requires use of a quality thermometer capable of reading to 0.5°F [0.25°C].*

NOTE: The following sample calculation uses only Fahrenheit temperature.

EXAMPLE: Assume local codes require 10% outdoor air during occupied conditions, outdoor air is 60°F and return air is 75°F. Under these conditions, what is the temperature of the mixed air?

$$(0.1 \times 60^\circ\text{F}) + (0.9 \times 75^\circ\text{F}) = 6.0^\circ\text{F} + 67.5^\circ\text{F} = 73.5^\circ\text{F}$$

Mixed air will be 73.5°F when OA is 60°F and RA is 75°F with 10 percent outdoor air entering the building.

### DCV Maximum Position Adjustment

1. Disconnect mixed air sensor from terminals T and T1 and short terminals T and T1.
2. Connect a jumper between terminals AQ and SO+.
3. Connect 24 Vac across terminals TR and TR1.
4. Adjust the potentiometer on the face of the device with a screwdriver for desired maximum position.

## Enthalpy Changeover

### Outdoor Enthalpy Changeover Setpoint (Single Enthalpy)

The outdoor enthalpy changeover setpoint returns the outdoor air damper to minimum position when enthalpy rises above its setpoint. Enthalpy setpoint scale markings, located in the device, are A, B, C, and D. See Fig. 34 for the corresponding control point. The factory-installed 620-ohm jumper must be in place across terminals SR and SR+.

### Differential Enthalpy Changeover Setting

Differential enthalpy control uses two C7400 Enthalpy Sensors connected to one logic module. The logic module compares outdoor air to return air instead of to a setpoint as it does for single enthalpy.

NOTE: Turn the setpoint potentiometer fully clockwise to the D setting.

The logic module selects the lower enthalpy air (return or outdoor) for cooling. For example, when outdoor air has lower enthalpy than return air, the outdoor air damper opens to bring in outdoor air for free cooling.

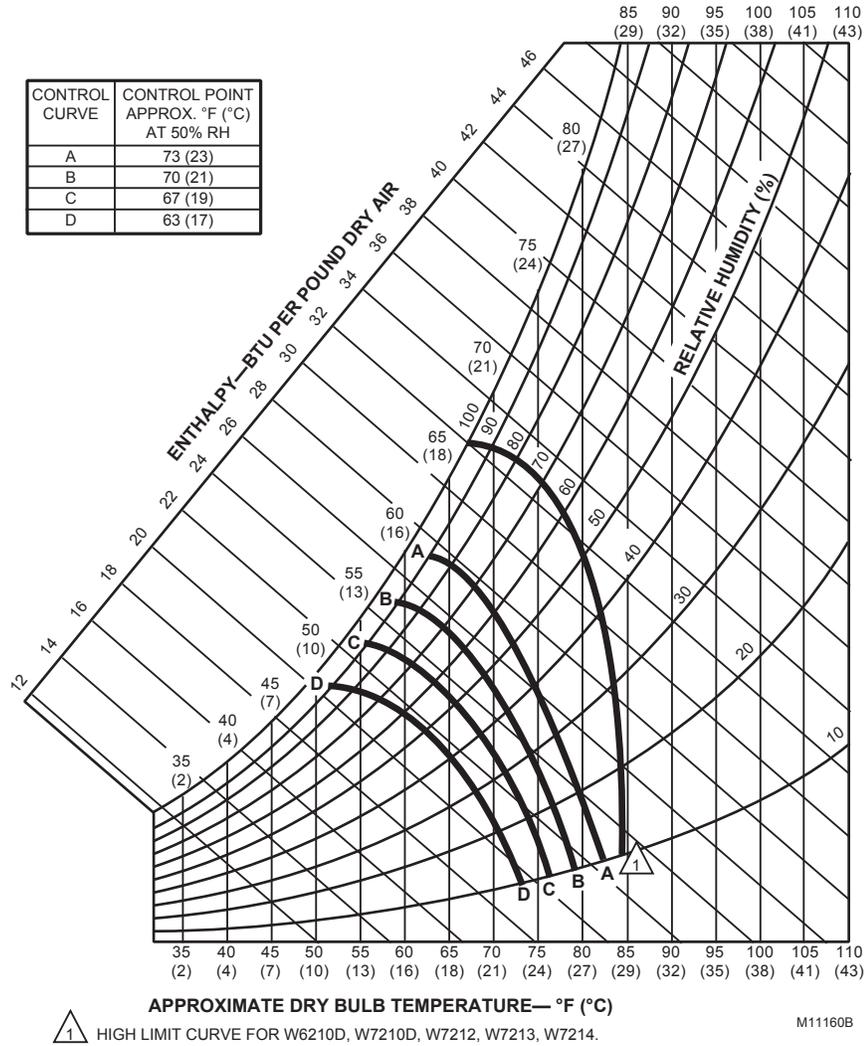
### Exhaust Setpoint

The exhaust setpoint determines when the exhaust fan runs based on damper position. When the exhaust fan call is made, the module provides a 60 ±30 second delay before exhaust fan activation. This delay allows the damper to reach the appropriate position to avoid unnecessary fan overload.

