



Series C & Series TM

User's Manual



Series C - On-Off Temperature Controller
Series TM - Temperature Indicator



**TOTAL
CUSTOMER
SATISFACTION**
3 Year Warranty



ISO 9001

Registered Company
Winona, Minnesota USA

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0600-0044-0000 Rev. A

Made in the U.S.A.



April 2003

\$5.00


Safety Information


We use note, caution and warning symbols throughout this book to draw your attention to important operational and safety information.

A “NOTE” marks a short message to alert you to an important detail.

A “CAUTION” safety alert appears with information that is important for protecting your equipment and performance. Be especially careful to read and follow all cautions that apply to your application.

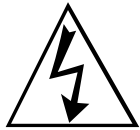
A “WARNING” safety alert appears with information that is important for protecting you, others and equipment from damage. Pay very close attention to all warnings that apply to your application.

The safety alert symbol,  (an exclamation point in a triangle) precedes a general CAUTION or WARNING statement.

The electrical hazard symbol,  (a lightning bolt in a triangle) precedes an electric shock hazard CAUTION or WARNING safety statement.



**CAUTION or
WARNING**



**Electrical
Shock Hazard**

CAUTION or WARNING

Technical Assistance

If you encounter a problem with your Watlow controller, review your configuration information to verify that your selections are consistent with your application: inputs, outputs, alarms, limits, etc. If the problem persists, you can get technical assistance from your local Watlow representative (see back cover), by e-mailing your questions to wintechsupport@watlow.com or by dialing +1 (507) 494-5656 between 7 a.m. and 5 p.m., Central Standard Time (CST). Ask for for an Applications Engineer. Please have the following information available when calling:

- Complete model number
- System wiring information
- Basic Controller User’s Manual

Warranty

These controllers are manufactured by ISO 9001-registered processes and are backed by a three-year warranty.

Return Material Authorization (RMA)

1. Call Watlow Customer Service, (507) 454-5300, for a Return Material Authorization (RMA) number before returning any item for repair. We need this information:
 - Ship to address
 - Contact name
 - Method of return shipment
 - Detailed description of the problem
 - Name and phone number of person returning the product.
 - Bill to address
 - Phone number
 - Your P.O. number
 - Any special instructions
2. Prior approval and an RMA number, from the Customer Service Department, is needed when returning any unused product for credit. Make sure the RMA number is on the outside of the carton, and on all paperwork returned. Ship on a Freight Prepaid basis.
3. After we receive your return, we will examine it and try to verify the reason for the return.
4. In cases of manufacturing defect, we will enter a repair order, replacement order or issue credit for material returned.
5. To return products that are not defective, goods must be in new condition, in the original boxes and they must be returned within 120 days of receipt. A 20 percent restocking charge is applied for all returned stock controls and accessories.
6. If the unit is unrepairable, it will be returned to you with a letter of explanation.
7. Watlow reserves the right to charge for no trouble found (NTF) returns.

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Overview

Watlow's Series C family of basic temperature controllers* provide an economical controller solution for applications where simple on/off control is needed.

These controllers are available with or without an operator interface and can be ordered in square 1/8th DIN panel mount, din rail mount, open board or potted module design configurations.

The microprocessor design platform provides improvements in the performance, repeatability, and accuracy offered by Watlow's current line of basic temperature control products.

The Series CV includes an operator interface to allow viewing and selection of the control set point. A red four character, seven segment LED displays the set point. It is also available with a push to show process option. The set point selection is made with a continuous turn, velocity sensitive rotary encoder. Set point range temperature values are customer definable in the product configuration part number.

The Series CF offers fixed control points. These units are supplied without an operator interface. Operating set point temperature values are customer definable in the product configuration part number.

The Series TM is a temperature indicator only version. It is available in DIN rail or panel mount configurations.

The features and performance of these products make them ideally suited for a wide range of industrial control applications in the food preparation, industrial machinery, packaging and plastic markets.

Watlow's Series C and TM controllers include industry leading service, support and a 3-year warranty.

*Also available in an FM-approved limit version.

Features and Benefits

Four Character LED Display

- Improves Set Point adjustment accuracy.

Fixed or Adjustable Set Points

- Tamper Proof Operation.
- Control Flexibility.

Push to Set Option

- Reduce accidental set point adjustments.

Push to Display Process Option

- Allows viewing of process value.

Multiple Mounting Options

- Minimizes installation time.

Heat or Cool Operation

- Application flexibility.

Fahrenheit or Celsius Operation with Indication

- Application flexibility.

Sensor Break Protection

- Provides positive system shutdown.

Agency Approvals

- Meets requirements for agency certification.

Micro Processor Based Technology

- Accurate and repeatable control.

Stock to Four Day Delivery

2

Installation

Installing the Open Board Controller

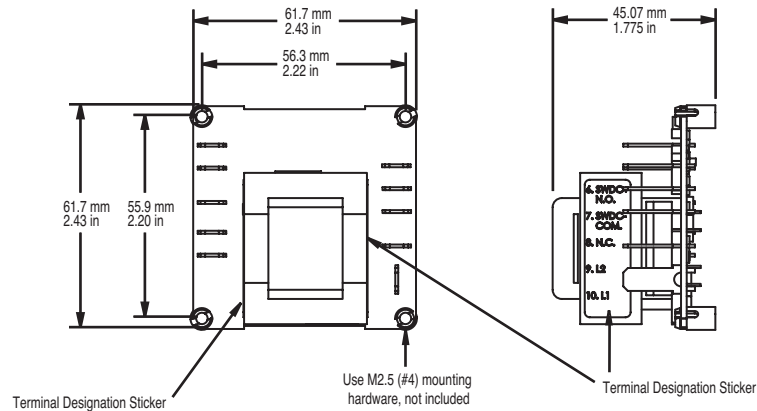


Figure 2a

1. Locate and drill four 3.2 mm (0.125 in) holes in the desired panel location. See Figure 2a for hole locations.
2. Mount the controller using four M2.5 (#4) screws.

Installing the Potted Controller

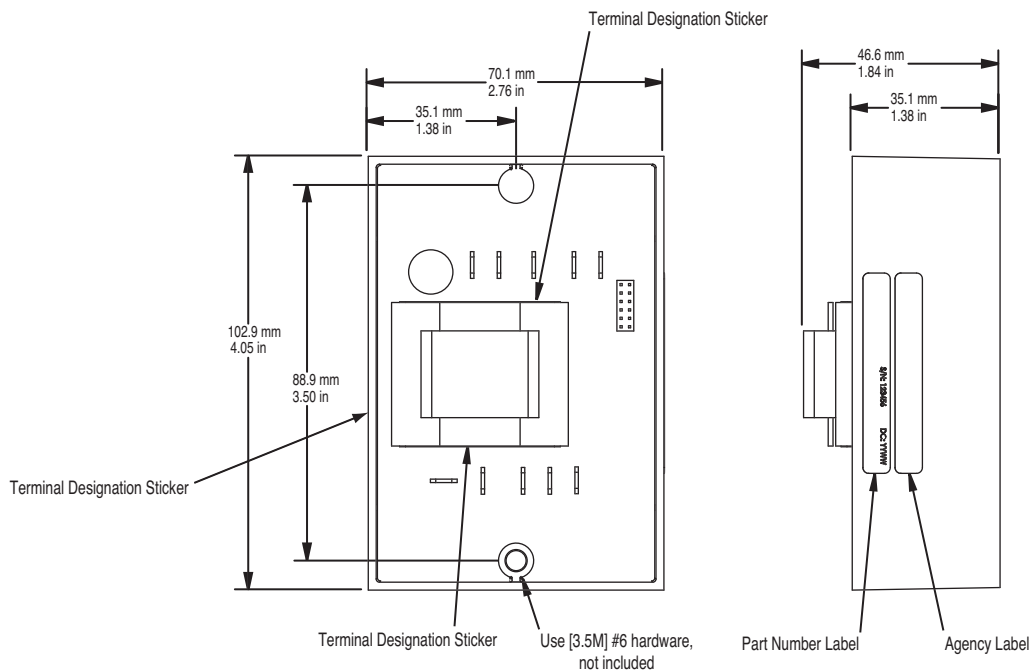


Figure 2b

1. Drill two 5 mm (0.187 in) diameter holes in the desired panel location. See Figure 2b for hole locations.
2. Mount the controller using two M3.5 (#6) screws.

