Temperature and Process

Product	Control/ Limit Loops	Mounting	Fiber Optic Temp. Measure- ment	Profiling	Maximum Output	Communication Protocols	Page
F4T with INTUITION®	4/4	DIN-rail, Flush mount	–	✔	12A	Standard bus, Modbus® TCP (Ethernet), Modbus® RTU, SCPI, USB Host (2), USB device	**271**
EZ-ZONE® RM	152/192	DIN-rail	–	✔	15A	Standard bus, EtherNet/IP™, DeviceNet™, PROFIBUS DP, Modbus® TCP, Modbus® RTU	**272**
EZ-ZONE RMF	8/0	DIN-rail	✔	–	–	Standard bus, EtherNet/IP™, DeviceNet™, PROFIBUS DP, Modbus® TCP, Modbus® RTU	**273**
EZ-ZONE RMZ	48/0	DIN-rail	✔	–	–	EtherCAT® Standard bus, EtherNet/IP™, DeviceNet™, PROFIBUS DP, Modbus® TCP, Modbus® RTU	**273**
EZ-ZONE ST	1/1	DIN-rail	–	✔	75A	Standard bus, Modbus® RTU	**274**
SERIES F4 Ramping	2/0	$1/4$ DIN front panel	–	✔	2A	Modbus® RTU	**275**
SERIES F4 Process	2/0	$1/4$ DIN front panel	–	–	2A	Modbus® RTU	**281**
EZ-ZONE PM	2/1	$1/32$, $1/16$, $1/8$, $1/4$ DIN front panel	–	✔	15A	Standard bus, EtherNet/IP™, DeviceNet™, PROFIBUS DP, Modbus® TCP, Modbus® RTU	**286**
EZ-ZONE PM Express	1/1	$1/32$, $1/16$ DIN front panel	–	–	15A	Standard bus	**287**
SERIES CV	1/0	DIN-rail, Front panel, chassis	–	–	8A	N/A	**288**
SERIES CF	1/0	DIN-rail, Front panel, chassis	–	–	8A	N/A	**291**
SERIES EHG® SL10	1/1	In-line/ Sub panel	–	–	10A	Modbus® RTU	**294**
SERIES EHG	1/0	In-line	–	–	10A	N/A	**295**

Note: The specifications in the table above are best available values in each category. Not all combinations of these values are available in a single model number.

Temperature and Process

F4T with INTUITION®

The F4T with INTUITION® temperature process controller offers a wide range of field removable I/O modules for maximum design flexibility. Configurations can be custom tailored to meet the scaling needs of a tremendous range of equipment and applications while providing exactly the hardware types required for compatibility. The F4T controller also features a 4.3 inch, color, graphical touch panel. Combining power, flexibility and functionality, this new controller offers unmatched versatility, and its best-in-class ease of use could very well make user manuals a thing of the past.

Features and Benefits

4.3-inch, color touch panel with high-resolution, graphical user-interface
- Shortens learning curve and reduces operator errors
- Allows channels, profiles, alarms, inputs and outputs to be personalized with user defined names

Temperature PID, data logger, trend chart, over/under-temperature limit, power switching, math, logic, timers and counters combined into an integrated system
- Lowers ownership costs
- Eliminates the need for separate discrete components
- Reduces complexity
- Simplifies design, ordering and installation
- Saves money

Robust algorithms for temperature, cascade, altitude, humidity and compressor
- Improves process control
- Offers one to four channels of control
- Provides multiple PID sets
- Enables TRU-TUNE®+ adaptive control algorithm
- Offers 40 ramp and soak profiles with real-time clock and battery backup

COMPOSER® graphical configuration PC software
- Speeds up and simplifies commissioning
- Archives and documents controller setup
- Connects with controller easily via Ethernet

Many communications options available including Ethernet Modbus® TCP and SCPI and EIA-232/485 Modbus® RTU
- Offers two USB host ports and one device port
- Simplifies file transfers
- Connects easily

Modular design
- Adapts quickly to evolving requirements
- Offers numerous types of field pluggable modules for maximum flexibility and easiest compatibility
- Features scalable and modular firmware functions
- Delivers scalable input/output quantities from 1 to 36

Agency certifications include UL®, FM, CE, RoHS, W.E.E.E., NEMA 4X/IP65
- Ensures high quality and reliability
- Verifies performance in installations worldwide

SERIES F4S/F4D/F4P backward compatible
- Provides easy retrofit with minimum pain and disruption
- Ensures proper fit in existing SERIES F4 panel cutout

Off-the-shelf solution
- Provides cost-effective "make versus buy"
- Offers preconfigured touch-panel screens
- Assures quicker time to market

EZ-ZONE® RM

The EZ-ZONE® RM controller simplifies thermal system management. The EZ-ZONE RM controller family is comprised of six module types: an integrated on-off or PID control, monitoring and over/under temperature limit module, a high-density on-off or PID control module, a high-density limit only module, an input/output (I/O) expansion module, a high-density monitor/scanner module and a data logging and field communications access module. A system is configured by connecting any combination of module types to address specific application needs. The EZ-ZONE RM is extremely flexible and scalable allowing mixing and matching of I/O to configure 1 to 152 control loops and up to 256 monitor points.

Optional integrated controller functions can be combined or ordered in different quantities:

- PID control loops
- Over/under temperature limit control loops
- 10 and 15 ampere power output/heater driver options
- On-board data logging
- Current measurement input
- Sequencer start up and control function
- Programmable timer and counter functions
- Programmable math and logic options
- Multiple communication protocol options
- Mobile configuration with removable secure digital (SD) flash card

Benefits of using an integrated controller solution:

- Reduces wiring time and termination complexity compared with connecting multiple discrete products
- Improves system reliability
- Reduces termination and installation cost
- Eliminates compatibility issues often encountered with using various discrete components and brands
- Reduces troubleshooting time and downtime costs because the system can specifically identify any problems with a sensor, controller, solid state relay (SSR) power output or heater load
- Complete thermal solution saves engineering time and labor costs while shortening project schedules
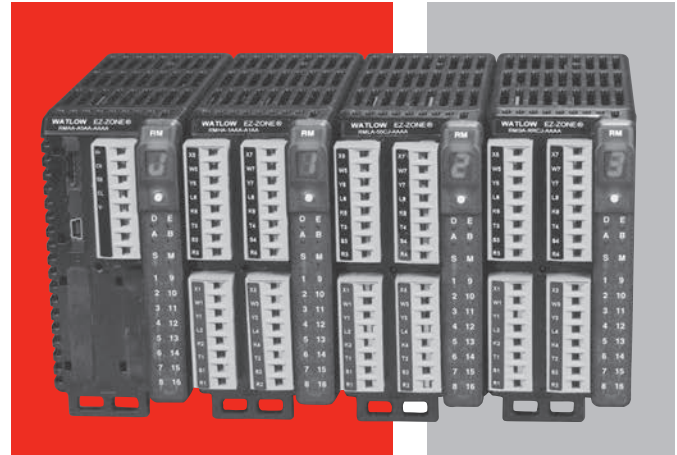
Features and Benefits

Multiple inputs; from 1 to 152 PID loops of control or monitor up to 256 analog inputs

- Mix and match I/O to fit any application; from 1 input with 2 outputs to 152 analog inputs with 152 outputs, or monitor up to as many as 256 analog inputs all in one system
- Reduces cost because only required loops are purchased
- Allows a common controller platform across many design applications as both loops and outputs can be ordered in single increments

Advanced PID control algorithm

- Offers TRU-TUNE®+ adaptive control to provide tighter control for demanding applications
- Enables auto-tune for fast, efficient start-up

Communication capabilities

- Provides a range of protocol options including universal serial bus (USB) device port, Modbus® RTU, EtherNet/IP™, Modbus® TCP, DeviceNet™ and PROFIBUS

USB Port

- Provides data log retrieval

SPLIT-RAIL control

- Allows modules mounted in separate high-voltage and low-voltage cabinets to function as an integrated system
- Minimizes the length and cost of wire runs and improves system reliability by locating inputs closer to sensors and outputs closer to loads

---

For detailed product and ordering information, see the full EZ-ZONE RM product section located on pages 222 through 239.

