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Basic Temperature and Limit Controllers

Basic Temperature and Limit Controllers Provide Economical Solution for a Wide Range of Applications



The basic and limit microprocessor-based controllers from Watlow® provide an economical solution for applications requiring simple on-off control. These controllers and limits are available in a broad range of packaging options, allowing users to select the best version for their individual application. The controllers and limits are available with or without an operator interface and can be ordered in a 1/8 DIN square panel mount, DIN-rail mount or open-board design configurations.

The basic and limit design provides significant improvements in the performance, repeatability and accuracy offered by analog basic temperature and limit controllers.

The variable options for the SERIES CV (controller) and SERIES LV (limit) include an operator interface for viewing and selecting the set point. A red, four-character, seven segment LED displays the set point to show the process option. The set point selection is made with a continuous turn rotary encoder, or with discrete up/down cursor keys. Operating range temperature values are customer definable in the product configuration part number.

The fixed options for the SERIES CF (controller) and SERIES LF (limit) offer fixed set points and are supplied without an operator interface. Operating set point temperature values are customer definable in the product configuration part number. The SERIES TM temperature indicator is available as an additional order option.

These basic and limit controllers are UL® recognized and include CE approvals. The limit controllers are FM approved with special UL® approval for the open-board potted versions. CV and LV panel mount controllers ordered with discrete up/down cursor keys include NEMA 4X/IP65 seal protection. Watlow's basic temperature and limit controllers include industry leading service and support and are backed by a three-year warranty.

Features and Benefits

Fixed or adjustable set points
- Provide tamper-proof operation
- Offer control flexibility

Four character LED display
- Improves set point selection accuracy

Multiple mounting options
- Minimize installation time

Heat or cool operation
- Provides application flexibility

High or low limit with auto or manual reset
- Provides application flexibility

Fahrenheit or Celsius operation with indication
- Offers application flexibility

Sensor break protection
- Provides positive system shutdown

Agency approvals
- Meet certification requirements/compliance

Microprocessor-based technology
- Ensures accurate, repeatable control

Typical Applications

- Food preparation
- Industrial machinery
- Packaging
- Plastics processing

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ISO 9001
Registered Company
Winona, Minnesota USA

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Specifications

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

Limit Controller
- Microprocessor based, limit controller
- Nominal switching hysteresis, typically 3°F (1.7°C)
- High or low limit, factory selectable
- Latching output requires manual reset upon over or under temperature condition
- Manual or automatic reset on power loss, factory selectable
- Internal front panel or external customer supplied momentary reset switch
- Input filter time: 1 second

Operator Interface
- Four digit, seven segment LED displays, 0.28 in. (7 mm) high
- °F or °C indicator LED
- Load/Alarm indicator LED
- Continuous turn, velocity sensitive rotary encoder for set point adjustment
- Front panel key on push for set point or push for show process options (on-off controller only)
- Front panel SET/RESET key on variable set point models (limit controller only)
- 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: 77°F (25°C) ±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, 100Ω
- DIN curve (0.00385 curve)
- 125 µA nominal RTD excitation current

Input Accuracy Span Range

Type E:	-328	to	1470°F	or	-200	to	800°C
Type J:	32	to	1382°F	or	0	to	750°C
Type K:	-328	to	2282°F	or	-200	to	1250°C
Type T:	-328	to	662°F	or	-200	to	350°C
RTD (DIN)	-328	to	1472°F	or	-200	to	800°C

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°C (-328 to 32°F)
- Temperature stability: ±0.3° 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° per degree change in ambient

Allowable Operating Ranges

Type E:	-328	to	1470°F	or	-200	to	800°C
Type J:	-346	to	1900°F	or	-210	to	1038°C
Type K:	-454	to	2500°F	or	-270	to	1370°C
Type T:	-454	to	750°F	or	-270	to	400°C
RTD (DIN)	-328	to	1472°F	or	-200	to	800°C