Installing the DIN Rail Mount Controller

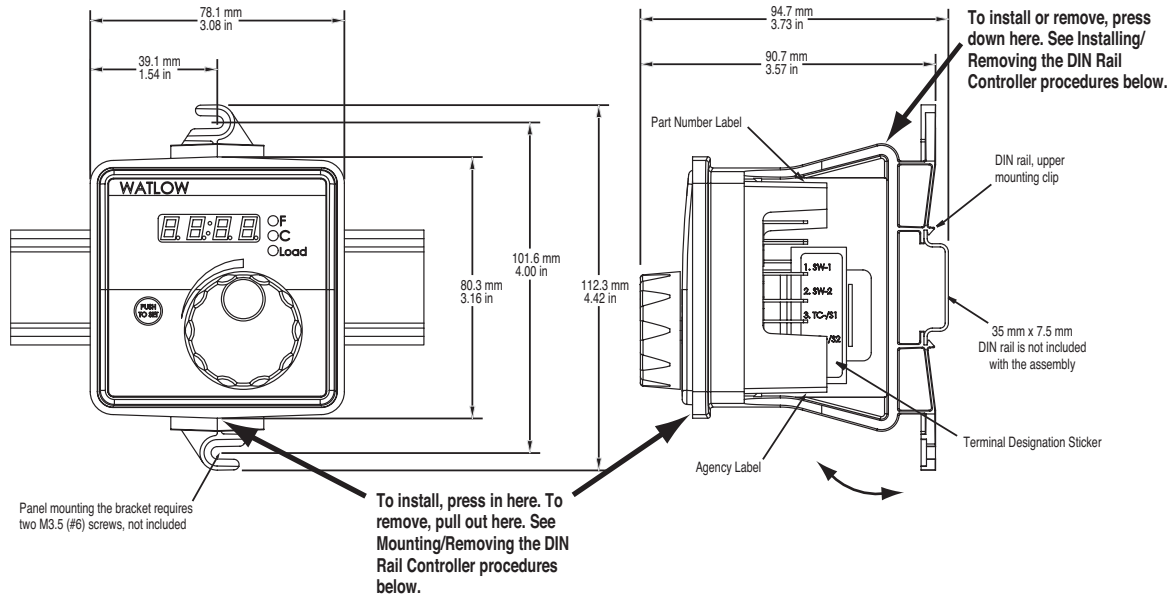


Figure 3a

Sub-Panel Mounting

1. Using the controller as a location template, mark both mounting holes.
2. Drill and tap two 2.7 mm (0.106 in) diameter holes in the desired panel location. See Figure 3a above for hole locations.
3. Mount the controller using two M3.5 (#6) screws.

DIN Rail Mounting

1. Place the DIN rail upper mounting clip on the top edge of the DIN rail. See Figure 3a. DIN rail spec, DIN 50022, 35 mm x 7.5 mm (1.38 in x 0.30 in).
2. Press down firmly on the top back edge of the DIN rail bracket and push in on the bottom, front edge of the bracket. The controller “snaps” securely onto the rail. See Figure 3a. If the controller does not snap on, check to see if the DIN rail is bent. Minimum clipping distance is 34.8 mm (1.37 in), the maximum is 35.3 mm (1.39 in).

Removing the DIN Rail Controller

1. Remove power from the system.
2. Remove all the wiring connections from the back of the controller.
3. While pressing down on the top, back edge of the DIN rail bracket, pull forward on the bottom, front edge of the DIN rail bracket. See Figure 3a.

Removing the Controller from the DIN Rail Bracket

1. Remove power from the system.
2. Remove all the wiring connections from the back of the controller.
3. Remove the DIN rail bracket from the DIN rail.
4. Insert a flat blade screwdriver between the DIN rail bracket and the case. Rotate the screwdriver to release the DIN rail bracket hooks from the ridges on the case, while firmly pushing the controller out the front of the DIN rail bracket. Alternate back and forth between the top and then the bottom. Be sure to support the controller as it comes out of the bracket. See Figure 3b.