WATLOW

EZ-ZONE® RMZ/RMF

By combining advances in fluorescent temperature sensing with the power of the proven EZ-ZONE® RM control system, Watlow® developed a best-in-class fiber optic temperature measurement and control system that will provide industry-leading performance for your specific application. By integrating fiber optic sensing capabilities into the EZ-ZONE RM control system, users will save space, improve performance with faster response times while simplifying their control system.

Watlow's EZ-ZONE RMZ and EZ-ZONE RMF make the system adaptable to all system requirements. Both are compatible with all other modules within the EZ-ZONE RM family and self-discover all existing modules within the system making a seamless integration into your temperature control/logic system.

EZ-ZONE RMZ Offers Fiber Optic Sensing Capabilities and EtherCAT® Communications

The EZ-ZONE RMZ integrates fiber optics, PID temperature control and EtherCAT® communications into a single package. It features multi-channel control, hosting up to four channels of fiber optic inputs as well as supporting up to 44 additional control loops from other EZ-ZONE RM modules. These modules support a wide array of capabilities including I/O, logic, current measurement, power switching and more.

EZ-ZONE RMF Offers Additional Fiber Optic Inputs for Expansion Opportunities

The EZ-ZONE RMF module is a dedicated fiber optic input module integrating the advanced control technology of the EZ-ZONE system with one to eight channels of fiber optic temperature sensing.

The EZ-ZONE RMF can also serve as additional inputs to the EZ-ZONE RMZ enabling extensive expansion opportunities for future system needs. The EZ-ZONE RMF is ideal either as an expansion module or configured with built-in temperature control loops (outputs via EZ-ZONE RME module). The EZ-ZONE RMF can be used independently when only sensing is required.

Benefits of Watlow's high-performance fluorescence-based temperature measurement system include:

- Compact integrated fiber optic sensing with temperature control
- Easily expands to increase number of zones as your system needs increase
- Integrates seamlessly with the temperature control system avoiding additional analog signal processing
- Faster temperature sampling rates with high resolution
- Minimizes installed footprint due to the small form factor and DIN-rail mounting
- Highly accurate fluorescent signal processing electronics
- Offers highly reliable LED light source designed to run at low currents for maximum life
- Up to 48 loops of input and control with all EZ-ZONE RM temperature control features
  - Temperature / limit loops
  - Current measurement
  - Power switching
  - Logic

For detailed product and ordering information, see the full RMZ/RMF product section located on pages 240 through 241.

EZ-ZONE ST

The EZ-ZONE ST integrated solid state controller from Watlow offers a complete thermal system control solution in a single package. Features include a PID temperature controller connected to a high-amperage solid state relay with the option of adding a properly sized heat sink, an over- and under-temperature limit, a power shut-down contactor and digital communications in one complete and professionally engineered product.

Because the system is modular and scalable, a user only pays for what is needed. Stacking the EZ-ZONE ST integrated controller into multiple configurations enables flexibility to standardize the product platform to solve a wide range of application needs.

This integrated controller also includes 200KA short circuit current rating (SCCR) tested up to 480VAC to minimize damage in the event of a short circuit when used with required fusing.

Features and Benefits

Back panel or DIN-rail mount
- Provides several mounting options

Compact package
- Reduces panel size

Touch-safe package
- Complies with IP2X increasing user safety

±0.1 percent temperature accuracy
- Provides efficient and accurate temperature control

200KA SCCR with proper fusing
- Minimizes damage in the event of a short circuit

Agency approvals: UL®, CSA, CE, RoHS, W.E.E.E.
- Meets applications requiring agency approvals

Three-year warranty
- Ensures Watlow's reliability and product support

Off-the-shelf designed system solution
- Improves system reliability and termination reduction
- Reduces installation cost
- Eliminates incompatibility headaches often encountered with using many different components and brands

Profile capability
- Includes ramp and soak with four files and 40 total steps
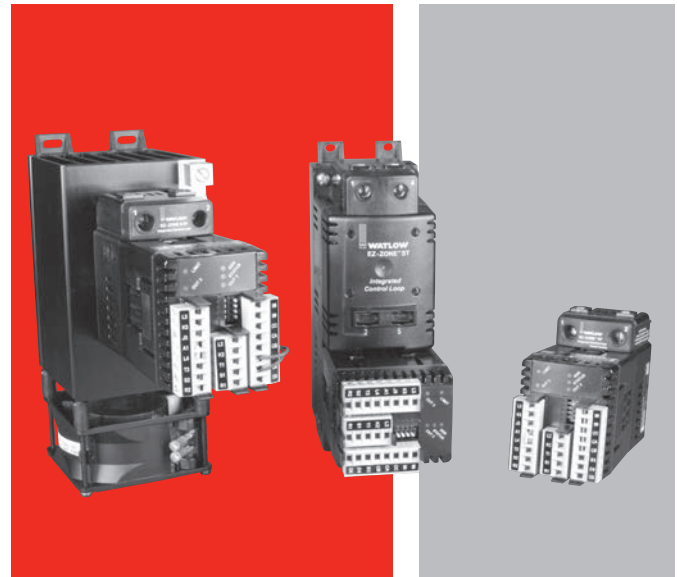
Ability to communicate with programmable logic controller (PLC), personal computer (PC) or operator interface terminal (OIT)
- Optional EIA-485 Modbus® RTU
- RUI/communications gateway with optional EIA-232/485 Modbus® RTU, EtherNet/IP™/TCP Modbus®, DeviceNet™ or PROFIBUS DP. Refer to page 371 for further information.

Solid state relay output
- Allows faster cycling, more precise control, increased heater life and improves energy efficiency
- Ability to handle up to 75 amperes
- Uses either zero-cross or phase angle control modes for flexibility to control resistive loads such as nichrome, tungsten or quartz lamps
- Utilizes phase angle control mode to prevent load failure or blowing fuses for tungsten or quartz loads

PID temperature control
- Allows single input/dual output
- Allows standard PID or adaptive TRU-TUNE+ tuning algorithms for demanding controllability requirements

Optional temperature limit
- Increases safety in over- and under-temperature condition

Optional definite purpose mechanical contactor
- Enables circuit safety shut down driven by limit control or PID alarm output signal

---

For detailed product and ordering information, see the full EZ-ZONE ST product section located on pages 242 through 248.

WATLOW

SERIES F4 Ramping

The SERIES F4 $^1/_4$ DIN industrial ramping controller meets the requirements of the most demanding ramp and soak processing applications. Easy to set up and operate, its programming features and proven performance capabilities are ideally suited for environmental chamber or furnace and oven applications. Single and dual channel versions are available.

Competitively-priced, the SERIES F4 ramping controller features a four line, high-definition LCD interface display for quick and easy profile programming and controller configuration. Its 16-bit microprocessor ensures accuracy and delivers performance advantages you can count on from a Watlow controller.

Up to 256 steps can be programmed into as many as 40 nameable profiles that can be programmed to wait for events or for up to three different process variables. A guaranteed soak feature allows a setting for how closely to control a process.

Program the four digital event inputs to remotely start, pause or terminate any preprogrammed process recipes. Eight event outputs are segment programmable and three outputs can be assigned to a programmable compressor and boost heat/boost cool control. A real-time clock can start a profile at any time.

Serial communication and dual alarm relays are included in the base unit. The SERIES F4 ramping controller is packaged with a NEMA 4X front face to withstand harsh environments and a four in. (102 mm) deep case with removable connectors for wiring convenience. It is manufactured by Watlow, ISO 9001 registered and protected by a three-year warranty.

Features and Benefits

Guided 256 step, 40 profile ramp and soak programmable memory
• Supports a wide range of processing applications

High-definition, four line LCD controller interface display
• Simplifies setup and operation

Menu customization
• Offers enhanced process monitoring

High-performance, 16-bit microprocessor
• Precise process control

Universal inputs
• Provides application versatility

Expandable modular construction
• Field upgradable

Enhanced environmental chamber control
• Supports humidity, compressor, boost heat/boost cool control

Cascade control
• Provides precise two variable control

Real-time clock with battery backup
• Offers operational flexibility

SERIES F4 Ramping

Set Point Ramp and Soak Programming

In response to customer needs, the Watlow SERIES F4 ramping controller has been enhanced with programming features that offer more capabilities with less programming complexity.

A programming guide provides step-by-step instructions for building profiles, offering choices for step configuration. For better operator recognition, profiles and digital I/O used for events can be named using up to 10 characters.