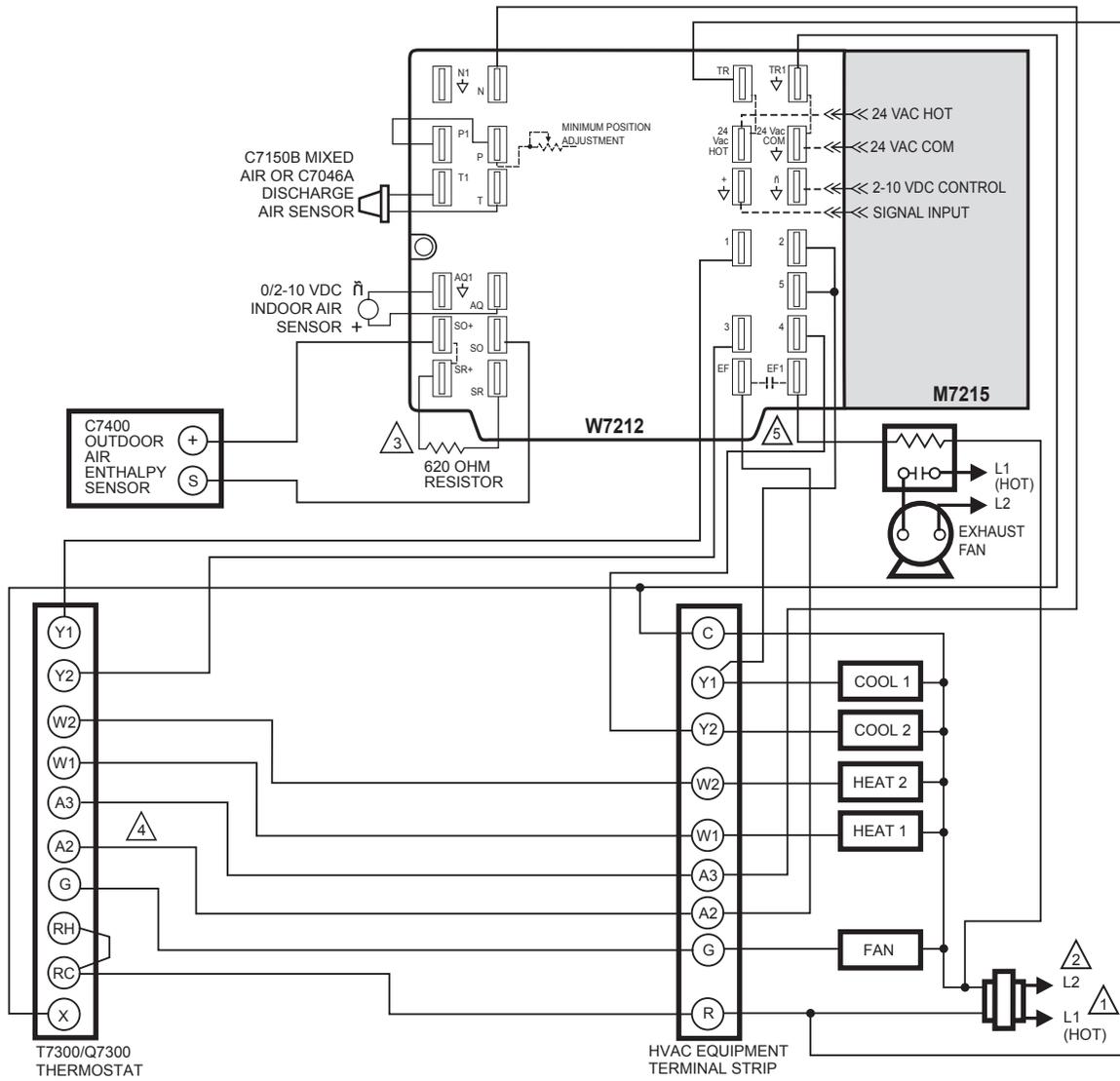
NOTE: EF and EF1 are dry contacts only. An external line voltage contactor is required to operate the exhaust fan.

### Adjustable Exhaust Setpoint

These logic modules have an adjustable setpoint. This potentiometer allows the installer to set the exhaust setpoint at an actual damper position percentage open from fully closed.