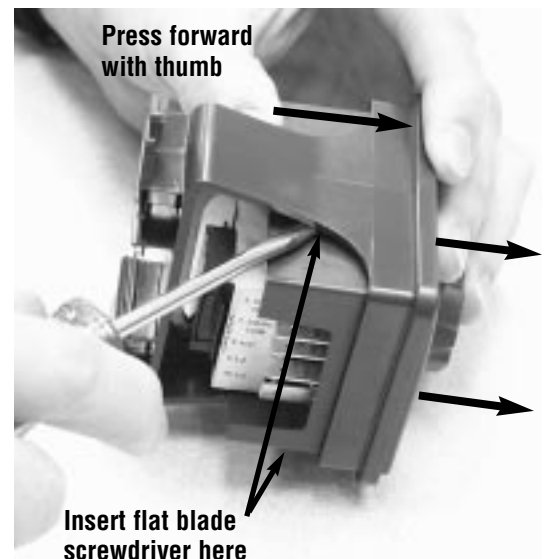


Figure 3b

Installing the Square 1/8 DIN Panel Mount Controller

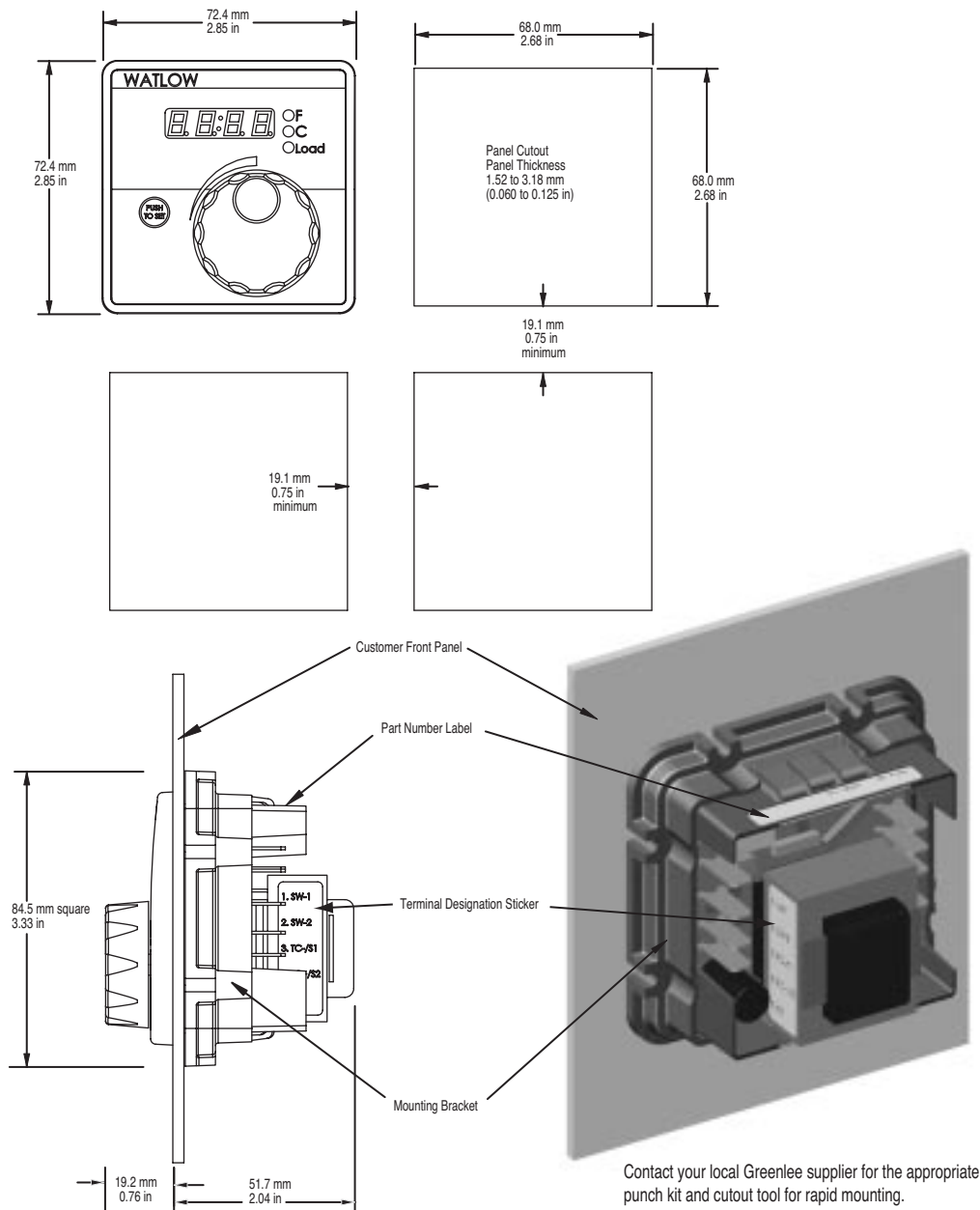


Figure 4

1. Make the panel cutout using the mounting dimensions above.
2. Remove mounting bracket from the back of the controller.
2. Insert the controller into the panel cutout.
3. While pressing the bezel firmly against the panel, slide the mounting bracket over the back of the controller. Be sure the levers on the mounting bracket line up with the teeth on the case.
4. Press the bracket up to the back of the panel. The controller should fit tightly in the panel cutout.

Removing the Panel Mount Square 1/8 DIN Controller

1. Remove power from the system.
2. Remove all the wiring connections from the back of the controller.
3. Slide a thin, wide tool (putty knife) under all three mounting tabs, top then bottom, while pushing forward on the back of the case. Be ready to support the controller as it slides out of the panel cutout.

3

Wiring



Warning:

Use National Electric (NEC) or other country-specific standard wiring and safety practices when wiring and connecting this controller to a power source and to electrical sensors or peripheral devices. Failure to do so may result in damage to equipment and property, and/or injury or loss of life.

Note: Insulated quick connect terminals required.

For terminals 1, 2, 6, 7, 8, 9, and 10, AMP P/N 3-520406-2 or equivalent recommended. Use Amp crimp tool P/N 58078-3, insert 90391-3.

For terminals 3, 4, and 5, AMP P/N 2-520405-2 or equivalent recommended. Amp crimp tool P/N 58078-3, insert 58079-3.

The terminals on the back of the Series C and Series TM controllers are the same for all of the package styles. They are 6.3 mm (0.25 in) quick connect, push on style terminals.

Check the part number to determine your hardware configuration. Refer to the wiring diagrams appropriate for your controller's configuration.

All outputs are referenced to a de-energized state.

Wiring Guidelines

1. Use the correct thermocouple type per the model number on the case sticker of the unit. See dimension drawings for sticker locations.
 - Use correct thermocouple polarity. Red is usually negative.
 - If you must extend thermocouple leads, use thermocouple extension wire to minimize errors.
 - Be sure you have good crimp connections on your thermocouple connections.
 - Insulate the thermocouple mounting from the mounting surface to prevent heat migration input errors.
 - Thermocouple leads should be routed separately from any high voltage lines.
 - Long lead lengths create electrical resistance and there is not any lead resistance compensation. When using a two or three-wire RTDs, there will be an additional 2.6° C (4.7° F) error for every 1Ω of lead length resistance. That resistance when added to the resistance of the RTD element, can result in erroneous input to the temperature controller.
2. In electrically-noisy environments (heavy switching contactors, motors, solenoids, etc.), use shielded thermocouple lead wire with the shield connected at the sensor end only.
3. Use a separate thermocouple to maintain the limit function of this controller; do not parallel thermocouple input from the primary controller.
4. All wiring and fusing must conform to the National Electric Code (NEC) NFPA70 and any other locally applicable codes.
5. Fuse the independent load voltage on the L1 (hot) side and connect it to the common (C) side of the relay.



Warning:

Use National Electric (NEC) or other country-specific standard wiring and safety practices when wiring and connecting this controller to a power source and to electrical sensors or peripheral devices. Failure to do so may result in damage to equipment and property, and/or injury or loss of life.



WARNING: If high voltage is applied to a low-voltage controller, irreversible damage will occur.

Note: Insulated quick connect terminals required.

For terminals 1, 2, 6, 7, 8, 9, and 10, AMP P/N 3-520406-2 or equivalent recommended. Use Amp crimp tool P/N 58078-3, insert 90391-3.

For terminals 3, 4, and 5, AMP P/N 2-520405-2 or equivalent recommended. Amp crimp tool P/N 58078-3, insert 58079-3.

Note: To prevent ground loops, isolation needs to be maintained from input to output when using a switched DC output. Ungrounded thermocouples recommended.

Figure 6a — AC Power Wiring

- Nominal voltage options:
 - 24V~ (ac)
 - 120V~ (ac)
 - 230 to 240V~ (ac)

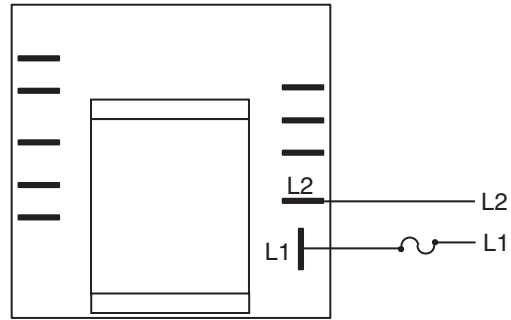


Figure 6b — Thermocouple Input

Thermocouples are polarity sensitive. The negative lead (usually red) must be connected to TC-.