Five step types including ramp, soak, jump, auto start and end, offer complete programming flexibility.

Ramp steps can be based on time or rate. Ramp and soak steps can be programmed to wait for up to four event inputs and three process variables. As many as eight event outputs are step selectable. To accommodate changes to thermal systems characteristics over the operating range, up to 10 sets of PID heat/cool parameters are step selectable. The auto start step can start a profile based on a chosen set date, day of the week or daily. A jump step enables movement within a profile or to another profile. The end step terminates a program with the control outputs programmed to specific process needs.

Temperature and Humidity Chamber Application
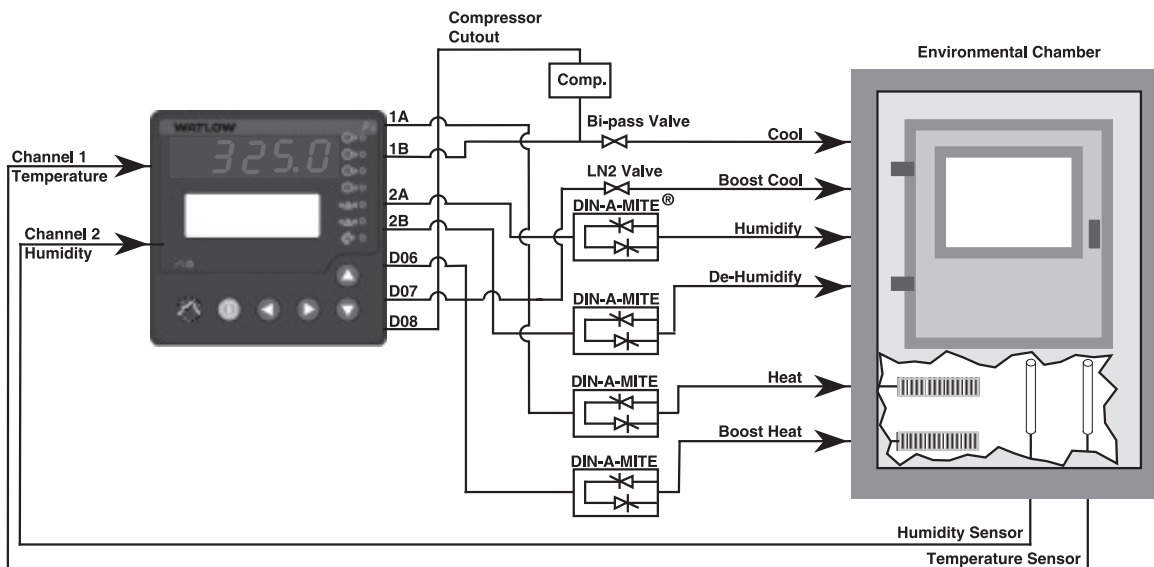

Serial Communication

EIA-232 and EIA-485 serial communication interfaces are included in the base unit of both the SERIES F4S (single channel) and the SERIES F4D (dual channel) controllers. The baud rate is selectable as either 9600 or 19200 Kbaud. The protocol is Modbus® RTU.

Alarms

Two Form "C" electromechanical alarm relays are included in the base units. These alarms can be programmed as either process or deviation alarms. The alarms can be tied to up to three process variables.

Optional Retransmit

Optional retransmit capability is available to retransmit one or two variables. These variables include up to three process variables, control set points or percent load power.
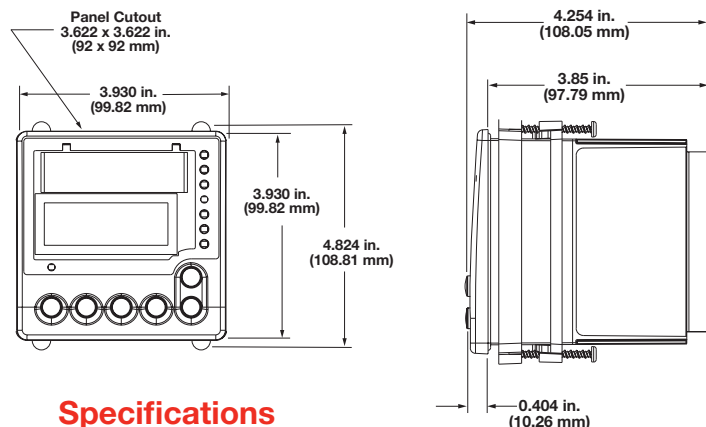
Specifications

Dimensions

- Width x height x depth
  3.93 in. x 3.93 in. x 3.85 in. (99 mm x 99 mm x 97 mm) panel mount

WATLOW

SERIES F4 Ramping

Specifications

Universal Analog Inputs 1 (2 and 3 Optional)
- Updates rates, IN1 = 20Hz, IN2 and IN3 = 10HZ

Thermocouple
- Type J, K, T, N, E, C (W5), D (W3), PTII, R, S, B
- Input impedance 20MΩ

RTD
- 2- or 3-wire platinum, 100, 500 or 1000Ω
- JIS or DIN curves, 1.0 or 0.1 indication

Process
- Input resolution ≈50,000 bits at full scale
- Range selectable: 0-10VDC, 0-5VDC, 1-5VDC, 0-50mV, 0-20mA, 4-20mA
- Voltage input impedance 20KΩ
- Current input impedance 100Ω

Digital Inputs (4)
- Update rate = 10Hz
- Contact or dc voltage (36VDC max.)
- 10KΩ input impedance

Control Outputs (1A, 1B, 2A, 2B)
- Update rate = 20Hz

Open Collector/Switched dc
- Internal load switching (nominal):
  Switched dc, 22 to 28VDC, limited @ 30mA
- External load switching (max.):
  Open collector 42VDC @ 0.5A

Solid State Relay
- Zero switched, optically coupled, 0.5A @ 24VAC min., 253VAC max.

Process Outputs (Optional Retransmit)
- Update rate = 1Hz
- User selectable 0-10VDC, 0-5VDC, 1-5VDC @ 1KΩ min., 0-20mA, 4-20mA @ 800Ω max.
- Resolution:
  dc ranges = 2.5mV nominal
  mA ranges = 5µA nominal
- Calibration accuracy:
  dc ranges = ±15mV
  mA ranges = ±30µA
- Temperature stability 100ppm/°C

Alarm Outputs
- Output update rate 1Hz
- Electromechanical relay, Form C, 2A @ 30VDC or 240VAC max.

Digital Outputs (8)
- Update rate = 10Hz
- Open collector output
- Off = 42VDC max. @ 10µA
- On = 0.2VDC max. @ 50mA sink
- Internal supply: 5VDC, @ 80mA

Communications
EIA-232 and EIA-485 serial communications with Modbus® RTU protocol

Safety and Agency Approvals
- UL®/C-UL® 916 listed, File #E185611

Process Control Equipment
- CE
  - EN 61010-1
  - EN 61326
  - IP65 and NEMA 4X

Terminals
- Touch-safe, removable terminal blocks, accepts 12 to 22 gauge wire

Power
- 100-240VAC, -15%, +10%; 50/60Hz, ±5%
- 39VA max. power consumption
- Data retention upon power failure via nonvolatile memory (7 years for battery backed RAM)
- Sensor input isolation from input to input to output to communication circuitry is 500VAC

Operating Environment
- 32 to 130°F (0 to 55°C)
- 0 to 90% RH, non-condensing
- Storage temperature: -40 to 158°F (-40 to 70°C)

Accuracy
- Calibration accuracy and sensor conformity:
  ±0.1% of span ±1°C @ 77°F ±5°F (25°C ±3°C) ambient and rated line voltage ±10% with the following exceptions:

  Type T: 0.12% of span for -328 to -58°F (-200 to -50°C)

  Types R and S: 0.15% of span for 32 to 212°F (0 to 100°C)

  Type B: 0.24% of span for 1598 to 3092°F (870 to 1700°C)
- Accuracy span: Less than or equal to operating ranges, 1000°F (540°C) min.
- Temperature stability: ±0.1°F/°F (±0.1°C/°C) rise in ambient for thermocouples
  ±0.05°F/°F (±0.05°C/°C) rise in ambient for RTD sensors

