



# Series 101

## User's Manual



### Temperature Controller



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 0600-0036-0001 Rev C

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 Made in the U.S.A.



Printed on Recycled Paper  
 10% Postconsumer Waste

### General Description

The Watlow Series 101 is an on-off temperature controller that comes in three common temperature ranges or can be custom ordered to meet your requirements. The input sensor can be either Type J or K thermocouple. The setpot is integral and has both degree Celsius and Fahrenheit scales.

### Specifications

(2060)

#### Control Mode

- On-Off
- Nominal switching hysteresis:  
 Type J thermocouple; 1.7°C (3°F);  
 Type K thermocouple; 2.2°C (4°F)

#### Operator Interface

- 76 mm (3 in.) dial scale calibrated to compensate for sensor non-linearities
- Dual °C and °F scales
- D-shaft pot and adjustable ratchet knob

#### Input

- Thermocouple with automatic cold junction compensation
- Sensor may be isolated or grounded
- Sensor break protection de-energizes output

#### Output

- Electromechanical relay with contact suppression, 3A, SPST: 3A @ 230V~ 3A @ 30V= (dc), 125VA pilot duty @ 120 or 230V~
- Solid-state relay, Form A, 0.5A @ 24V~ min., 230V~ max., opto-isolated burst fire switched, without contact suppression. Off state output impedance is 31MΩ.
- Switched dc signal provides a non-isolated minimum turn on voltage of 3V= (dc) into a minimum 500W load maximum on voltage not greater than 28V= (dc) into an infinite load.

#### Accuracy

- Calibration accuracy and sensor conformity: ±1% of span, at 25°C ± 3°C (77°F ±5°F) ambient and rated line voltage ±1%
- Set point accuracy: ±2% of dial scale
- Accuracy span: 540°C (1000°F) minimum
- Temperature stability: 9µV/°C (5µV/°F) ambient, maximum referred to the input
- Voltage stability: ±0.01% of span per % of rated line voltage

#### Agency Approvals

- CE approved:  
 89/336/EEC Electromagnetic Compatibility Directive  
 EN 55011: 1991 Emissions class B  
 EN 50082-1: 1992 Immunity  
 73/23/EEC Low Voltage Directive  
 EN 61010-1: 1993 Safety
- 873, File #E43684
- to C22.2 No. 24, File #E43684
- ANSI Z21.23. Gas Appliance Thermostats

#### Classification

- Installation category II, Pollution category II

#### Terminals

- Quick connects, 1/4 in. (6 mm) appliance

#### Power

- 115V~, ±10%, 50/60 Hz
- 230V~, ±10%, 50/60 Hz
- 24V~, ±10%, 50/60 Hz
- 4VA power consumption

#### Operating Environment

- 0 to 70°C (30 to 158°F)
- 0 to 90% RH, non-condensing

#### Dimensions

- See page 2.

#### Weight

- 0.3kg (0.7 lb)

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**Note: Specifications subject to change without notice.**

## Ordering Information

(1576) **101** - - **0000**

### Output

- A = Electromechanical relay, Form A, 3A, with contact suppression
- B = Solid-state relay, 0.5A, Form A, without contact suppression
- C = Switched dc, non-isolated

### Line Voltage

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

### Input and Range

- |        |                                   |
|--------|-----------------------------------|
| Type J | 601 = -20 to 260°C (0 to 500°F)   |
|        | 602 = -20 to 540°C (0 to 1000°F)  |
|        | 608 = -20 to 120°C (0 to 250°F)   |
| Type K | 603 = -20 to 1100°C (0 to 2000°F) |

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

## Safety



A Caution symbol (an exclamation point in a triangle) appears with information that is important to protect equipment and performance. Read and follow all cautions that apply to your application.



The equipment is protected throughout by double or reinforced insulation. Use only to Watlow specifications. If the Series 101 is used in a manner not specified by Watlow, the protection provided by the equipment may be impaired.