Output Types

Switched dc (non-isolated, on-off controller only)
- Supply voltage max.: 24VDC into an infinite load
- Supply voltage min.: 5VDC at 10mA
- Min. load impedance: 500Ω

Electromechanical Relay, Form C
- Min. load current: 100mA
- 8A @ 240VAC or 30VDC max., resistive
- 250VA pilot duty, 120/240VAC max., inductive
- Use RC suppression for inductive loads
- Electrical life 100,000 cycles at rated current

External Reset Switch (limit controller only)
- Momentary, dry contact closure

Agency Approvals
- CE [1], W.E.E.E., RoHS EU Directive (2002-95-EC)

Agency Approvals (on-off controller only)
- UL® 873 recognized temperature controller and indicator, File # E43684
- UL® 197 reviewed for use in foodservice appliances
- ANSI Z21.23 gas appliance thermostat approval
- Temperature control and indicator CSA 22.2 No. 24, File # 30586
- NEMA 4X/IP65 (SERIES CV and LV panel mount controllers with up/down cursor keys)

Agency Approvals (limit controller only)

SERIES LF (potted version only)
- UL® 991 recognized temperature limit for foodservice industry

SERIES LV and SERIES LF (including potted version)
- UL® 873 recognized temperature regulator, File # E43684
- UL® 197 reviewed for use in foodservice appliances
- ANSI Z21.23 gas appliance thermostat approval
- CSA C22.2#24 approved temperature control, File # 30586
- FM Class 3545 temperature limit switches, File # 3017239

Terminals
- 0.25 in. (6.3 mm) quick connect, push on terminal or removable screw style terminal block

Power
- 24VAC +10%; -15%; 50/60Hz, ±5%
- 100 to 120VAC +10%; -15%; 50/60Hz, ±5%
- 200 to 240VAC +10%; -15%; 50/60Hz, ±5%
- 10VA max. power consumption
- Data retention upon power failure via nonvolatile memory

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

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

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

[1] See declaration of comformity.

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Ordering Information

Part Number

Indicator only, 4 character, 7 segment display

①②	③ Power Supply	④ Package	⑤ Sensor Type and Scale	⑥⑦⑧⑨⑩⑪⑫⑬⑭	⑮
TM				AAAAAAAAA	

③	Power Supply
B =	120VAC
D =	230 to 240VAC
F =	24VAC

④	Package
1 =	Panel mount, 1/8 DIN square - spade terminals
2 =	DIN-rail mount - spade terminals
5 =	Panel mount, 1/8 DIN square - screw terminals
6 =	DIN-rail mount - screw terminals
A =	NEMA 4X panel mount, (spade terminals)
C =	NEMA 4X panel mount, (screw terminals)

⑤	Sensor Type and Scale
H =	T/C Type J °F (-346 to 1900°F)
J =	T/C Type J °C (-210 to 1038°C)
K =	T/C Type K °F (-454 to 2500°F)
L =	T/C Type K °C (-270 to 1370°C)
M =	T/C Type T °F (-454 to 750°F)
N =	T/C Type T °C (-270 to 400°C)
P =	RTD °F (-328 to 1472°F)
R =	RTD °C (-200 to 800°C)
S =	T/C Type E °F (-328 to 1470°F)
T =	T/C Type E °C (-200 to 800°C)

⑮	Overlay/Customs Options
A =	Standard with Watlow logo
1 =	Standard without Watlow logo

Ordering Information

Part Number

Limit control with 8A relay output. Fixed set point, no user interface

①②	③ Power Supply	④ Package	⑤ Sensor Type and Scale	⑥ Limit Type	⑦⑧⑨⑩ Fixed Set Point Temp. Value	⑪⑫⑬⑭	⑮ Overlay/ Custom Options
LF						AAAA	

③	Power Supply
C =	120VAC
E =	230 to 240VAC
G =	24VAC

④	Package
1 =	Panel mount, 1/8 DIN square - spade terminals
2 =	DIN-rail mount - spade terminals
3 =	Open, non potted - spade terminals
4 =	Potted case - spade terminals
5 =	Panel mount, 1/8 DIN square - screw terminals
6 =	DIN-rail mount - screw terminals
7 =	Open, non potted - screw terminals