SERIES F4 Ramping

Specifications *(Continued)*

Displays
- Process: 5 digit, 7 segment LED, red
- Control interface display: 4-row, 20-character high definition LCD green

Sensor Operating Ranges

Type J:	32	to	1500°F	or	0	to	815°C
Type K:	-328	to	2500°F	or	-200	to	1370°C
Type T:	-328	to	750°F	or	-200	to	400°C
Type N:	32	to	2372°F	or	0	to	1300°C
Type E:	-328	to	1470°F	or	-200	to	800°C
Type C (W5):	32	to	4200°F	or	0	to	2315°C
Type D (W3):	32	to	4352°F	or	0	to	2400°C
Type Pt 2:	32	to	2543°F	or	0	to	1395°C
Type R:	32	to	3200°F	or	0	to	1760°C
Type S:	32	to	3200°F	or	0	to	1760°C
Type B:	32	to	3300°F	or	0	to	1816°C
RTD (DIN):	-328	to	1472°F	or	-200	to	800°C
RTD (JIS):	-328	to	1166°F	or	-200	to	800°C
Process:			-19,999 to 30,000 units				

Sensor Accuracy Ranges
Input ranges

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
Type N:	32	to	2282°F	or	0	to	1250°C
Type E:	-328	to	1470°F	or	-200	to	800°C
Type C (W5):	32	to	4200°F	or	0	to	2315°C
Type D (W3):	32	to	4352°F	or	0	to	2400°C
Type Pt 2:	32	to	2540°F	or	0	to	1393°C
Type R:	32	to	2642°F	or	0	to	1450°C
Type S:	32	to	2642°F	or	0	to	1450°C
Type B:	1598	to	3092°F	or	870	to	1700°C
RTD (DIN)	-328	to	1472°F	or	-200	to	800°C
RTD (JIS):	-328	to	1166°F	or	-200	to	630°C
Process:			-19,999 to 30,000 units				

Note: Specifications subject to change without notice.

SERIES F4 Ramping

Ordering Information - ¼ DIN Single Channel Ramping Controller

Part Number

① ②	③ Single Channel Ramping	④ Power Supply	⑤ Output 1A	⑥ Output 1B	⑦	⑧ Auxiliary Input Module	⑨ Auxiliary Retransmit Module	⑩ Language and RTD Options	⑪ ⑫ Display and Custom Options
F4	**S**		**-**		**A**		**-**		

③	Single Channel Ramping Controller
S =	1 universal analog input, 4-digital inputs, 8-digital outputs, 2 alarms, EIA-232/485 comms

④	Power Supply
H =	100-240VAC/VDC

⑤	Output 1A
C =	Open collector/switched dc
F =	Process, 0-5, 1-5, 0-10VDC, 0-20mA, 4-20mA
K =	Solid state Form A 0.5A relay

⑥	Output 1B
A =	None
C =	Open collector/switched dc
F =	Process, 0-5, 1-5, 0-10VDC, 0-20mA, 4-20mA
K =	Solid state Form A 0.5A relay

⑧	Auxiliary Input Module
0 =	None
6 =	Dual universal inputs

⑨	Auxiliary Retransmit Module
0 =	None
1 =	Single retransmit output 0-5, 1-5, 0-10VDC, 0-20mA, 4-20mA
2 =	Dual retransmit outputs 0-5, 1-5, 0-10VDC, 0-20mA, 4-20mA

⑩	Language and RTD Option
1 =	English with 100Ω RTD
2 =	German with 100Ω RTD
3 =	French with 100Ω RTD
4 =	Spanish with 100Ω RTD
5 =	English with 500 and 1KΩ RTD
6 =	German with 500 and 1KΩ RTD
7 =	French with 500 and 1KΩ RTD
8 =	Spanish with 500 and 1KΩ RTD

⑪ ⑫	Display and Custom Options
RG =	Standard display (Red/Green display only)
XX =	Custom options: software, setting parameters, overlay

SERIES F4 Ramping

Ordering Information - $^1/_4$ DIN Dual Channel Ramping Controller

Part Number

① ②	③ Dual Channel Ramping	④ Power Supply	⑤ Output 1A	⑥ Output 1B	⑦ Output 2A	⑧ Output 2B	⑨ Auxiliary Retransmit Module	⑩ Language and RTD Options	⑪ ⑫ Display and Custom Options
F4	D		-				-		

③	Dual Channel Ramping Controller
D =	3 universal analog inputs, 4-digital inputs, 8-digital outputs, 2 alarms, EIA-232/485 comms

④	Power Supply
H =	100-240VAC/VDC

⑤	Output 1A
C =	Open collector/switched dc
F =	Process, 0-5, 1-5, 0-10VDC, 0-20mA, 4-20mA
K =	Solid state Form A 0.5A relay

⑥	Output 1B
A =	None
C =	Open collector/switched dc
F =	Process, 0-5, 1-5, 0-10VDC, 0-20mA, 4-20mA
K =	Solid state Form A 0.5A relay

⑦	Output 2A
C =	Open collector/switched dc
F =	Process, 0-5, 1-5, 0-10VDC, 0-20mA, 4-20mA
K =	Solid state Form A 0.5A relay

⑧	Output 2B
A =	None
C =	Open collector/switched dc
F =	Process, 0-5, 1-5, 0-10VDC, 0-20mA, 4-20mA
K =	Solid state Form A 0.5A relay

⑨	Auxiliary Retransmit Module
0 =	None
1 =	Single retransmit output 0-5, 1-5, 0-10VDC, 0-20mA, 4-20mA
2 =	Dual retransmit outputs 0-5, 1-5, 0-10VDC, 0-20mA, 4-20mA

⑩	Language and RTD Option
1 =	English with 100Ω RTD
2 =	German with 100Ω RTD
3 =	French with 100Ω RTD
4 =	Spanish with 100Ω RTD
5 =	English with 500 and 1KΩ RTD
6 =	German with 500 and 1KΩ RTD
7 =	French with 500 and 1KΩ RTD
8 =	Spanish with 500 and 1KΩ RTD

⑪ ⑫	Display and Custom Options
RG =	Standard display (Red/Green display only)
XX =	Custom options: software, setting parameters, overlay

Compatible Accessories

Operator Interface Terminals (OIT)

Silver Series EM touchscreen operator interface terminals provide a customizable user interface, email event notifications and log and graph data for Watlow controllers and other devices. A Silver Series EM operator interface terminal paired with Watlow controllers is the perfect solution for industrial processes or machine control applications. See page 365.

SpecView

SpecView is designed for industrial users and includes features such as data logging, trending and support for bar code readers and touch screens. Errors are reduced for any process by creating application-specific screens. The software provides a historical replay option, easy-to-use recipe features and remote access options, including LAN, Internet and modem. See page 385.

SERIES F4 Process

The SERIES F4 $^1/_4$ DIN temperature process controller offers performance features to meet a wide range of industrial processing needs. The F4 process controller is ideal for semiconductor manufacturing equipment, plastic processing and packaging equipment and industrial process control applications.

This controller features a four line, high definition LCD interface display, in addition to an information key that enables easy set up and control operation, minimizing the chance for error. Its 16-bit microprocessor ensures accuracy and delivers performance advantages you can count on from a Watlow controller.

Four digital inputs remotely modify controller operation or enable display of pre-defined operator messages. Advanced features include cascade, ratio, differential, duplex slide wire and retransmit options.

Serial communication and dual alarm relays are included in the base unit. The SERIES F4 is packaged with a NEMA 4X front face to withstand harsh environments and a four-inch (101.6 mm) deep case with removable connectors for wiring convenience. It is manufactured by Watlow, ISO 9001 registered and protected by a three-year warranty.

Features and Benefits

Guided set-up
- Removes "guess work" from the set-up process
- Saves time by reducing programming errors

High definition four-line LCD display
- Simplifies set up process and operations
- Quickly and easily identifies process, alarm and set point values

Information "I" Key
- Displays essential elements from the user manual on board

Customized menuing
- Quickly displays up to 16 parameters
- Allows users to create custom messaging and easily identify key events or alarms

High performance 16-bit microprocessor
- Provides precise process control with 20Hz update rate on input 1. (10Hz on inputs 2 and 3)
- Calibration accuracy of ±0.1 percent of span

Universal input
- Embedded software provides application versatility
- Eliminates the need for dip switches

Modbus® communications ready
- Equipped to handle RS232 or EIA-485 communications

SERIES F4 Process

General Purpose Control Operation

The SERIES F4 temperature process controller with a single channel PID controller supports either closed or open loop operation. The design utilizes the latest technology to meet complex processing needs while maintaining an easily understood operator interface.