- Input impedance: >10 MΩ

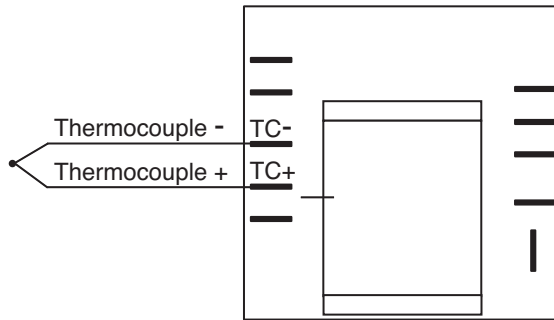
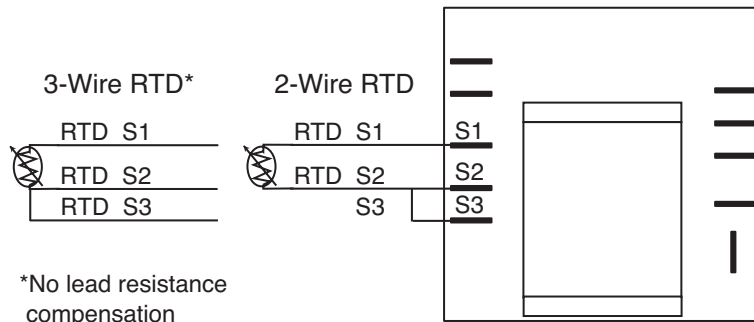


Figure 6c — RTD Input

(100 Ω Platinum DIN curve 0.00385 Ω/Ω/°C)

- Terminals S2 and S3 must be shorted for a two-wire RTD
- Nominal excitation current: 125 μA





Warning:

Use National Electric (NEC) or other country-specific standard wiring and safety practices when wiring and connecting this controller to a power source and to electrical sensors or peripheral devices. Failure to do so may result in damage to equipment and property, and/or injury or loss of life.

Note: Insulated quick connect terminals required.

For terminals 1, 2, 6, 7, 8, 9, and 10, AMP P/N 3-520406-2 or equivalent recommended. Use Amp crimp tool P/N 58078-3, insert 90391-3.

For terminals 3, 4, and 5, AMP P/N 2-520405-2 or equivalent recommended. Amp crimp tool P/N 58078-3, insert 58079-3.

Quencharc Note: Switching pilot duty loads (relay coils, solenoids, etc.) with the mechanical relay output options requires use of an R.C. suppressor.

Watlow carries the R.C. suppressor Quencharc brand name, which is a trademark of ITW Paktron. Watlow Part No. 0804-0147-0000.

Figure 7a — Switched DC Output

- Maximum voltage output into an infinite load, 24V_{DC}
- Minimum output voltage at 10 mA, 5V_{DC}
- Minimum load impedance, 500Ω
- Offstate leakage, 100μA_{DC}
- Not recommended for switching mechanical relays
- Output supplies power

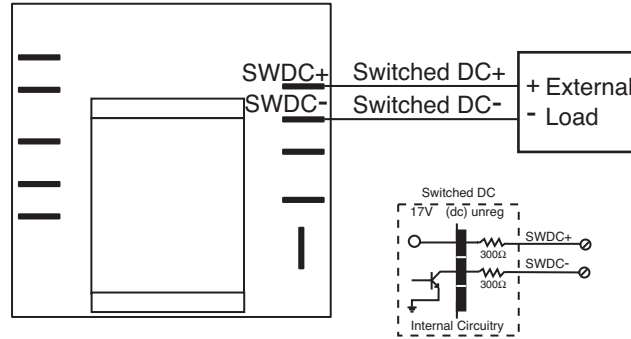
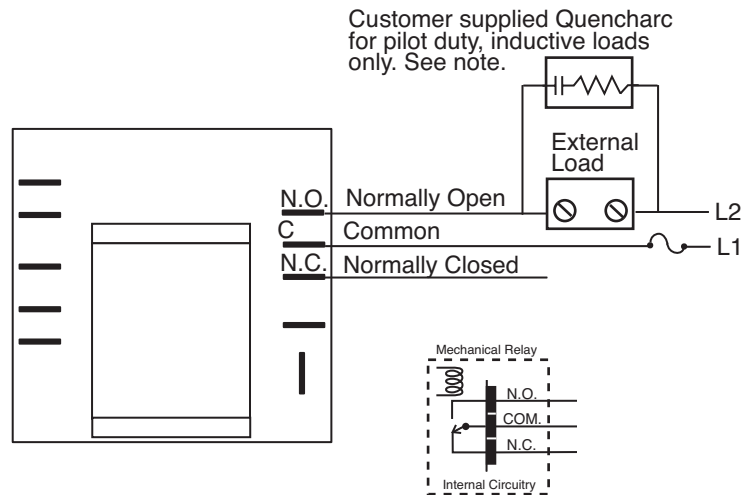


Figure 7b — Mechanical Relay Output

- Form C contacts
- 8 A, resistive
- 250 VA pilot duty, 120/240V_{AC}, inductive
- 240V_{AC} maximum
- 30V_{DC} maximum
- See Quencharc note
- For use with ac or dc
- Minimum load current 100 mA
- Output does not supply power



