The Watlow Series 146 is a DIN rail mount, temperature regulating controller with a thermocouple or RTD sensor input. The DIN rail mounting offers quick and easy installation with the use of simple hand tools. The controller may also be flush mounted.

The Series 146 is designed to meet the needs of a wide range of safety applications. Factory selectable options include high or low control mode with either manual or automatic reset on power loss.

The Series 146 has an LED for output status indication and can be ordered with an integral or remote adjustable set point, or a fixed set point.

Specifications

Control Mode
- High or low limit, factory selectable
- Manual or automatic reset on power loss, factory selectable
- Latching alarm with manual reset on over or under temperature
- Internal and/or customer supplied external reset switch

Operator Interface
- LED indication of output status
- Dial scale calibrated to compensate for sensor non-linearities
- Integral or remote set point
  - Dual temperature scale (°C and °F)
- Fixed set point
  - Manufactured to specified value

Input
- Thermocouple or platinum RTD available
- Thermocouple with automatic cold junction compensation
- Thermocouple may be isolated or grounded
- Thermocouple and RTD break protection de-energizes output
- 2- or 3-wire RTD input, 100Ω @ 0°C calibrated for 0.003850Ω/°C curve

Output
- Electromechanical relay, 8A, Form C, SPDT: 8A @ 240V~ resistive, 8A @ 28 V~ (dc) resistive, 275VA pilot duty rated

Accuracy
Adjustable Set Point, integral or remote
- Calibration accuracy: ±1% of span, at 25°C ± 3°C (77°F ±5°F) ambient and rated line voltage ± 1%
- Set point accuracy: ±3% of dial scale
- Accuracy span: 540°C (1000°F) minimum

Fixed Set Point
- Calibration accuracy: ±6°C/±10°F of setting, at 25°C ±3°C (77°F ±5°F) ambient and rated line voltage ±1%

Temperature Stability
- Thermocouple: Typically 9µV/°C ambient (5µV/°F ambient) input referenced
- RTD: Typically 0.2°C/°C ambient (0.2°F/°F ambient)

Voltage Stability
- ±0.01% of span (min. span of 540°C or 1000°F) per % of rated line voltage

Agency Approvals
- CE: EN61010 - Safety
  - EN61326 - Industrial Immunity, Class B Emissions
  - Installation Category 2, Pollution Degree 2
  - 873, File #E43684
  - to C22.2 No. 24, File #E43684
- Approved for use in commercial cooking applications
  - FM Class 3545, File J.I. 3007307

Terminals
- Captive screw, cage clamp connection, 4 mm (0.155 in.) max. width screwdriver blade, 30 to 14-gauge wire

Mounting
- DIN rail, DIN EN50022, 35 mm x 7.5 mm
- Sub-panel flush mounting

Power
- 24V~ - +10%/-15%, 50/60 Hz
- 120V~ - +10%/-15%, 50/60 Hz
- 230V~ to 240~ - +10%/-15%, 50/60 Hz
- 10VA maximum power

Operating Environment
- 0 to 55°C (32 to 131°F)
- 0 to 90% RH, non-condensing
- Storage temperature: -20 to 85°C (-4 to 185°F)

Dimensions
- Width: 60 mm (2.28 in)
- Height: 115 mm (4.45 in)
- Depth: 100 mm (3.89 in)

Weight
- 0.3kg (0.7 lb.)

UL® is a registered trademark of Underwriter’s Laboratories, Inc.

Note: Specifications subject to change without notice.
Installation

Sub-Panel Mounting the Series 146

NOTE: FM approval requires limit switches to be suitably enclosed to minimize casual readjustment of set temperature.

1. Using the controller as a location template, mark both mounting holes.
2. Drill two 5 mm (0.19 in.) diameter holes in the desired panel location. See Figure 2a for hole locations.
3. Mount the Series 146 using two #8-32 screws.