Full, non-abbreviated parameter choices are displayed using a four line, high-definition LCD interface display that is back lit for wide angle viewing. Firmware guides the operator through parameter choices for feature configuration. An information key (I) provides the operator with detailed help information regarding the parameter or feature being configured. The main page menu can be programmed to display output power through 16 control variables including: bar graphs, set points and operating ranges. Up to four programmable messages can be activated remotely to inform the operator that the process requires attention.

Five sets of PID values can be auto-tuned to support varying system reactions over the complete operating range. Up to 10 offset points can programmed to compensate for differences between the actual process value and sensor readings caused by sensor placement.

Control Inputs

Up to three universal analog inputs are configured through software to support thermocouples, RTDs and process (voltage/current) sensors. Auxiliary inputs 2 and 3 can function as a remote set point input, sources for retransmission or as the outer loop for cascade operation.

Digital Inputs

Four inputs are programmable and can remotely modify controller operation and display pre-programmed messages on the operations display.

Control Outputs

Heat/cool or reverse/direct action is supported. Time based outputs can be configured for variable burst fire or a cycle time can be selected. On-off boost heat or boost cool operation is also supported. Boost operation is enabled based on load power requirements

Alarms

Two alarms are included in the base unit and can be programmed as process, deviation or rate.

Serial Communications

Both EIA-232 and EIA-485 communications are included in the base unit. The SERIES F4 operates via the Modbus® RTU protocol and responds to requests for information only when queried. Baud rate selections are 9600 or 19200.

Retransmit

Up to two optional programmable voltage or current signal retransmit outputs are supported. Retransmit sources include up to three process variables; set point and output percent power.

SERIES F4 Process

Enhanced Control Operation

An enhanced operation option for the SERIES F4 process controller includes additional universal analog inputs (inputs 2 and 3) and enhanced firmware to support several features that utilize the two additional inputs. The enhanced control option can be configured to support cascade control, (see the application diagram below), differential control, ratio control and slide wire valve control. The enhanced control option can also alternate between control inputs, display up to three process variables and support remote set point operation.

In this sample application, the SERIES F4 process controller uses the enhanced cascade control feature to heat lube oil to 51.6°C (125°F). Cascade control is a control strategy in which one control loop provides the set point for another loop. It allows the process or part temperature to be reached quickly while minimizing overshoot. Cascade is used to optimize thermal system performance with long lag times. Input 3 measures the lube oil temperature before it leaves the tank. Input 1 measures the heater temperature. The input 3 process value is compared to the set point which generates an internal set point used to control the heater.
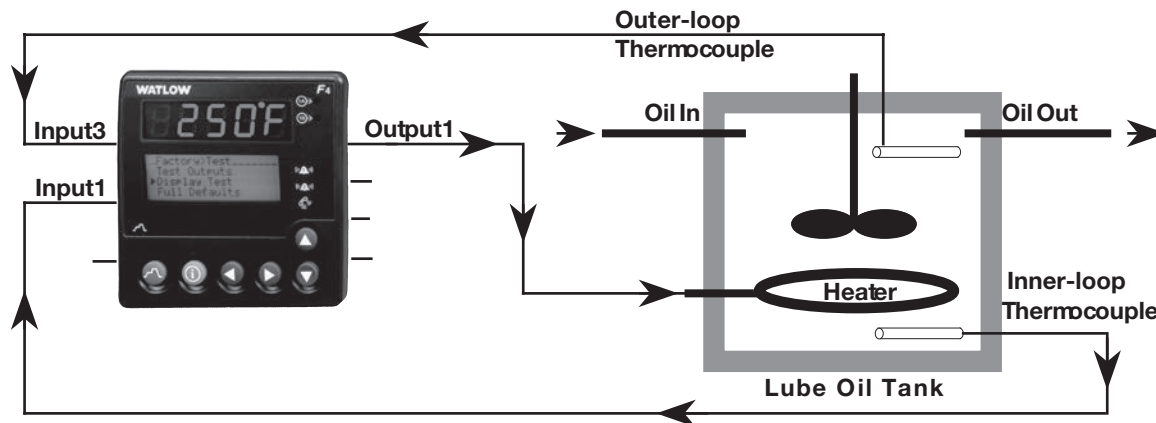
Specifications

Universal Analog Inputs 1 (2 and 3 optional)
• Update rates, IN1 = 20Hz, IN2 and IN3 = 10Hz

Thermocouple
• Type J, K, T, N, C (W5), E, Pt 2, D (W3), B, R, S

RTD
• 2- or 3-wire platinum, 100, 500, or 1KΩ
• JIS or DIN curves, 1.0 or 0.1 indication

Process
• Input resolution ≈ 50,000 bits at full scale
• Range selectable: 0-10VDC, 0-5VDC, 1-5VDC, 0-50mV, 0-20mA, 4-20mA
• Voltage input impedance 20KΩ
• Current input impedance 100Ω

Digital Inputs (4)
• Update rate = 10Hz
• Contact or dc voltage; 36VDC max
• 10KΩ input impedance

Control Outputs (1A, 1B)
• Update rate = 20Hz

Open Collector/Switched dc
• Internal load switching (nominal):
  Switched dc, 22 to 28VDC, limited @ 30mA
• External load switching max.:
  Open collector 42VDC @ 0.5A

Solid-state Relay
• Zero switched, optically coupled, 0.5A @ 24VAC min., 253VAC max.

Electromechanical Relay
• Form C, 2A @ 250VAC or 30VDC max.
• Resistive or inductive load
• Without contact suppression

Process Outputs (Optional Retransmit)
• Update rate = 1Hz
• User-selectable 0-10VDC, 0-5VDC, 1-5VDC @ 1KΩ min., 0-20mA, 4-20mA @ 800Ω max.
• Resolution:
  dc ranges = 2.5mV nominal
  mA ranges = 5µA nominal
• Calibration accuracy:
  dc ranges = ±15mV
  mA ranges = ±30µA
• Temperature stability 100ppm/°C

SERIES F4 Process

Alarm Outputs
- Output update rate 1Hz
- Electromechanical relay, Form C, 2A @ 30VDC or 240VAC max.

Communications
- EIA-232 and EIA-485 serial communications with Modbus® RTU protocol

Safety and Agency Approvals
- UL®/C-UL® 916 listed, File # E185611 Process Control Equipment
- NEMA 4X and IP65
- CE to EN 61010-1 and 61326

Terminals
- Touch-safe, removable terminal blocks, accepts 12 to 22-gauge wire

Power
- 100-240VAC, -15%, +10%; 50/60Hz, ±5%
- 39VA max. power consumption
- Data retention upon power failure via nonvolatile memory. Sensor input isolation from input to input to output to communication circuitry is 500VAC

Operating Environment
- 32 to 149°F (0 to 65°C)
- 0 to 90% RH, non-condensing
- Storage temperature: -40 to 158°F (-40 to 70°C)

Accuracy
- Calibration accuracy and sensor conformity: ±0.1% of span ±1°C @ 77°F ±5°F (25°C ±3°C) ambient, and rated line voltage ±10% with the following exceptions:
  Type T: 0.12% of span for -328 to -58°F (-200 to -50°C)
  Types R and S: 0.15% of span for 32 to 212°F (0 to 100°C)
  Type B: 0.24% of span for 1598 to 3092°F (870°C to 1700°C)
- Accuracy span: less than or equal to operating ranges, 1000°F (540°C) min.
- Temperature stability: ±0.1°F/°F (±0.1°C/°C) rise in ambient for thermocouples
- ±0.05°F/°F (±0.05°C/°C) rise in ambient for RTD sensors

Displays
- Process: 5 digit, 7 segment LED, red
- Control interface display: 4-row, 20-character high definition LCD green