System Wiring Examples

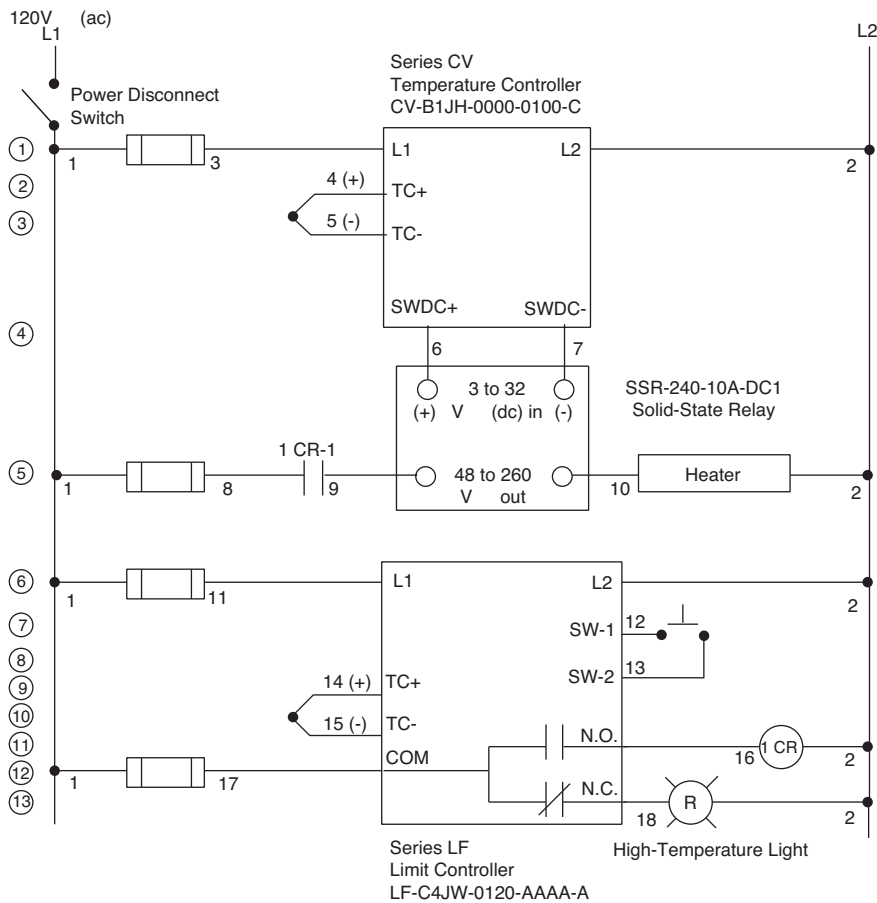
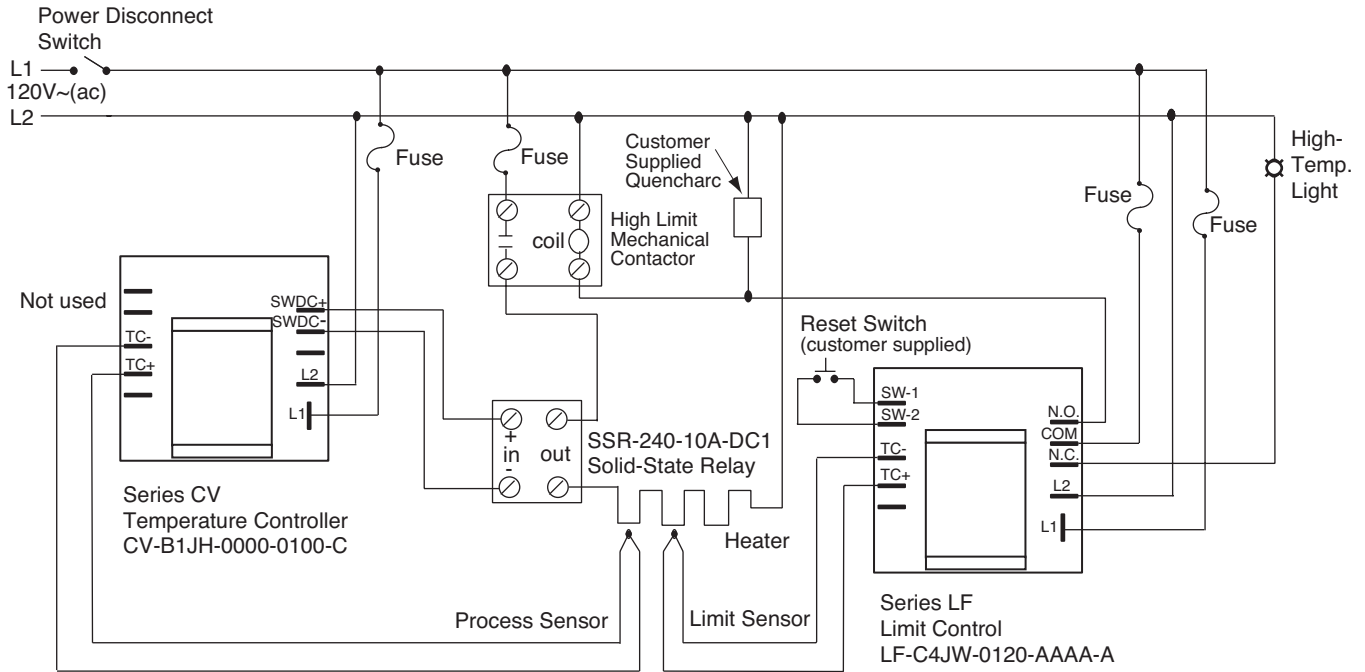