⑤	Sensor Type and Scale
H =	T/C Type J °F (-346 to 1900°F)
J =	T/C Type J °C (-210 to 1038°C)
K =	T/C Type K °F (-454 to 2500°F)
L =	T/C Type K °C (-270 to 1370°C)
M =	T/C Type T °F (-454 to 750°F)
N =	T/C Type T °C (-270 to 400°C)
P =	RTD °F (-328 to 1472°F)
R =	RTD °C (-200 to 800°C)
S =	T/C Type E °F (-328 to 1470°F)
T =	T/C Type E °C (-200 to 800°C)

⑥	Limit Type
U =	High limit manual reset
W =	High limit auto reset
Y =	Low limit manual reset
Z =	Low limit auto reset

⑦⑧⑨⑩ Fixed Set Point Temperature Value
Note: An A (-) used in the left most digit of the fixed set point indicates a negative temperature value.

⑮	Overlay/Customs Options
A =	Standard with Watlow logo
1 =	Standard without Watlow logo

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Ordering Information

Part Number

Limit control with 8A relay output. Rotary set point adjustment, 4 character, 7 segment display, reset switch

①②	③	④	⑤	⑥	⑦⑧⑨⑩	⑪⑫⑬⑭	⑮
LV	Power Supply	Package	Sensor Type and Scale	Limit Type	Low Set Point Operating Range Value	High Set Point Operating Range Value	Overlay/ Custom Options

③	Power Supply
C =	120VAC
E =	230 to 240VAC
G =	24VAC

④	Package
1 =	Panel mount, 1/8 DIN square - spade terminals
2 =	DIN-rail mount - spade terminals
5 =	Panel mount, 1/8 DIN square - screw terminals
6 =	DIN-rail mount - screw terminals
A =	NEMA 4X panel mount, tactile keys (spade terminals)
B =	DIN-rail mount, tactile keys (spade terminals)
C =	NEMA 4X panel mount, tactile keys (screw terminals)
D =	DIN-rail mount, tactile keys (screw terminals)

⑤	Sensor Type and Scale
H =	T/C Type J °F (-346 to 1900°F)
J =	T/C Type J °C (-210 to 1038°C)
K =	T/C Type K °F (-454 to 2500°F)
L =	T/C Type K °C (-270 to 1370°C)
M =	T/C Type T °F (-454 to 750°F)
N =	T/C Type T °C (-270 to 400°C)
P =	RTD °F (-328 to 1472°F)
R =	RTD °C (-200 to 800°C)
S =	T/C Type E °F (-328 to 1470°F)
T =	T/C Type E °C (-200 to 800°C)

⑥	Limit Type
U =	High limit manual reset
W =	High limit auto reset
Y =	Low limit manual reset
Z =	Low limit auto reset

⑦⑧⑨⑩ Low Limit Set Point Operating Range Value

Note: An A (-) used in the left most digit of the fixed set point indicates a negative temperature value.

⑪⑫⑬⑭ High Set Operating Range Value

Note: An A (-) used in the left most digit of the fixed set point indicates a negative temperature value.

⑮	Overlay/Customs Options
A =	Standard with Watlow logo
1 =	Standard without Watlow logo

Ordering Information

Part Number

On-off controller, fixed set point, no user interface

①②	③	④	⑤	⑥	⑦⑧⑨⑩	⑪⑫⑬⑭	⑮
CF	Power Supply	Package	Sensor Type and Scale	Control Type	Fixed Set Point Temp. Value	AAAA	Overlay/ Custom Options

③	Power Supply
B =	120VAC, switched dc output
C =	120VAC, 8A relay output
D =	230 to 240VAC, switched dc output
E =	230 to 240VAC, 8A relay output
F =	24VAC, switched dc output
G =	24VAC, 8A relay output