Sensor Operating Ranges

Type	°F low		°F high	or	°C low		°C high
Type J:	32	to	1500°F	or	0	to	815°C
Type K:	-328	to	2500°F	or	-200	to	1370°C
Type T:	-328	to	750°F	or	-200	to	400°C
Type N:	32	to	2372°F	or	0	to	1300°C
Type E:	-328	to	1470°F	or	-200	to	800°C
Type C:	32	to	4200°F	or	0	to	2315°C
Type D:	32	to	4352°F	or	0	to	2400°C
Type Pt 2:	32	to	2543°F	or	0	to	1395°C
Type R:	32	to	3200°F	or	0	to	1760°C
Type S:	32	to	3200°F	or	0	to	1760°C
Type B:	32	to	3300°F	or	0	to	1816°C
RTD (DIN):	-328	to	1472°F	or	-200	to	800°C
RTD (JIS):	-328	to	1166°F	or	-200	to	800°C
Process:	-19,999 to 30,000 units						

Sensor Accuracy Ranges
Input ranges

Type	°F low		°F high	or	°C low		°C high
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
Type N:	32	to	2282°F	or	0	to	1250°C
Type E:	-328	to	1470°F	or	-200	to	800°C
Type C(W5):	32	to	4200°F	or	0	to	2315°C
Type D(W3):	32	to	4352°F	or	0	to	2400°C
Type Pt 2:	32	to	2540°F	or	0	to	1393°C
Type R:	32	to	2642°F	or	0	to	1450°C
Type S:	32	to	2642°F	or	0	to	1450°C
Type B:	1598	to	3092°F	or	870	to	1700°C
RTD (DIN):	-328	to	1472°F	or	-200	to	800°C
RTD (JIS):	-328	to	1166°F	or	-200	to	630°C
Process:	-19,999 to 30,000 units						

WATLOW

SERIES F4 Process

Ordering Information

Part Number

① ②	③ Temperature /Process Controller	④ Power Supply	⑤ Output 1A	⑥ Output 1B	⑦	⑧ Enhanced Control Operation	⑨ Auxiliary Retransmit Module	⑩ Language and RTD Options	⑪ ⑫ Display and Custom Options
F4	P		-		A		-		

③	Temperature/Process Controller
P =	Single channel temperature/process controller, two alarms, EIA-232/485 comms. four event inputs

④	Power Supply
H =	100-240VAC/VDC

⑤	Output 1A
C =	Open collector/switched dc
E =	Electromechanical relay, Form C 2A without contact suppression
K =	Solid state Form A 0.5A relay without contact suppression
F =	Process, 0-5, 1-5, 0-10VDC, 0-20mA, 4-20mA

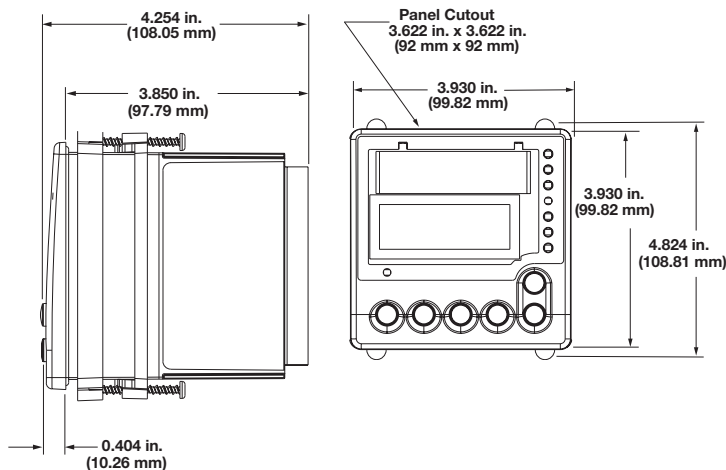| ⑥	Output 1B
A =	None
E =	Electromechanical relay, Form C 2A without contact suppression
C =	Open collector/switched dc
K =	Solid state Form A 0.5A relay without contact suppression
F =	Process, 0-5, 1-5, 0-10VDC, 0-20mA, 4-20mA

⑧	Enhanced Control Operation
A =	Standard control operation
B =	Enhanced control operation, dual universal inputs, cascade, ratio, duplex, differential, slidewire

⑨	Auxiliary Retransmit Module
0 =	None
1 =	Single retransmit output 0-5, 1-5, 0-10VDC, 0-20mA, 4-20mA
2 =	Dual retransmit outputs 0-5, 1-5, 0-10VDC, 0-20mA, 4-20mA

⑩	Language and RTD Option
1 =	English with 100Ω RTD
2 =	German with 100Ω RTD
3 =	French with 100Ω RTD
4 =	Spanish with 100Ω RTD
5 =	English with 500 and 1KΩ RTD
6 =	German with 500 and 1KΩ RTD
7 =	French with 500 and 1KΩ RTD
8 =	Spanish with 500 and 1KΩ RTD

⑪ ⑫	Display and Custom Options
RG =	Red/Green display
XX =	Custom options: software, setting parameters, overlay

Dimensional Drawings

4.254 in. (108.05 mm)

3.850 in. (97.79 mm)

0.404 in. (10.26 mm)

Panel Cutout 3.622 in. x 3.622 in. (92 mm x 92 mm)

3.930 in. (99.82 mm)

3.930 in. (99.82 mm)

4.824 in. (108.81 mm)

Dimension Specifications
- Width x height x depth
  3.93 in. x 3.93 in. x 3.85 in. panel mount
  (99 mm x 99 mm x 97 mm)

Compatible Accessories

Operator Interface Terminals (OIT)

Silver Series EM touchscreen operator interface terminals provide a customizable user interface, email event notifications and log and graph data for Watlow controllers and other devices. A Silver Series EM operator interface terminal paired with Watlow controllers is the perfect solution for industrial processes or machine control applications.
See page 365.

EZ-ZONE PM

The EZ-ZONE PM panel mount controller offers control options that reduce system complexity and thermal loop ownership cost. It can be ordered as a PID controller, an over/under limit controller or its functions can be combined into an integrated controller. An option to integrate a high amperage power controller output with a high-performance PID controller and an over/under limit controller in one space-saving, panel mount package is also available. Many communications options are offered to support connectivity needs.

Because the EZ-ZONE PM controller is highly scalable, pay only for what is needed. This controller is available in $1/32$, $1/16$, $1/8$ and $1/4$ DIN panel mount packages. The EZ-ZONE PM controller is easy to use and is ideal for PID, over/under limit or integrated controller needs.

Features and Benefits

Integrated PID and limit controller
- Reduces wiring time and termination complexity compared with connecting discrete products
- Decreases required panel space
- Lowers installation costs
- Increases user and equipment safety for over/under temperature conditions

High amperage power control output
- Drives 15 ampere resistive loads directly
- Reduces component count
- Decreases cost of ownership

Current monitoring
- Detects heater current flow and provides alarm indication of a failed output device or heater load

Serial communication capabilities
- Provides a wide range of protocol choices including Modbus® RTU, EtherNet/IP™, Modbus® TCP, PROFIBUS DP and DeviceNet™
- Supports network connectivity to a PC or PLC

Dual-channel controller
- Provides two PID controllers in one space-saving package

Enhanced control options
- Easily handles complex process problems such as cascade, ratio, differential, square-root, motorized valve control without slidewire feedback, wet-bulb/dry-bulb, compressor control and peltier loads

Advanced PID control algorithm
- Offers TRU-TUNE®+ adaptive control to provide tighter control for demanding applications
- Provides auto-tune for fast, efficient startup

Configuration communications with software
- Includes Watlow standard bus communications and EZ-ZONE configurator software
- Saves time and improves reliability of controller setup

Ten-point linearization curve
- Improves sensor accuracy

For detailed product and ordering information, see the full EZ-ZONE PM product section located on pages 249 through 257.

EZ-ZONE PM Express

The EZ-ZONE PM Express panel mount controller is an industry-leading PID controller that allows optimal performance utilizing simple control and menu functionality without complex features. It is ideal for basic applications and usage levels.

The EZ-ZONE PM Express is the next generation controller to follow the legacy of Watlow's SERIES 93, SERIES 935 AND SERIES SD controllers that offer easy-to-use features to perform many basic applications. The EZ-ZONE PM Express includes one universal input and an option for up to two outputs and is available in $1/32$, $1/16$, $1/8$ and $1/4$ DIN panel mount packages. It can be ordered as a PID process controller or as a dedicated over and under-temperature limit controller.