Figure 8 — System Wiring Examples

4

User Interface

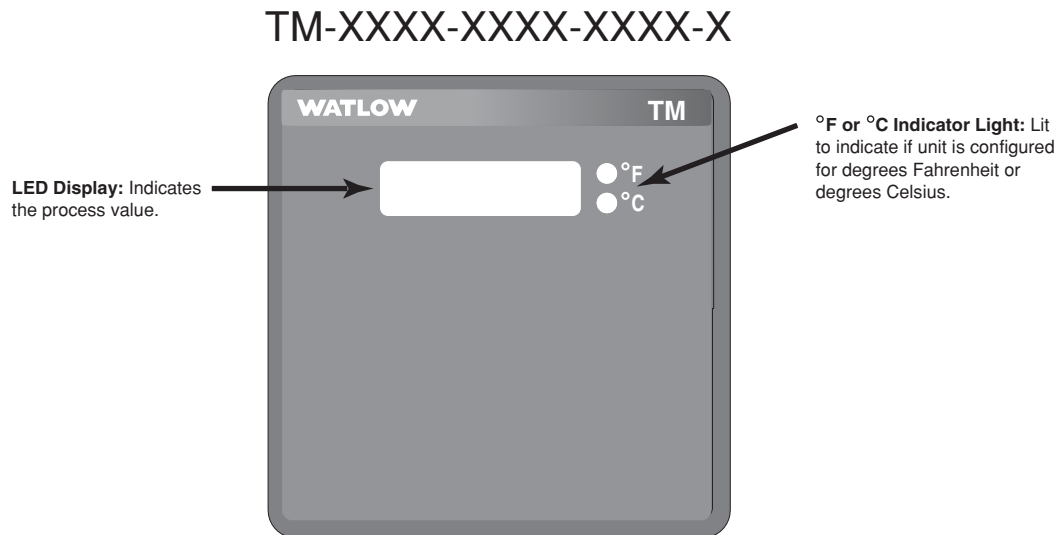


Figure 9a — Temperature Indicator Interface

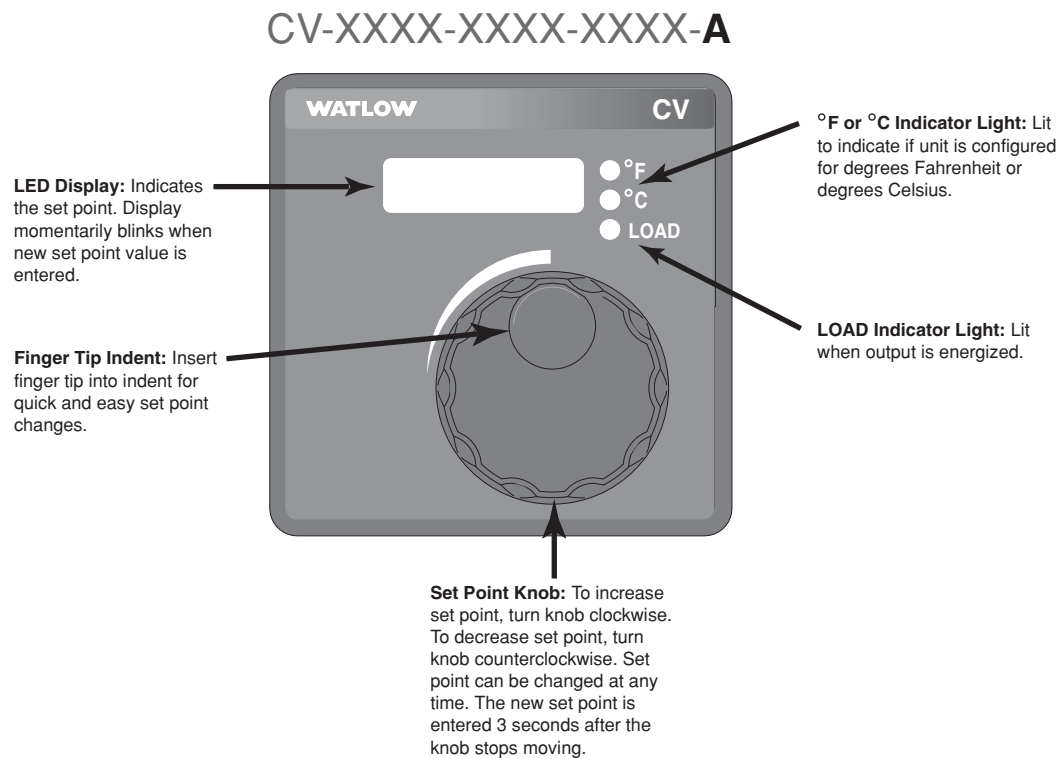


Figure 9b — Variable Set Point Standard Interface

CV-XXXX-XXXX-XXXX-B

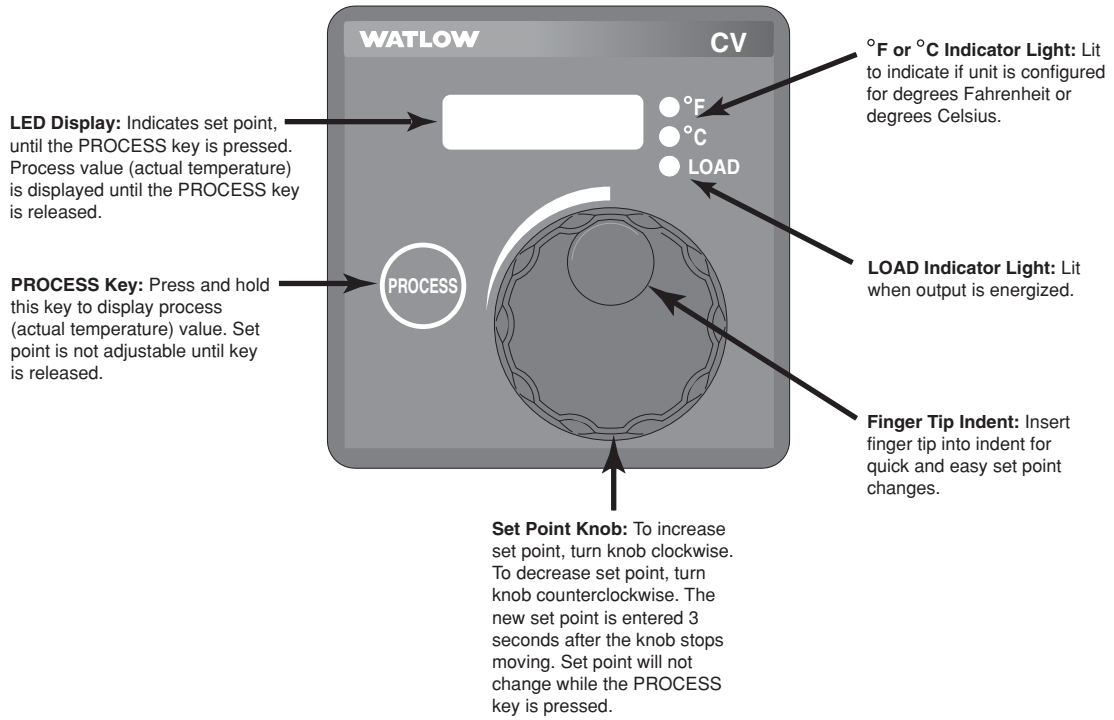


Figure 10a — Variable Set Point, Push for Process Interface

CV-XXXX-XXXX-XXXX-C

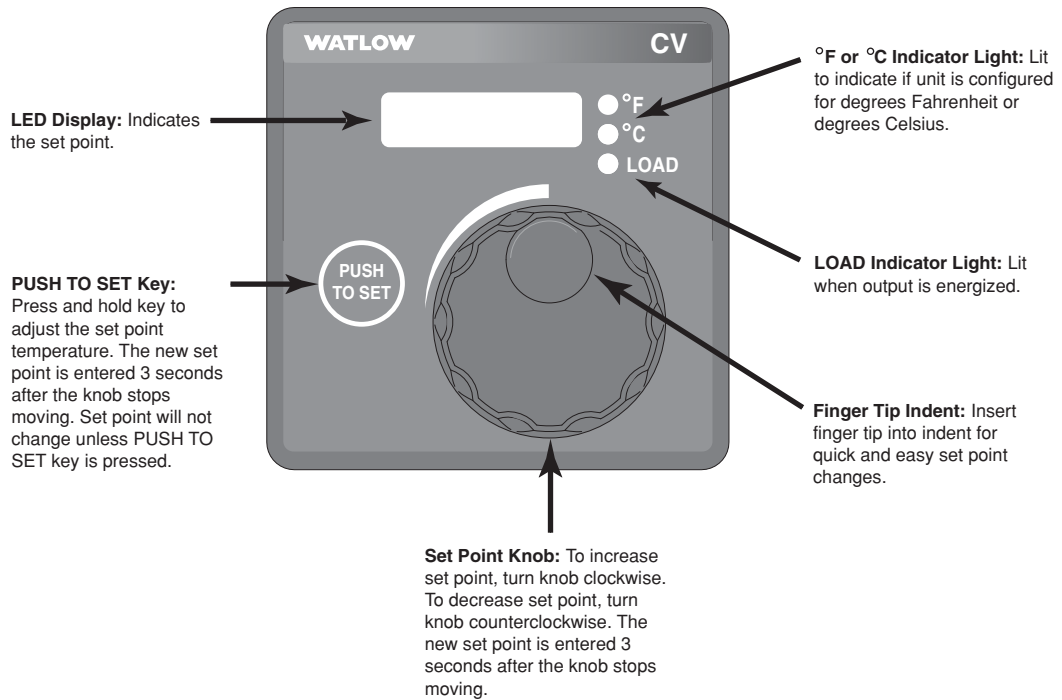


Figure 10b — Variable Set Point, Push to Set Interface

Troubleshooting

<p>On indicating controls, the display is not illuminated</p>	<ul style="list-style-type: none"> • Power supply switch off. • Fuse blown. • Breaker tripped. • Safety interlock door switch activated. • Separate system limit control latched. • Wiring incorrect or open. • Power supply voltage incorrect. • Defective controller. 	<ul style="list-style-type: none"> • Turn switch on. • Replace fuse (check cause of failure). • Reset breaker (check cause of failure). • Close door. • Reset limit controller. • Check wiring. • Verify input power • Repair or replace controller.
Troubleshooting thermocouple inputs		
<p>Temperature reading is incorrect, showing a sensor error, (Er, In), or LOAD LED is switching at the wrong temperature.</p>	<ul style="list-style-type: none"> • Sensor or controller may be bad. Sensor connections may be bad. • Ambient temperature in the control cabinet is over 70°C. • Ground loop problem. Can occur when using a switched DC output and a grounded thermocouple. 	<ul style="list-style-type: none"> • Place a jumper wire across the thermocouple input terminals. The display should indicate ambient temperature. If it does, the controller is OK. <p>For controllers without the ability to view process temperature:</p> <ul style="list-style-type: none"> - Decrease set point below ambient temperature, LOAD LED should be off for heating controllers and on for cooling controllers. - Increase set point above ambient temperature. LOAD LED should be on for heating controllers and off for cooling controllers. <ul style="list-style-type: none"> • Measure temperature in cabinet to ensure it is below 70C. Vent cabinet or add fans if necessary. • Remove power from the system. Use an ohm meter to measure resistance between output DC- and the thermocouple sheath. If there is continuity, replace sensor with an ungrounded thermocouple.
<p>Temperature reading is decreasing, but actual process is increasing</p>	<ul style="list-style-type: none"> • Thermocouple polarity is reversed. In the US, red wire insulation denotes the negative wire. 	<ul style="list-style-type: none"> • Check thermocouple connections. All connections, including extension wire must maintain the correct polarity. Correct polarity problems.
<p>Temperature reading is reading low and not increasing while actual process temperature is increasing.</p>	<ul style="list-style-type: none"> • Sensor is bad. Thermocouple is shorted. 	<ul style="list-style-type: none"> • Check thermocouple connections. Check thermocouple wire insulation to make sure it is not damaged, causing the wires to short (making a new junction).
<p>Temperature reading is offset from actual process temperature, or the output switches on or off at the wrong temperature. The offset changes with changes in process temperature.</p>	<ul style="list-style-type: none"> • Copper wire was used instead of thermocouple extension wire. Connectors of metals different than thermocouple metal were used to splice or make connections. 	<ul style="list-style-type: none"> • Check thermocouple connections. Check to make sure that only thermocouple extension wire of the correct type was used to extend thermocouple leads. Replace if necessary.