**Fig. 34. Partial psychrometric chart with single C7400 Solid State Enthalpy Sensor and W7212 Solid State Economizer Logic Module performance Curves.**



- ⚠️ 1 POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
- ⚠️ 2 ENSURE THAT TRANSFORMER IS SIZED TO HANDLE THE EXTRA LOAD OF THE ECONOMIZER AND ACTUATOR.
- ⚠️ 3 FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR SHOULD NOT BE REMOVED. DIFFERENTIAL ENTHALPY NOT RECOMMENDED FOR USE WITH SINGLE-STAGE COOLING SYSTEMS OR SINGLE-STAGE COOLING THERMOSTATS.
- ⚠️ 4 T7300 TERMINALS A1 AND A3 ARE CONNECTED WHEN THERMOSTAT IS IN THE UNOCCUPIED MODE.
- ⚠️ 5 EF AND EF1 ARE DRY CONTACTS IN THE LOGIC MODULE.

M20716B

Fig. 35. W7212 used with M7215 Damper Motor.

# CHECKOUT AND TROUBLESHOOTING

Checkout requires a 9V battery, 620 ohm, 1.2K ohm, 5.6K ohm, and 6.8K ohm resistors. Use Table 10 and Fig. 36 for checkout.

## CAUTION

**Equipment Damage Hazard.**  
**Excessive force can damage potentiometer controls.**  
 Use a small screwdriver when adjusting enthalpy changeover and minimum damper position controls.

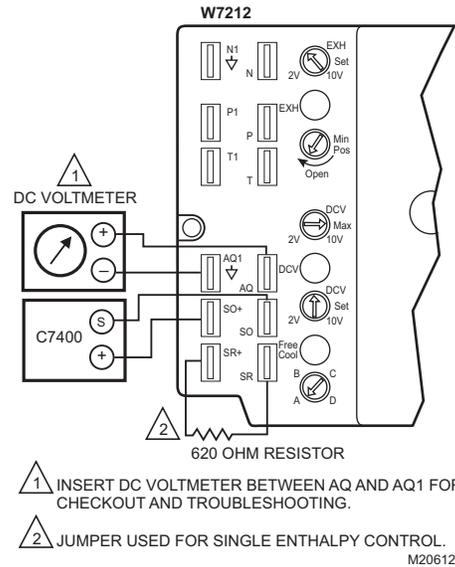


Fig. 36. Meter location for checkout and troubleshooting.

Table 10. Checkout for W7212 Economizers Connected to Honeywell Actuator.

Step	Checkout Procedure	Proper Response
1.	<b>CHECKOUT PREPARATION</b>	
	Disconnect power at TR and TR1.	All LED are off; Exhaust Fan contacts are open.
	Disconnect devices at P and P1.	
	Jumper P to P1.	
	Place 5.6K ohm resistor across T and T1.	
	Jumper TR to 1.	
	W7212 only: Jumper TR to N.	
	If connected, remove C7400 Enthalpy Sensor from terminals S <sub>O</sub> and +.	
	Connect 1.2K ohm 4074EJM Checkout Resistor across terminals S <sub>O</sub> and +.	
	Put 620 ohm resistor across S <sub>R</sub> and +.	
	Set minimum position, DCV, and Exhaust potentiometers fully CCW.	
	Turn DCV maximum position potentiometer fully CW.	
	Set enthalpy potentiometer to D.	
W7214 only: Jumper TR to O.		
Apply power (24 Vac) to terminals TR and TR1.		
2.	<b>DIFFERENTIAL ENTHALPY</b>	
	Execute step one, Checkout Preparation.	—
	Place 620 ohm resistor across S <sub>O</sub> and +.	—
	Place 1.2K ohm resistor across S <sub>R</sub> and +.	Free cool LED turns on.
	Remove 620 ohm resistor from S <sub>O</sub> and +.	Free cool LED turns off.
3.	<b>SINGLE ENTHALPY</b>	
	Execute step one, Checkout Preparation.	—
	Set enthalpy potentiometer to A (fully CCW).	Free cool LED turns on.
	Set enthalpy potentiometer to D (fully CW).	Free cool LED turns off.