The EZ-ZONE PM Express is a valuable addition to the EZ-ZONE PM controller family which also includes the EZ-ZONE PM integrated controller and the EZ-ZONE PM standard version.

Features and Benefits

Simplified menu
- Fits basic applications with a user-friendly interface supported by two menus and a streamlined list of parameters
- Eliminates complexity often experienced with more advanced controllers and unnecessary features
- Reduces training costs and user programming errors

PID auto-tune
- Provides auto-tune for fast, efficient startup

Standard bus communications
- Allows easy product configuration via PC communications protocol and free software
- Saves time, simplifies programming process and improves reliability of controller setup

Factory Mutual (FM) approved over and under limit with auxiliary outputs
- Increases user and equipment safety for over and under-temperature conditions

Agency approvals: UL® listed, CSA, CE, RoHS, W.E.E.E., FM, SEMI F47-0200, Class 1, Div. 2 rating on selected models
- Assures prompt product acceptance
- Reduces end product documentation costs

Front panel removable
- Saves time and labor for replacements and troubleshooting

P3T armor sealing system
- Complies with NEMA 4X, IP65 specifications
- Allows controller to be cleaned and washed
- Certified UL® 50 independent to NEMA 4X specification

Touch-safe package
- Increases installer and operator safety
- Complies with IP2X requirements

Consistent Termination Labeling (CTL) connection system
- Simplifies switching between products
- Speeds up user's system documentation

Three-year warranty
- Demonstrates Watlow's reliability and product support

High-amperage power control output
- Drives 15 ampere resistive loads direct
- Reduces component count
- Saves panel space and simplifies wiring
- Reduces cost of ownership

For detailed product and ordering information, see the full EZ-ZONE PM Express product section located on pages 258 through 261.

SERIES CV

Watlow's family of microprocessor-based temperature controllers offers an economical solution for applications that require simple, on/off control. Controllers are available in a broad range of packaging options, allowing selection of the best version for a specific application. They are available with an operator interface and can be ordered in a $^1/_8$ DIN square panel mount or DIN-rail mount configuration.

The SERIES CV temperature controller incorporates a microprocessor design that delivers the repeatability, accuracy and performance advantages you can count on from Watlow's basic temperature controllers.

The SERIES CV controller includes an operator interface for viewing and set point selection. A red, four-character, seven segment LED displays the set point to show process options. The set point selection is made with a continuous turn, rotary encoder. Operating range temperature values are user definable as specified in the product configuration part number.

SERIES CV controllers are UL® and C-UL® listed and carry CSA and CE approvals. Watlow's temperature controllers include industry-leading service and support and are protected by a three-year warranty.

Features and Benefits

Adjustable set points
• Offers control flexibility

Four character LED display
• Improves set point selection accuracy

Multiple mounting options
• Minimizes installation time

Heat or cool operation
• Provides application flexibility

Fahrenheit or Celsius operation with indication
• Offers application flexibility

Agency approvals
• Meets certification requirements/compliance

Microprocessor based technology
• Ensures accurate repeatable control

Temperature and Process

SERIES CV

Specifications

On-Off Controller
- Microprocessor based, on-off control mode
- Nominal switching hysteresis, typically 3°F (1.7°C)
- 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 indicator LED
- Continuous turn, velocity sensitive rotary encoder for
  set point adjustment
- Front panel key push for set point or push for show
  process options

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 or T thermocouple
- >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	(-200 to 800°C)
Type J:	32 to 1382°F	(0 to 750°C)
Type K:	-328 to 2282°F	(-200 to 1250°C)
Type T:	-328 to 662°F	(-200 to 350°C)
RTD (DIN)	-328 to 1472°F	(-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 -328 to 32°F (-200 to 0°C)
- 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:	-328 to 1470°F	(-200 to 800°C)
Type J:	-346 to 1900°F	(-210 to 1038°C)
Type K:	-454 to 2500°F	(-270 to 1370°C)
Type T:	-454 to 750°F	(-270 to 400°C)
RTD (DIN)	-328 to 1472°F	(-200 to 800°C)

Output Types
Switched dc (non-isolated)
- 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

Agency Approvals
- UL® 60730-1 Recognized Temperature Controller and
  Indicator on potted models
- UL® 50 IP65 - tactile key models
- UL® 197 Reviewed for Use in Cooking Appliances
- UL® 873
- ANSI Z21.23 Gas Appliance Thermostat Approval
- Temperature Control and Indicator CSA 22.2 No. 24

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%
- 120VAC +10%; -15%; 50/60Hz, ±5%
- 230 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
DIN-rail	3.08 in. (78.1 mm)	4.42 in. (112.3 mm)	3.57 in. (90.7 mm)
Square ⅛ DIN-panel	2.85 in. (72.4 mm)	2.85 in. (72.4 mm)	Behind panel 2.04 in. (51.7 mm)

SERIES CV

Ordering Information

- **On-off controller, rotary set point adjustment, four character, seven segment display**

Part Number

① ②	③ Power Supply	④ Package	⑤ Sensor Type and Scale	⑥ Control Type	⑦⑧⑨⑩ Low Set Point	⑪⑫⑬⑭ High Set Point	⑮ Overlay/Customs 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 square 1/8 DIN - spade terminals
2 =	DIN-rail mount - spade terminals
5 =	Panel mount square 1/8 DIN - 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 Fahrenheit (-346 to 1900°F)
J =	T/C Type J Celsius (-210 to 1038°C)
K =	T/C Type K Fahrenheit (-454 to 2500°F)
L =	T/C Type K Fahrenheit (-270 to 1370°F)
M =	T/C Type T Fahrenheit (-454 to 750°F)
N =	T/C Type T Fahrenheit (-270 to 400°F)
P =	RTD Fahrenheit (-328 to 1472°F)
R =	RTD Celsius (-200 to 800°C)
S =	T/C Type E Fahrenheit (-328 to 1470°F)
T =	T/C Type E Celsius (-200 to 800°C)

⑥	Control Type
H =	Heat
C =	Cool

⑦⑧⑨⑩	Low Set Point Operating Range Value
Note: A (-) is used in the left most digit of the set point operating ranges to indicate a negative temperature value.	

⑪⑫⑬⑭	High Set Point Operating Range Value
Note: 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

WATLOW

SERIES CF

Watlow's family of microprocessor-based temperature controllers offers an economical solution for applications that require simple, on-off control. Controllers are available in a broad range of packaging options, allowing selection of the best version for a specific application. They are available with or without an indicating display and can be ordered in a $^1/_8$ DIN square panel mount, DIN-rail mount or open board design configuration.

The SERIES CF temperature controller incorporates a microprocessor design that delivers the repeatability, accuracy and performance advantages you can count on from Watlow's basic temperature controllers. Fixed set points are available and an indicating display is an option. Operating set point temperature values can be specified in the product configuration part number.

SERIES CF controllers are UL® and C-UL® listed and carry CSA and CE approvals. Watlow's temperature controllers include industry-leading service and support and are protected by a three-year warranty.

Features and Benefits

Fixed set points
• Provides tamper-proof operation

Multiple mounting options
• Minimizes installation time

Heat or cool operation
• Provides application flexibility

Fahrenheit or Celsius operation with indication
• Offers application flexibility

Agency approvals
• Meets certification requirements/compliance

Microprocessor based technology
• Ensures accurate repeatable control

SERIES CF

Specifications

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

Operator Interface
- 4-digit, 7-segment LED displays, 0.28 in. (7 mm) high non-condensing, 15-minute warm-up
- °F or °C indicator LED

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 or T thermocouple
- >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	(-200 to 800°C)
Type J:	32 to 1382°F	(0 to 750°C)
Type K:	-328 to 2282°F	(-200 to 1250°C)
Type T:	-328 to 662°F	(-200 to 350°C)
RTD (DIN)	-328 to 1472°F	(-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 -328 to 32°F (-200 to 0°C)
- 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:	-328 to 1470°F	(-200 to 800°C)
Type J:	-346 to 1900°F	(-210 to 1038°C)
Type K:	-454 to 2500°F	(-270 to 1370°C)
Type T:	-454 to 750°F	(-270 to 400°C)
RTD (DIN)	-328 to 1472°F	(-200 to 800°C)

Output Types
Switched dc (non-isolated)
- 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