Indication	Probable Cause(s)	Corrective Action
Troubleshooting RTD inputs		
<p>Temperature reading is incorrect, showing a sensor error, [Err In], or LOAD LED is switching at the wrong temperature.</p>	<ul style="list-style-type: none"> • Sensor or controller may be bad. Sensor connections may be bad. • Ambient temperature in the control cabinet is over 70°C (158°F). • Sensor connections may be bad. Excessive lead wire resistance. 	<ul style="list-style-type: none"> • Place a 110 ohm resistor across the sensor input terminals. The display should indicate 25°C (77°F). If it does, the controller is OK. Sensor or connections may be bad. For controllers without the ability to view process temperature: <ul style="list-style-type: none"> - Decrease set point below ambient temperature, LOAD LED should be off for heating controllers and on for cooling controllers. - Increase set point above ambient temperature. LOAD LED should be on for heating controllers and off for cooling controllers. • Measure temperature in cabinet to ensure it is below 70°C (158°F). Vent cabinet or add fans if necessary. • Check sensor connections. Measure lead wire resistance. There will be a 2.6C (4.7°F) error for every ohm of lead wire resistance.
Troubleshooting controller outputs		
<p>Controller output signal is not on when it should be. Load LED is not on.</p>	<ul style="list-style-type: none"> • Temperature reading is incorrect on display of indicating controls or limit. See input troubleshooting. • Set point is not set correctly. 	<ul style="list-style-type: none"> • See input troubleshooting. • Verify set point setting.
<p>Controller output signal is not on when it should be. Load LED is on.</p>	<ul style="list-style-type: none"> • Output wiring is incorrect 	<ul style="list-style-type: none"> • Verify wiring. Relay outputs act as a switch, they do not source power. For DC output controls, voltage should be about 20VDC with no load. Greater than 5 volts with load of 500Ω or greater.
<p>Control output signal is on when it should not be on. Load LED is on.</p>	<ul style="list-style-type: none"> • Temperature reading is incorrect on display of indicating controls or limit. see input troubleshooting. • Set point is not set correctly. • Control output is defective. 	<ul style="list-style-type: none"> • See input troubleshooting. • Verify set point setting. • Repair or replace controller.
<p>Load is on when it should not be on. Load LED is off.</p>	<ul style="list-style-type: none"> • Power switching device (SSR, HG relay, mechanical relay) is shorted. Controller outputs shorted. • Output wiring is incorrect 	<ul style="list-style-type: none"> • Remove wires from output of control to input of power switching device. If load is still on, replace power switching device. If load turns off, replace controller or sensor. See input troubleshooting. • Verify wiring.

Specifications

(2354)

Controller

- Microprocessor based, on-off control mode.
- Nominal switching hysteresis, typically 1.7°C (3°F).
- Input filter time: 1 second

Operator Interface (model dependent)

- Four digit , 7 segment LED displays, .28" high.
- °F or °C indicator LED.
- LOAD indicator LED.
- Continuous turn, velocity sensitive rotary encoder for set point adjustment.
- Front panel key on Push for Set Point or Push for Process options.
- No operator interface on fixed set point models.

Standard Conditions For Specifications

- Rated line voltage, 50 to 60Hz, 0 to 90% RH non-condensing, 15-minute warm-up.

Calibration ambient range: 25°C (77°F) ±3°C

Sensor Input

Thermocouple

- Grounded or ungrounded.
- Type E, J, K, T thermocouple types.
- >10 MΩ input impedance
- 250 nV input referenced error per 1Ω source resistance.

RTD

- 2-wire platinum, 100 Ω
- DIN curve (.00385 curve)
- 125 μA nominal RTD excitation current

Input Accuracy Span Range

Type E:	-200 to 800°C	or	-328 to 1,470°F
Type J:	0 to 750°C	or	32 to 1,382°F
Type K:	-200 to 1,250°C	or	-328 to 2,282°F
Type T:	-200 to 350°C	or	-328 to 662°F
RTD (DIN):	-200 to 800°C	or	-328 to 1,472°F

Thermocouple Input

- Calibration accuracy: ±1% of input accuracy span, ±1° at standard conditions and actual calibration ambient.
Exception: Type T, ±2.4% of input accuracy span for -200 to 0° (-328 to 32°F)
- Temperature stability: ±0.3 degree per degree change in ambient.

RTD Input

- Calibration accuracy ±1% of input accuracy span ±1° at standard conditions and actual calibration ambient.
- Temperature stability: ±0.2 degree per degree change in ambient

Allowable Operating Ranges

Type E:	-200 to 800°C	or	-328 to 1,470°F
Type J:	-210 to 1,038°C	or	-346 to 1,900°F
Type K:	-270 to 1,370°C	or	-454 to 2,500°F
Type T:	-270 to 400°C	or	-454 to 750°F
RTD (DIN):	-200 to 800°C	or	-328 to 1,472°F

Output Types

Switched DC (non-isolated)

- Supply voltage maximum: 24V_{DC} (dc) into an infinite load.
- Supply voltage minimum: 5V_{DC} (dc) at 10 mA
- Minimum load impedance: 500Ω

Electromechanical Relay, Form C

- Minimum load current: 100 mA
- 8 A @ 240V_{AC} (ac) or 30V_{DC} (dc) maximum, resistive
- 250 VA pilot duty, 120/240V_{AC} (ac) maximum, inductive
- Use RC suppression for inductive loads
- Electrical life 100,000 cycles at rated current

Agency Approvals

- UL®873 Recognized Temperature Controller and Indicator.
- UL®197 Reviewed for use in cooking appliances.
- CE - See Declaration of Conformity.
- ANSI Z21.23 Gas Appliance Thermostat approval.
- Temperature Control and Indicator CSA 22.2 No. 24.

Terminals

- 6.4 mm (0.25 in) quick connect, push on terminal. See wiring section for terminal recommendations.

Power

- 24V_{AC} (ac) +10%; -15%; 50/60 Hz, ±5%
- 120V_{AC} (ac) +10%; -15%; 50/60 Hz, ±5%
- 230 to 240V_{AC} (ac) +10%; -15%; 50/60 Hz, ±5%
- 10VA maximum power consumption
- Data retention upon power failure via nonvolatile memory

Operating Environment

- 0 to 70°C (32 to 158°F)
- 0 to 90% RH, non-condensing
- Storage temperature: -40 to 85°C (-40 to 185°F)

Dimensions

- DIN Rail model can be DIN rail or chassis mount
DIN rail spec DIN 50022, 35 mm x 7.5 mm (1.38 in x 0.30 in).