## Installation

1. Remove the setpot knob and the dial scale from the Series 101 control. See the side view in Figure 2a.
2. Using the dial scale as a location/drilling template, locate and center punch the setpot locating tab, setpot shaft and four mounting holes at the desired location. See Figure 2c.
3. Drill one 4 mm (0.156 in.) setpot locating tab hole, one 10.3 mm (0.406 in.) setpot shaft hole and four 3.2 mm (0.128 in.) diameter mounting holes.
4. Insert the setpot shaft of the controller through the 10.3 mm (0.4064 in.) diameter hole. Replace the dial scale and align the mounting holes, then tighten the pot shaft nut.
5. Insert #4 thread-forming screws in mounting holes and tighten in place.
6. Wire the control following the wiring diagrams. See next page.

NOTE: The Series 101 has a 2.3 mm (0.090 in.) diameter by 13 mm (0.500 in.) deep screw hole cavity. Design is based on using Textron Camcar Division "Plastite" or "Pushite" thread forming hardware or equivalent. Screw length is 9.5 to 12.7 mm (0.375 to 0.500 in.) maximum.

## Dimensions

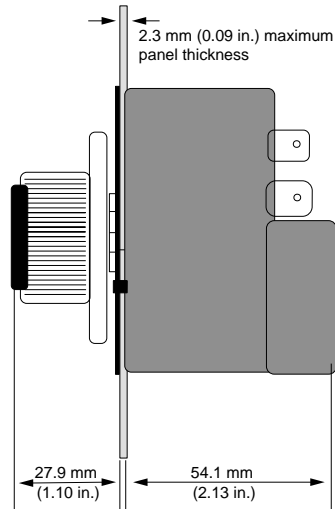


Figure 2a — Series 101 side dimensions.

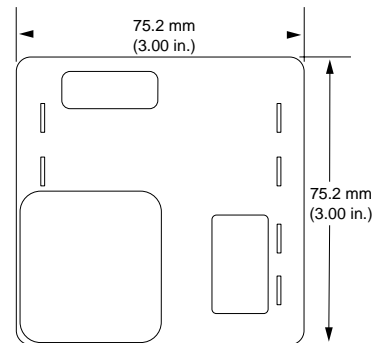


Figure 2b — Series 101 dimensions.

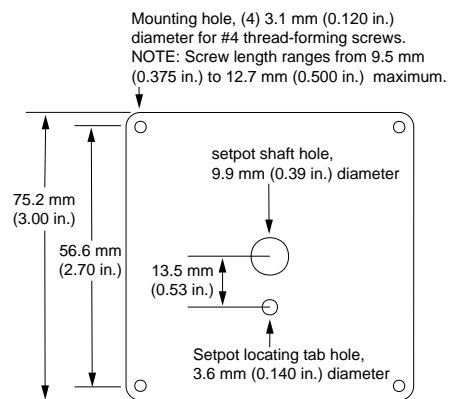


Figure 2c — Series 101 mounting.

## Wiring Guidelines

- Use the correct thermocouple type matching the model number on the unit sticker. See the underside of the unit.
- Use the proper thermocouple polarity. Red is negative.
- 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.

## Power Wiring

120V~ 101 \_ - 1 \_ \_ - 0000

230V~ 101 \_ - 2 \_ \_ - 0000

24V~ 101 \_ - 3 \_ \_ - 0000

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

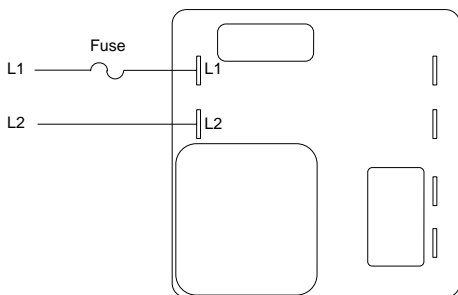


Figure 3a — Power wiring.



**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.



**WARNING:** Applying incorrect voltage may result in irreversible damage to the control.

NOTE: We strongly recommend that all control loops use an approved temperature limit control for over or under temperature limit protection. Failure to install temperature limit control protection where a potential hazard exists could result in damage to equipment and property and injury to personnel.