DIN Rail Mounting the Series 146

1. Place the Series 146 upper mounting clip on the top edge of the DIN rail. See Figure 2b on this page.
2. Press down firmly on the top front edge of the Series 146. The controller “snaps” securely onto the rail. 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 Series 146 from the DIN Rail

1. Place your fingers on the release lever located at the base of the Series 146.
2. While gently pressing on the top of the case, above Terminals 1-9, pull forward on the release lever.

Safety Information

Note, caution and warning symbols appear 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.

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 ¡ symbol (an exclamation point in a triangle) precedes a general CAUTION or WARNING statement.

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

Wiring Guidelines

• Use the correct sensor type per the model number on the unit sticker.
• Use the proper thermocouple or RTD polarity.
• Insulate the thermocouple mounting from the mounting surface to prevent heat migration input errors.
• Thermocouple leads should be twisted pair wire and routed separately from any other lines.
• In electrically noisy environments (heavy switching of contactor, motors, solenoids, etc.) use shielded thermocouple lead wire with the shield connected at the sensor end only.
• All wiring and fusing must conform to the National Electric Code (NEC) NFPA70 and any other locally applicable codes.
• Fuse the independent load voltage on the L1 (hot) side and connect it to the common (COM) side of the relay.

CAUTION: A power disconnect located near the controller is recommended to shut down power in case of controller failure.

• Long lead lengths create electrical resistance. When using a two wire RTD, there will be an additional 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 limit. To overcome this problem, use a three wire RTD sensor, which compensates for lead length resistance. When extension wire is used for a three wire RTD, all three extension wires must have the same electrical resistance. (i.e. same gauge, copper stranded.)
**Power Wiring**

- 120V~  146_ - 1___ - 0000
- 230 to 240 V~  146_ - 2___ - 0000
- 24V~  146_ - 3___ - 0000

**NOTE:** The line voltage is specified by your model number.

⚠️ **WARNING:** To avoid potential electric shock, use National Electrical Code safety practices when wiring and connecting this unit to a power source and to electrical sensors or peripheral devices. All wiring and fusing must conform to the National Electric Code and to any locally applicable codes. Failure to comply with these recommendations could result in damage to equipment and property, and injury to personnel.

⚠️ **WARNING:** The Series 146 safety limit should be mounted in an inconspicuous location to discourage unauthorized changes to the set point. Only approved and appropriate personnel should have the authority to change the set point on the limit switch. Failure to comply with these recommendations could result in damage to equipment and property, and injury to personnel.

⚠️ **CAUTION:** Applying incorrect voltage may result in irreversible damage to the controller.

**Input Wiring**

**Thermocouple**

![Thermocouple Wiring](image)

Figure 3b — Thermocouple wiring.

**2- and 3-Wire RTD**

![2- and 3-Wire RTD Wiring](image)

Figure 3c — 2- and 3-Wire RTD Wiring

**NOTE:** 2- or 3-wire RTD input, calibrated for 0.00385\(\Omega/\Omega \degree C\) curve.

**Output Wiring**

**Electromechanical Relay, Form C**

![Electromechanical Relay Wiring](image)

Figure 3d — Electromechanical relay wiring.

**NOTE:** Switching inductive loads (relay coils, solenoids, etc.) with the mechanical relay, switched dc or solid-state 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.

**Remote Reset**

![Remote Reset Wiring](image)

Figure 3e — Remote reset wiring.

**NOTE:** The Series 146 used with a remote reset may affect FM recognition. Only the use of a momentary switch is valid for approval.

**NOTE:** Reset is customer-supplied.
Figure 4 — System wiring examples.
Declaration of Conformity

Series 146

WATLOW WINONA
1241 Bundy Boulevard
Winona, Minnesota  55987 USA

Declares that the following product:

Designation: Series 146
Model Numbers: 146E - (1, 2 or 3) (100-999) - (1, 2, 3 or 4) (Any three letters or numbers)
Classification: Temperature control, Installation Category II, Pollution degree II
Rated Voltage: 24, 120 or 240 V - (ac)
Rated Frequency: 50 or 60 Hz
Rated Power Consumption: 10 VA maximum

EN 61000-4-11:1994 Voltage Dips, Short Intermittions and Voltage Variations Immunity
EN 61000-4-4:1995 - Electrical Fast-Transient / Burst Immunity
EN 61000-4-3:1997 - Radiated Field Immunity
EN 61326:1997 With A1:1998 - Electrical equipment for measurement, control and relevant standards shown below to indicate compliance.