Style	Width	Height	Depth
Open board	61.7 mm (2.43 in)	61.7 mm (2.43 in)	45.1 mm (1.78 in)
Potted	70.1 mm (2.76 in)	102.9 mm (4.05 in)	46.6 mm (1.84 in)
DIN Rail	78.1 mm (3.08 in)	112.3 mm (4.42 in)	90.7 mm* (3.57 in)
Square 1/8 DIN Panel	72.4 mm (2.85 in)	72.4 mm (2.85 in)	Behind panel 51.7 mm (2.04 in)

*Depth including DIN rail, 94.7 mm (3.73 in)

Note: These specifications are subject to change without prior notice.

Ordering Information and Model Numbers (2355)

On-off controller		No user interface		C F -				- - - -				- A A A A -			
Set Point Type															
F	Fixed Set Point														
Line Voltage and Output															
B	120V~ (ac), Switched DC Output														
C	120V~ (ac), 8 Amp Relay Output														
D	230-240V~ (ac), Switched DC Output														
E	230-240V~ (ac), 8 Amp Relay Output														
F	24V~ (ac), Switched DC Output														
G	24V~ (ac), 8 Amp Relay Output														
Controller Package															
1	Panel Mount, 1/8 DIN Square														
2	DIN Rail Mount														
3	Open Board, not potted														
4	Potted Case														
Sensor and Scale															
H	Type J -346 to 1900 Degrees F														
J	Type J -210 to 1038 Degrees C														
K	Type K -454 to 2500 Degrees F														
L	Type K -270 to 1370 Degrees C														
M	Type T -454 to 750 Degrees F														
N	Type T -270 to 400 Degrees C														
P	100Ω RTD -328 to 1472 Degrees F														
R	100Ω RTD -200 to 800 Degrees C														
S	Type E -328 to 1470 Degrees F														
T	Type E -200 to 800 Degrees C														
Control Mode															
H	Heat														
C	Cool														
Fixed Set Point Value *															
XXXX	Control set point value**														
Overlay/Custom Option															
A	Standard														

*Note: Set point must fall within the sensor operating range.

**Note: A (-) is used in the left digit of the operating range to indicate negative values.

Ordering Information and Model Numbers (2356)

On-off controller	LED Display	C	V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Set Point Type																		
V	Variable Set Point																	
Line Voltage and Output																		
B	120V~ (ac), Switched DC Output																	
C	120V~ (ac), 8 Amp Relay Output																	
D	230-240V~ (ac), Switched DC Output																	
E	230-240V~ (ac), 8 Amp Relay Output																	
F	24V~ (ac), Switched DC Output																	
G	24V~ (ac), 8 Amp Relay Output																	
Controller Package																		
1	Panel Mount, 1/8 DIN Square																	
2	DIN Rail Mount																	
Sensor and Scale																		
H	Type J -346 to 1900 Degrees F																	
J	Type J -210 to 1038 Degrees C																	
K	Type K -454 to 2500 Degrees F																	
L	Type K -270 to 1370 Degrees C																	
M	Type T -454 to 750 Degrees F																	
N	Type T -270 to 400 Degrees C																	
P	100Ω RTD -328 to 1472 Degrees F																	
R	100Ω RTD -200 to 800 Degrees C																	
S	Type E -328 to 1470 Degrees F																	
T	Type E -200 to 800 Degrees C																	
Control Mode																		
H	Heat																	
C	Cool																	
Low SP Range Limit *																		
XXXX	Low set point operating range value**																	
High SP Range Limit *																		
XXXX	High set point operating range value																	
Overlay/Custom Option																		
A	Standard																	
B	Push to Show Process																	
C	Push to Adjust Set Point																	

*Note: Set point ranges must fall within the sensor operating range.

**Note: A (-) is used in the left digit of the operating range to indicate negative values.

Ordering Information and Model Numbers (2357)

T M - A - A A A A - A A A A -

Temperature Indicator

Line Voltage and Output

B	120V~ (ac)
D	230-240V~ (ac)
F	24V~ (ac)

Controller Package

1	Panel Mount, 1/8 DIN Square
2	DIN Rail Mount

Sensor and Scale

H	Type J -346 to 1900 Degrees F
J	Type J -210 to 1038 Degrees C
K	Type K -454 to 2500 Degrees F
L	Type K -270 to 1370 Degrees C
M	Type T -454 to 750 Degrees F
N	Type T -270 to 400 Degrees C
P	100Ω RTD -328 to 1472 Degrees F
R	100Ω RTD -200 to 800 Degrees C
S	Type E -328 to 1470 Degrees F
T	Type E -200 to 800 Degrees C

Overlay/Custom Option

A	Standard
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Declaration of Conformity

Series C and Series TM

Watlow Winona, Inc.
1241 Bundy Blvd.
Winona, MN 55987 USA

Declares that the following product:

Designation: **Series C and Series TM**

Model Numbers: **CF** - (B, C, D, E, F or G) (1, 2, 3 or 4)(any letter) (H or C) - (any four numbers or - and three numbers) - (AAAA) - may be followed by additional numbers or letters
CV - (B, C, D, E, F or G) (1 or 2) (any letter) (H or C) - (any four numbers or - and three numbers) - (any four numbers) - may be followed by additional numbers or letters
TM - (B, D or F) (1 or 2) (any letter) (A) - (AAAA) - (AAAA) - may be followed by additional numbers or letters

Classification: CF and CV = Temperature control, TM = Indicator, Installation Category II, Pollution degree II

Rated Voltage: 24, 120, 230/240 V~ (ac)

Rated Frequency: 50 or 60 Hz

Rated Power Consumption: 10VA maximum

Meets the essential requirements of the following European Union Directives by using the relevant standards shown below to indicate compliance.

89/336/EEC Electromagnetic Compatibility Directive

EN 61326: 1997 With A1, 1998: A2:2001: Electrical equipment for measurement, control and laboratory use – EMC requirements (Industrial Immunity, Class B Emissions).

EN 61000-4-2:	1995 A1, A2:2001:	Electrostatic Discharge Immunity
EN 61000-4-3:	1997 A1, A2:2001:	Radiated Field Immunity
EN 61000-4-4:	1995 A1:2001:	Electrical Fast-Transient / Burst Immunity
EN 61000-4-5:	1995 A1, A2:2001:	Surge Immunity
EN 61000-4-6:	1996 A1, A2, CRGD1:2001:	Conducted Immunity
EN 61000-4-11:	1994:	Voltage Dips, Short Interruptions and Voltage Variations Immunity
EN 61000-3-2:	ED.2. 2000:	Harmonic Current Emissions
EN 61000-3-3:	1995 With A1, 1998:	Voltage Fluctuations and Flicker

73/23/EEC Low-Voltage Directive


EN 60730-1:2000 With A11:2002 and EN 60730-2-9:2002: Safety Requirements of electrical equipment for measurement, control and laboratory use. Part 1: General requirements

Raymond D. Feller III
Name of Authorized Representative

Winona, Minnesota, USA
Place of Issue

General Manager
Title of Authorized Representative

April 2003
Date of Issue


Signature of Authorized Representative
(2358)

How to Reach Us

TOTAL
CUSTOMER
SATISFACTION
3 Year Warranty

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