## Input Wiring

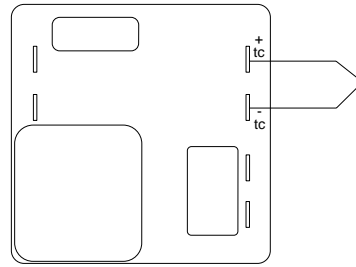


Figure 3b — Thermocouple wiring.

NOTE: When an external device with a non-isolated circuit common is connected to the dc output, you must use an isolated or ungrounded thermocouple.

## Output Wiring

Electromechanical Relay, Form C with suppression 3A

101A - \_ \_ \_ - 0000

Solid State Relay, Form A, 0.5A without suppression

101B - \_ \_ \_ - 0000

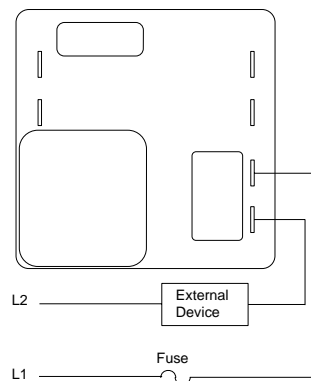


Figure 3c — Mechanical and solid-state relay wiring.

Switched DC

10 1C - \_ \_ \_ - 0000

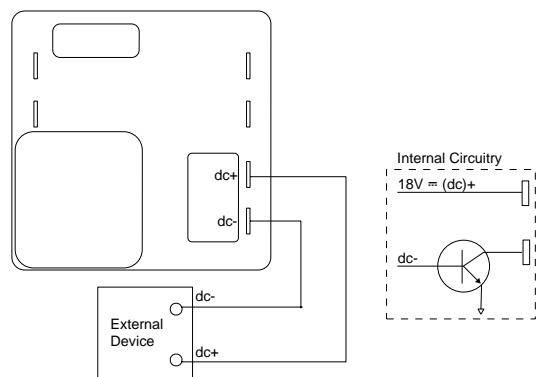


Figure 3d — Switched dc wiring.

## Field Calibration

### Required Equipment

- A calibration quality portable temperature indicator.
- A sensor for the portable indicator.

### Setup

1. With the Series 101 installed in your system, set the controller to your desired set point.
2. Apply power to your system and allow it to stabilize.

### Procedure

1. Measure temperature at the point you wish to control (near the Series 101 sensor) with a portable temperature indicator.
2. Adjust the Series 101 until the portable indicator reads the average of the system temperature variations as the Series 101 switches on and off.
3. Carefully pull the Series 101 knob straight off the D-shaft.
4. Slightly loosen the two screws on the back of the knob.
5. Carefully replace the knob on the D-shaft without moving the shaft.
6. Read the portable indicator. Then hold the black part of the knob in place while turning the clear plastic skirt to match the portable indicator reading. Simply put the white line on the clear skirt over the dial scale position which is the average of the portable indicator readings.
7. Carefully remove the knob from the D-shaft again and tighten the screws.
8. Replace the knob on the shaft and check the portable indicator for agreement. Repeat as required.

## Warranty

The Series 101 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: +1 (507) 454-5300
- Fax: +1 (507) 452-4507

## Technical Support

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 +1 (507) 454-5300, 7 a.m. to 7 p.m. Central Standard Time.

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## Troubleshooting

Problem	Probable Cause	Action
Control will not operate.	Voltage is not present at ac input or load output.	Check wiring. See wiring page. Check fuses or circuit breakers. Check power sources.
Relay will not energize, ac voltage is present, and the controller is wired correctly.	Sensor is not wired correctly.	Check for open sensor element or open sensor lead wires. Check sensor wiring. See wiring page.
Controller is out of calibration.	Sensor is not measuring actual temperature.	Check sensor element location for proper temperature response.
	Unit is out of calibration.	Calibrate the unit following the field calibration procedure above.