EN 61000-4-11:1994 Immunidade a caixas de tensão, interrupções curtas e variações de tensão
EN 61000-3-1:1995 CON A1:1998 - Fluctuaciones de voltaje y centelleo

Enfrüllt die wichtigsten Normen der folgenden Anweisung(en) der Europäischen Union unter Verwendung des wichtigsten Abschnitts bzw. der wichtigsten Abschnitte die unten zu Befolgung aufgezogen werden.

Erfüllt die wichtigsten Normen der folgenden Anweisung(en) der Europäischen Union unter Verwendung des wichtigsten Abschnitts bzw. der wichtigsten Abschnitte die unten zu Befolgung aufgezogen werden.

73/23/EEC Low-Voltage Directive

Declaración de Conformidad

Designación: Serie 146
Modelo: 146E - (1, 2 o 3) (100-999) - (1, 2, 3 o 4) (Tres letras o números)
Clasificación: Control de temperatura, Categoría de instalación II, Degrado de contaminación II
Consumo nominal de energía: 10 VA máximo
Frecuencia nominal: 50/60 Hz

EN 61010-1:1993 con A1:1995 Requisitos de seguridad de equipo eléctrico para la medición, el control y el uso en laboratorio - Exigencias CEM (Inmunidad industrial, Clase A).
EN 61000-4-11:1994 - Inmunidad a caídas de voltaje, variaciones y cortes de tensión
EN 61000-4-3:1997 - Inmunidad a campos radiados

73/23/CEC Directiva de baja voltaje
EN 61010-1:1993 con A1:1995 Requisitos de seguridad de equipo eléctrico para medición, control y uso en laboratorio - Parte 1: Requisitos generales

Declara que el producto siguiente:

Designación: Serie 146
Modelo: 146E - (1, 2 o 3) (100-999) - (1, 2, 3 o 4) (Tres letras o números)
Clasificación: Control de temperatura, Categoría de instalación II, Degrado de contaminación ambiental II
Tensión nominal: 24, 120 o 240V
Frecuencia nominal: 50/60 Hz
Consumo nominal de energía: 10 VA máximo

Cumple con los requisitos esenciales de las siguientes Directivas de la Unión Europea mediante el uso de las normas pertinentes que se muestran a continuación para indicar su acatamiento.

89/336/EEC Directiva de compatibilidad electromagnética

Einfacht, daß das folgende Produkt:

Beschreibung: Serie 146
Modellnummer(n): 146E - (1, 2 oder 3) (100-999) - (1, 2, 3 oder 4) (Drei beliebige Buchstaben oder Ziffern)
Klassifikation: Regelsystem, Installationskategorie II, Emissionsgrad II
Nennspannung: 24, 120 oder 240V
Nennfrequenz: 50/60 Hz
Nomineller Stromverbrauch: Maximaler 10VA

89/336/EEC Elektromagnetische Übereinstimmungsanweisung

### Ordering Information

<table>
<thead>
<tr>
<th>Output Type</th>
<th>146 - - 00</th>
</tr>
</thead>
<tbody>
<tr>
<td>E = Electromechanical relay, 8A, Form C</td>
<td></td>
</tr>
</tbody>
</table>

### Line Voltage

- 1 = 120V~
- 2 = 230V~ to 240V~
- 3 = 24V~

### Input and Range

#### Type E
- 619 = 0 to 799°C (32 to 1470°F)
- 615 = Fixed at 315°C (600°F)
- 618 = -17 to 93°C (0 to 200°F)
- 623 = 43 to 54°C (110 to 130°F)
- 620 = 149 to 427°C (300 to 800°F)
- 625 = 121 to 221°C (250 to 430°F)