④	Package
1 =	Panel mount, 1/8 DIN square - spade terminals
2 =	DIN-rail mount - spade terminals
3 =	Open board, non potted - spade terminals
4 =	Potted case - spade terminals
5 =	Panel mount, 1/8 DIN square - screw terminals
6 =	DIN-rail mount - screw terminals
7 =	Open board, non potted - screw terminals

⑤	Sensor Type and Scale
H =	T/C Type J °F (-346 to 1900°F)
J =	T/C Type J °C (-210 to 1038°C)
K =	T/C Type K °F (-454 to 2500°F)
L =	T/C Type K °C (-270 to 1370°C)
M =	T/C Type T °F (-454 to 750°F)
N =	T/C Type T °C (-270 to 400°C)
P =	RTD °F (-328 to 1472°F)
R =	RTD °C (-200 to 800°C)
S =	T/C Type E °F (-328 to 1470°F)
T =	T/C Type E °C (-200 to 800°C)

⑥	Control Type
H =	Heat
C =	Cool

⑦⑧⑨⑩ Fixed Set Point Temperature Value

Note: An A (-) is used in the left most digit of the set point operating ranges to indicate a negative temperature value.

⑮	Overlay/Customs Options
A =	Standard with Watlow logo
1 =	Standard without Watlow logo

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Ordering Information

Part Number

On-off controller, rotary set point adjustment, 4 character, 7 segment display

①②	③ Power Supply	④ Package	⑤ Sensor Type and Scale	⑥ Control Type	⑦⑧⑨⑩ Low Set Point Operating Range Value	⑪⑫⑬⑭ High Set Point Operating Range Value	⑮ Overlay/ Custom Options
CV							

③	Power Supply
B =	120VAC, switched dc output
C =	120VAC, 8A relay output
D =	230 to 240VAC, switched dc output
E =	230 to 240VAC, 8A relay output
F =	24VAC, switched dc output
G =	24VAC, 8A relay output

④	Package
1 =	Panel mount, 1/8 DIN square - spade terminals
2 =	DIN-rail mount - spade terminals
5 =	Panel mount, 1/8 DIN square - screw terminals
6 =	DIN-rail mount - screw terminals
A =	NEMA 4X panel mount, tactile keys (spade terminals)
B =	DIN-rail mount, tactile keys (spade terminals)
C =	NEMA 4X panel mount, tactile keys (screw terminals)
D =	DIN-rail mount, tactile keys (screw terminals)

⑤	Sensor Type and Scale
H =	T/C Type J °F (-346 to 1900°F)
J =	T/C Type J °C (-210 to 1038°C)
K =	T/C Type K °F (-454 to 2500°F)
L =	T/C Type K °C (-270 to 1370°C)
M =	T/C Type T °F (-454 to 750°F)
N =	T/C Type T °C (-270 to 400°C)
P =	RTD °F (-328 to 1472°F)
R =	RTD °C (-200 to 800°C)
S =	T/C Type E °F (-328 to 1470°F)
T =	T/C Type E °C (-200 to 800°C)

⑥	Control Type
H =	Heat
C =	Cool

⑦⑧⑨⑩ Low Set Point Operating Range Value

Note: An A (-) is used in the left most digit of the set point operating ranges to indicate a negative temperature value.

⑪⑫⑬⑭ High Set Operating Range Value

Note: An A (-) is used in the left most digit of the set point operating ranges to indicate a negative temperature value.

⑮	Overlay/Customs Options
A =	Standard with Watlow logo
B =	Push to show process with Watlow logo
C =	Push to adjust set point with Watlow logo
D =	Show process push to adjust set point with Watlow logo
1 =	Standard without Watlow logo
2 =	Push to show process without Watlow logo
3 =	Push to adjust set point without Watlow logo
4 =	Show process push to adjust set point without Watlow logo

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Austria	+43 6244 20129 0	**Germany**	+49 7253 9400 0	**Mexico**	+52 442 256 2200
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