# Declaration of Conformity Series 101

Watlow

1241 Bundy Boulevard  
Winona, Minnesota USA 55987



Declares that the following product: **English**  
Designation: **Series 101**  
Model Number(s): 101 (A, B or C) (1 or 2) (Any three numbers) -  
(Any four letters or numbers)  
Classification: Controller, Installation Category II, Pollution  
Degree II  
Rated Voltage: 120V~ (ac) or 230V~ (ac)  
Rated Frequency: 50/60 Hz  
Rated Power Consumption: 4VA

Meets the essential requirements of the following European Union  
Directive(s) using the relevant section(s) of the normalized standards and  
related documents shown:

## 89/336/EEC Electromagnetic Compatibility Directive

EN 50082-1: 1992 **EMC Generic immunity standard, Part 1:  
Residential, commercial and light industry  
environment**  
EN 61000-4-2: 1995 Electrostatic discharge  
EN 61000-4-4: 1995 Electrical fast transients  
EN 60801-2: 1994 Electrostatic discharge requirements  
IEC 801-3: 1994 Radiated electromagnetic field requirements  
IEC 801-4: 1988 Electrical fast transient/burst requirements  
EN 55011: 1991 **Limits and methods of measurement of radio  
disturbance characteristics of industrial,  
scientific and medical radio-frequency  
equipment (Class B)**  
EN 61000-3-2: 1995 **Limits for harmonic current emissions**  
EN 61000-3-3: 1995 **Limitations of voltage fluctuations and flicker**

## 73/23/EEC Low-Voltage Directive

EN 61010-1 1993 **Safety requirements for electrical equipment  
for measurement, control, and laboratory use,  
Part 1: General requirements**

Déclare que le produit suivant : **Français**  
Désignation : Série 101  
Numéro(s) de  
modèle(s) : 101 (A, B ou C) (1 ou 2) (Trois lettres  
quelconques) (quatre lettres ou chiffres  
quelconques)  
Classification : Commande, installation catégorie II, degré de  
pollution II  
Tension nominale : 120V~ (ac) ou 230V~ (ac)  
Fréquence nominale : 50/60 Hz  
Consommation  
d'alimentation nominale : 4VA

Conforme aux exigences de la (ou des) directive(s) suivante(s) de l'Union  
Européenne figurant aux sections correspondantes des normes et  
documents associés ci-dessous :

## 89/336/EEC Directive de compatibilité électromagnétique

EN 50082-1: 1992 **Norme générique sur l'immunité, Partie 1 :  
Environnement résidentiel, commercial et  
industrielléger**  
EN 61000-4-2: 1995 Décharge électrostatique  
EN 61000-4-4: 1995 Transitoires rapides électriques  
EN 60801-2: 1994 Exigences concernant les décharges  
électrostatiques  
IEC 801-3: 1994 Insensibilité à l'énergie rayonnée  
IEC 801-4: 1988 Exigences concernant les courants électriques  
transitoires rapides et les suramplifications  
brusques  
EN 55011 : 1991 **Limites et méthodes de mesure des  
caractéristiques des perturbations  
radioélectriques des appareils industriels,  
scientifiques et médicaux (Classe B)**  
EN 61000-3-2: 1995 **Limites d'émission d'harmoniques**  
EN 61000-3-3: 1995 **Limitations d'écart de tensions et de  
papillotement**

## 73/23EEC Directive sur les basses tensions

EN 61010-1 1993 **Exigences de sécurité pour le matériel  
électrique de mesure, commande et de  
laboratoire, Partie 1: Exigences générales**

Erklärt, daß das folgende Produkt: **Deutsch**  
Beschreibung: **Serie 101**  
Modellnummer(n): 101 (A, B oder C) (1 oder 2) (3 beliebige  
Ziffern) - (4 beliebige Buchstaben oder Ziffern)  
Klassifikation: Regelsystem, Installationskategorie II,  
Emissionsgrad II  
Nennspannung: 120V~ (ac) oder 230V~ (ac)  
Nennfrequenz: 50/60 Hz  
Nominaler Strom  
verbrauch: 4VA