Agency Approvals
- UL® 60730-1 Recognized Temperature Controller and Indicator on potted models
- UL® 197 Reviewed for Use in Cooking Appliances
- UL® 873
- ANSI Z21.23 Gas Appliance Thermostat Approval
- Temperature Control and Indicator CSA 22.2 No. 24

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%
- 120VAC +10%; -15%; 50/60Hz, ±5%
- 230 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 ⅛ DIN-panel	2.85 in. (72.4 mm)	2.85 in. (72.4 mm)	Behind panel 2.04 in. (51.7 mm)

SERIES CF

Ordering Information

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

Part Number

① ②	③ Power Supply	④ Package	⑤ Sensor Type and Scale	⑥ Control Type	⑦⑧⑨⑩ Fixed Set Point Temp. Value	⑪⑫⑬⑭	⑮ Overlay/ Customs Options
CF						AAAA	

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 square ⅛ DIN - spade terminals
2 =	DIN-rail mount - spade terminals
3 =	Open board, non potted - spade terminals
4 =	Potted case - spade terminals
5 =	Panel mount square ⅛ DIN - 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 Fahrenheit (-346 to 1900°F)
J =	T/C Type J Celsius (-210 to 1038°C)
K =	T/C Type K Fahrenheit (-454 to 2500°F)
L =	T/C Type K Celsius (-270 to 1370°F)
M =	T/C Type T Fahrenheit (-454 to 750°F)
N =	T/C Type T Celsius (-270 to 400°F)
P =	RTD Fahrenheit (-328 to 1472°F)
R =	RTD Celsius (-200 to 800°C)
S =	T/C Type E Fahrenheit (-328 to 1470°F)
T =	T/C Type E Celsius (-200 to 800°C)

⑥	Control Type
H =	Heat
C =	Cool

⑦⑧⑨⑩	Fixed Set Point Temperature Value
Note: 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

SERIES EHG® SL10

The SERIES EHG® SL10 integrated, multi-function controller is a key component to a powerful system that includes a heater, an adjustable set point temperature controller, a high/low temperature alert, a power switching device and a high temperature safety limit. Its agency recognized controller/safety limit meets UL® 1998 and CE 60730 requirements.

An optional display/communications module can be easily added in the field to provide a digital display indication, an adjustment of set point, RS485 Modbus® communications and other Human Machine Interface (HMI) features. As a scalable system, only what is needed can be purchased.

The EHG SL10 controllers' easy to install, compact design, inherent reliability and integrated limit functions offer unmatched value. It is designed for easy integration with Watlow heaters to simplify engineering, reduce component count for new equipment and decrease ownership cost. For original equipment manufacturers, (OEMs), the EHG SL10 controller's CE, Semi-S2 compliance and UL® recognition reduces time and costs associated with global agency testing and validation. U.S. Patent Number 8,044,329.

Features and Benefits

Extended temperature range -0.4 to 999°F (-18 to 537°C)
- Ideal for demanding environments

Process controller and safety limit in one package
- Meets UL® 1998 and CE 60730 requirements
- Eliminates the need for a thermal fuse on a heater
- Eliminates replacement of heater when fuse fails

**Optional display/communications module**
- Allows easy upgrade on to base device
- Offers low cost field upgrade
- Provides easy, snap-on installation

Accurate and flexible temperature process controller
- Replaces problematic bi-metal thermostats with accurate electronic temperature process controller
- Allows easy change of process parameters

Extended set point/process range
- Supports broader applications
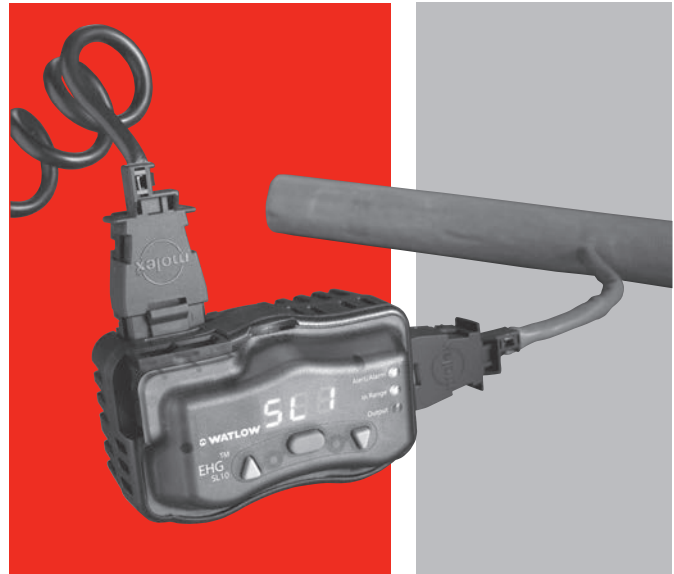
Ambient operating temperature range 32 to 158°F (0 to 70°C)
- Increases reliability when mounting in harsh temperature environments or in close proximity to heaters

Integrated high/low temperature alert signal relay
- Provides dry contact output to activate external alarm or process function
- Signals control status with three integrated LEDs
- Allows a signal of up to two amperes 30VAC/VDC, Form A to alert if process temperature is out of range limits

Health check diagnostics
- Monitors maximum heater process temperature, maximum ambient temperature and thermocouple operation
- Provides health check signal to inform operator that the process is working correctly

Universal power supply
- Allows an input of 85 to 264VAC, 50/60Hz
- Provides safe control of up to 2400 watts with 10 amperes switching in both controller and safety limit

Can be switched from on-off and PID algorithm
- Increases product life (on-off control is default)
- Offers selectable PID control algorithm for tighter temperature uniformity

SERIES EHG

Many applications requiring a fixed temperature set point rely on a mechanical thermostat for thermal control. Thermostats have proven, however, to be inadequate for many applications due to long-term reliability issues, such as 100,000 cycle rating and poor temperature control.

The SERIES EHG thermal solution includes a compact temperature control, thermocouple sensor and power switching device integrated into the heater's power cord. The SERIES EHG reduces system costs and lasts substantially longer than a conventional thermostat solution.

The evolution of miniature microprocessor technology and Watlow switching technology fostered development of a small, versatile temperature control and thermocouple sensor that is integrated with Watlow silicone rubber heater products. This device senses the temperature via input from a thermocouple strategically placed on the heater mat. The microprocessor is programmed prior to shipment with an application specific set point. This results in quick delivery of a custom, integrated system.

The small thermocouple mass provides superior response to changes in process temperature enabling higher watt density silicone rubber heater designs. These features offer an integrated custom set point temperature controller with superior life span, faster heat-up rates and improved accuracy. The SERIES EHG System has been tested to over four million cycles at rated amperage. Depending on the application, Watlow's power switching design can last up to 40 times longer than a conventional thermostat.
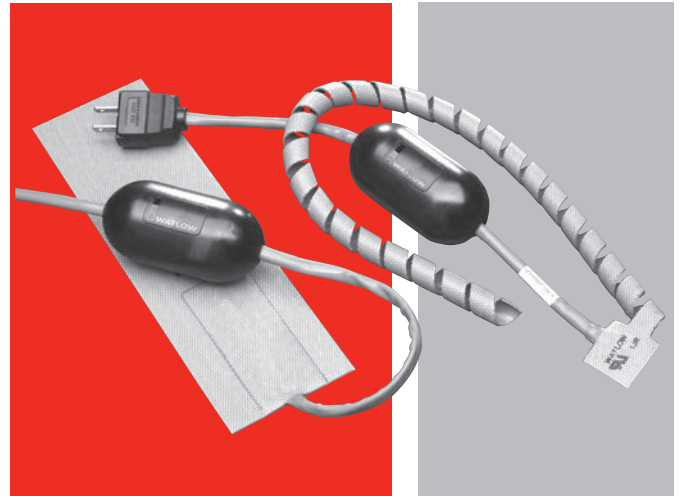
Features and Benefits

Long operational life
- Improves system reliability

Tight temperature control
- Ensures process accuracy

Small sensor footprint
- Fits with almost any heater
- Responds quickly to temperature changes
- Controls high watt densities in low mass applications

Reduced system cost
- A single EHG control can be configured with multiple heaters

Pre-wired, in line control
- Simplifies installation
- Two wire power connection

Durable housing with built-in strain relief
- Protects electronics
- Low risk of mechanical damage

Manufactured with proven Watlow components
- Assures reliable system performance