#### Type J
- 601 = 0 to 315°C (32 to 600°F)
- 602 = 0 to 750°C (32 to 1382°F)
- 615 = Fixed at 315°C (600°F)
- 618 = -17 to 93°C (0 to 200°F)
- 623 = 43 to 54°C (110 to 130°F)
- 625 = 121 to 221°C (250 to 430°F)

#### Type K
- 603 = 0 to 1250°C (32 to 2282°F)
- 611 = 0 to 600°C (32 to 1112°F)
- 626 = 16 to 149°C (60 to 300°F)
- 628 = -17 to 315°C (0 to 600°F)
- 611 = 0 to 600°C (32 to 1112°F)
- 626 = 16 to 149°C (60 to 300°F)
- 628 = -17 to 315°C (0 to 600°F)
- 629 = -200 to 350°C (-328 to 662°F)
- 632 = Fixed at -75°C (-103°F)

#### RTD
- 101 = -73 to 600°C (-100 to 1112°F) (100Ω)
- 104 = -73 to 600°C (-100 to 1112°F) (1000Ω)
- 105 = 0 to 80°C (32 to 176°F)
- 106 = Fixed at 200°C (392°F)
- 107 = Fixed at 350°C (662°F)
- 108 = Fixed at 110°C (230°F)
- 109 = Fixed at 150°C (302°F)
- 110 = Fixed at 120°C (248°F)
- 111 = Fixed at 250°C (482°F)

### Limit Mode

- 1 = High limit, manual reset on power loss
- 2 = Low limit, manual reset on power loss
- 3 = High limit, automatic reset on power loss
- 4 = Low limit, automatic reset on power loss

### Remote Options

- 0 = Regulating control, integral setpot
- N = Regulating control, no setpot, customer provided
- S = Regulating control, remote setpot with remote reset
- P = Regulating control, remote setpot

### Technical Support

**Troubleshooting**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Probable Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>The load will not turn on.</td>
<td>An open sensor</td>
<td>Repair or replace.</td>
</tr>
<tr>
<td></td>
<td>The load circuit is open.</td>
<td>Check the fuses, circuit breakers, load and wiring.</td>
</tr>
<tr>
<td></td>
<td>The ac input is not connected or is connected improperly.</td>
<td>Check the ac input connections. If not present, connect per Power Wiring, page 3.</td>
</tr>
<tr>
<td>The load will not turn off.</td>
<td>The polarity is reversed on the thermocouple.</td>
<td>Connect per Input Wiring, page 3.</td>
</tr>
<tr>
<td></td>
<td>A faulty unit.</td>
<td>Remove power to the controller and the controller from the system. Apply power to the system with the controller removed. If the load turns off, return the controller to the factory. If the load remains on, there are other problems in the system that must be resolved. Consult the factory.</td>
</tr>
</tbody>
</table>

**Warranty**

The Series 146 is warranted to be free of defects in material and workmanship for 36 months after delivery to the first purchaser for use, providing that the unit has not been misapplied. Since Watlow has no control over its use or misuse, we cannot guarantee against failure. Watlow’s obligations hereunder, at Watlow’s option, are limited to replacement or refund of purchase price of a unit which upon examination proves to be defective within the warranty period. This warranty does not apply to damage resulting from transportation, alteration, misuse or abuse.

**Returns**

- Call or fax Customer Service for a Return Material Authorization (RMA) number before returning a product.
- Put the RMA number on the shipping label, and also a description of the problem.
- A 20% of net price restocking charge applies to all standard units returned to stock.

**Contact**

- Phone: 507/454-5300
- Fax: 507/452-4507

**Note:** User documentation may be available in French, German, Spanish, Italian, and Dutch, as well as English. Check Watlow’s website (www.watlow.com/) for availability. Specify language at time of order.

**User Documentation:**

If you encounter a problem with your Watlow controller, verify that your wiring is correct for your specific model number. If the problem persists, an Application Engineer can discuss your application with you.

Before calling, please have the complete model number and user's manual available. You can get technical support by dialing 507/454-5300, 7 a.m. to 7 p.m. Central Standard Time. The Series 146 User’s Manual is copyrighted by Watlow Inc., © 2001, with all rights reserved. (1965)