**Table 10. Checkout for W7212 Economizers Connected to Honeywell Actuator. (Continued)**

Step	Checkout Procedure	Proper Response
4.	<b>DCV AND EXHAUST</b>	
	Execute step one, Checkout Preparation.	—
	Ensure terminals AQ and AQ1 are open.	LED for both DCV and Exhaust should be off. Actuator drives fully closed.
	Connect 9V battery positive to AQ and negative to AQ1.	LED for both DCV and Exhaust turn on. Actuator drives 90 to 95 percent open.
	Turn Exhaust potentiometer CW until Exhaust LED turns off.	Exhaust LED turns off with potentiometer at approximately 90 percent. Actuator remains in position.
	Turn DCV potentiometer CW.	DCV LED turns off with potentiometer at approximately 9V. Actuator drives fully closed.
	Turn DCV and Exhaust potentiometers CCW until Exhaust LED turns on.	Exhaust contacts close 30-120 seconds after Exhaust LED turns on.
5.	<b>MINIMUM AND MAXIMUM POSITION</b>	
	Execute step one, Checkout Preparation.	—
	Connect 9V battery positive to AQ and negative to AQ1.	DCV LED turns on. Actuator drives 90 to 95 percent open.
	Turn DCV maximum position potentiometer to midpoint.	Actuator drives to between 20 and 80 percent open.
	Turn DCV maximum position potentiometer to fully CCW.	Actuator drives fully closed.
	Turn minimum position potentiometer to midpoint.	Actuator drives to between 20 and 80 percent open.
	Turn minimum position potentiometer fully CW.	Actuator drives fully open.
	W7212: Remove jumper from TR and N.	Actuator drives fully closed.
W7213, W7214: Jumper TR to N.		
6.	<b>MIXED AIR INPUT</b>	
	Execute step one, Checkout Preparation.	—
	Set enthalpy potentiometer to A.	Free cool LED turns on. Actuator drives to between 20 and 80 percent open.
	Remove 5.6K ohm resistor and jumper from T and T1.	Actuator drives fully open.
	Remove jumper from T and T1 and leave open.	Actuator drives fully closed.
7.	<b>HEAT PUMP INPUT - W7213, W7214 ONLY</b>	
	Execute step one, Checkout Preparation.	—
	Set enthalpy potentiometer to A.	Free cool LED turns on. Actuator drives to between 20 and 80 percent open.
	W7213: Jumper TR to B. W7214: Remove jumper from TR and O.	Free cool LED turns off. Actuator drives fully closed.

# APPENDIX

## IMPORTANT

This page is only for C7232 models with date code prior to 0309.

### Pre 0309 Date Code Jumper Settings

#### Input Signal

The C7232 Sensors have an adjustable range. These ranges are determined by the SW2 and OUT1 jumper settings (see Table 11).

NOTE: When choosing analog output, be sure to set the SW1 jumper to the On position.

**Table 11. CO<sub>2</sub> Range Jumper Settings for models with date code prior to 0309.**

Jumper	Setting	Jumper SW1		Jumper SW2	
		On <sup>a</sup>	Off	On <sup>a</sup>	Off
OUT1 <sup>b</sup>	AN1	X	— <sup>c</sup>	0 to 1000	0 to 2000
	AN2 <sup>a</sup>	X	— <sup>c</sup>	500 to 1500	500 to 2000
Relay Switching <sup>b</sup>		X		800 <sup>d</sup>	1200 <sup>d</sup>
			X	1000 <sup>d</sup>	

<sup>a</sup> Setting when shipped from the factory.

<sup>b</sup> OUT1 jumper setting does not affect the Relay Switching.

<sup>c</sup> The analog output will not work properly when SW1 is Off.

<sup>d</sup> When the level reaches this value, the contacts close; when the level drops 100 ppm below this value, the contacts open.

#### Output Signal

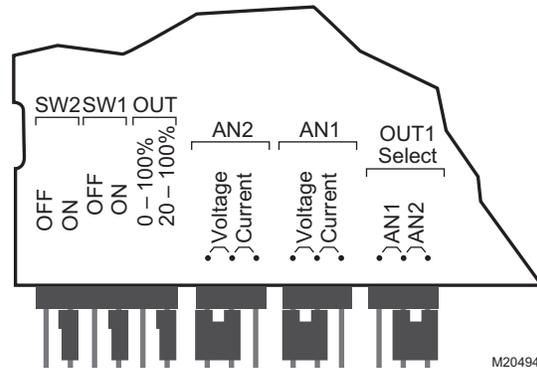
The output signal can be adjusted for 0/2-10Vdc or 0/4-20mA (see Table 12).

**Table 12. Output Signal Jumper Settings for models with date code prior to 0309.**

AN1 and AN2 (set both the same)	OUT	
	0-100%	20-100%
Voltage	0-10Vdc	2-10Vdc
Current	0-20 mA	4-20 mA

NOTES:

- On duct models with date code prior to 0309, remove the screw holding the board in place to view jumper settings on reverse. (See Fig. 37.)
- The CO<sub>2</sub> settings and the output signal settings are independent of each other. 0-100% and 20-100% are simply markings for the OUT jumper settings on the sensor (to differentiate between the two voltage and the two current ranges) and do not refer to or alter the ppm range chosen.



**Fig. 37. C7232 default jumper settings for models with date code prior to 0309.**

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