Erfüllt die wichtigsten Normen der folgenden Anweisung(en) der  
Europäischen Union unter Verwendung des wichtigsten Abschnitts bzw.  
der wichtigsten Abschnitte der normalisierten Spezifikationen und der  
untenstehenden einschlägigen Dokumente:

## 89/336/EEC EWG Elektromagnetische Verträglichkeit

EN 50082-2: 1992 **EMC-Rahmennorm für Störsicherheit, Teil 1:  
Wohngebieten, Handelsverkehr und  
Leichtindustrie**  
EN 61000-4-2: 1995 Elektrostatische Entladung  
EN 61000-4-4: 1995 Elektrische schnelle Stöße  
EN 60801-2: 1994 Elektrostatische Entladung (Anforderungen)  
IEC 801-3: 1994 Strahlungsimmunität  
IEC 801-4: 1988 Elektrische schnelle Stöße/Burst (Anforderungen)  
EN 55011: 1991 **Beschränkungen und Methoden der Messung  
von Funkstörungsmerkmalen industrieller, wis  
senschaftlicher und medizinischer  
Hochfrequenzgeräte (Klasse B)**  
EN 61000-3-2: 1995 **Grenzen der Oberwellenstromemission**  
EN 61000-3-3: 1995 **Grenzen der Spannungsschwankungen und  
Flimmern**

## 72/23/EEC EWG Niederspannungsrichtlinie

EN 61010-1 1993 **Sicherheitsrichtlinien für Elektrogeräte zur  
Messung, zur Steuerung und im Labor, Teil 1:  
Allgemeine Richtlinien**

Declara que el producto siguiente: **Español**  
Designación: **Serie 101**  
Números de modelo: 101 (A, B ór C) (1ór 2) (Cualquier  
combinación de tres números) - (Cualquier  
combinación de cuatro números y letras)  
Clasificación: Control, categoría de instalación II, grado de  
contaminación ambiental II  
Tensión nominal: 120V~ (ac) ór 230V~ (ac)  
Frecuencia nominal: 50/60 Hz  
Consumo nomina  
de energía: 4VA

Cumple con los requisitos esenciales de las siguientes Directivas de la  
Unión Europea, usando las secciones pertinentes de las reglas  
normalizadas y los documentos relacionados que se muestran:

## 89/336/EEC - Directiva de Compatibilidad Electromagnética

EN 50082-1: 1992 **Norma de inmunidad genérica del EMC, Parte  
1: Ambiente residencial, comercial e industria  
ligera**  
EN 61000-4-2: 1995 Descarga electrostática  
EN 61000-4-4: 1995 Perturbaciones transitorias eléctricas rápidas  
EN 60801-2: 1994 Requerimientos de descargas electrostáticas  
IEC 801-3: 1994 Inmunidad radiada  
IEC 801-4: 1988 Requerimientos de perturbaciones transitorias  
eléctricas rápidas  
EN 55011: 1991 **Limites y métodos de medición de  
características de perturbaciones de radio  
correspondientes a equipos de  
radiofrecuencia industriales, científicos y  
médicos (Clase B)**  
EN 61000-3-2: 1995 **Limites para emisiones de corriente armónica**  
EN 61000-3-3: 1995 **Limitaciones de oscilaciones y fluctuaciones  
de voltaje**

## 73/23/EEC Directiva de Baja Tensión

EN 61010-1 1993 **Requerimientos de seguridad para equipos  
eléctricos de medición, control y uso en  
laboratorios, Parte 1: Requerimientos  
generales**

Erwin D. Lowell Winona, Minnesota USA  
Name of Authorized Representative Place of Issue

November, 1998  
Title of Authorized Representative Date of Issue

  
Signature of Authorized Representative

**Watlow Series 101 User's Manual**

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**For other product information:** Watlow FAX REPLY: +1 (732) 885-6344, outside the U.S.; or +1 (800) 367-0430, inside the U.S.