EZ-ZONE RMT Controller

Rail Mount TC Heater Engine Temperature with Integrated Safety Limit Controller

User's Guide

Powered by Possibility

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TOTAL CUSTOMER SATISFACTION 3 Year Warranty

ISO 9001 Registered Company Winona, Minnesota USA

Document 10-50621 Rev –

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February 2024

Technical Assistance

If you encounter a problem with your Watlow® controller, review your configuration information to verify that your selections are consistent with your application: inputs, outputs, alarms, limits, etc. If the problem persists, you can get technical assistance from your local Watlow representative "How to Reach Us" on page 15, by e-mailing your questions to wintechsupport@watlow.com or by dialing +1 (507) 494-5656 between 7 a.m. and 5 p.m. Central Time USA & Canada. Ask for an Applications Engineer. Please have the complete model number available when calling.

Return Material Authorization (RMA)

1. If you purchased the Watlow product you wish to return from a distributor or as part of a larger assembly from a third party, please contact that company for repair service. If you purchased the product directly from Watlow please go to www.watlow.com/rma to start the RMA process. Watlow Customer Service will then respond back with the RMA number via an email.
2. Goods returned for credit must comply with Watlow's standard terms, found at www.watlow.com/terms.
3. A return merchandise authorization (RMA) number issued by Watlow is required when returning any product for credit, repair or evaluation. Make sure the RMA number is on the outside of the carton and on all paperwork returned. Ship on a Freight Prepaid basis.
4. After we receive your return, we will examine it to verify the reason for the failure. Unless otherwise agreed to in writing, Watlow's standard warranty provisions, found at www.watlow.com/terms, apply to any failed product.
5. In the event that the product is not subject to an applicable warranty, we will quote repair costs to you and request a purchase order from you prior to proceeding with the repair work.
6. Watlow reserves the right to charge for no trouble found (NTF) returns.

Warranty

The Watlow EZ-ZONE RMT controller is warranted by Watlow in accordance with the terms and conditions set forth on Watlow's website at www.watlow.com/terms.

Trademarks

Watlow® is a registered trademark of Watlow Electric and Manufacturing Company.
STREAMLINE™ is a trademark of Watlow Electric and Manufacturing Company.
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Molex® is a registered trademark of Molex, LLC.
UL® is a registered trademarks of Underwriter's Laboratories, Inc.

TC

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1 Safety Information

Safety Information

We use Note, Caution and Warning symbols throughout this book to draw your attention to important operational and safety information.

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

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

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

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

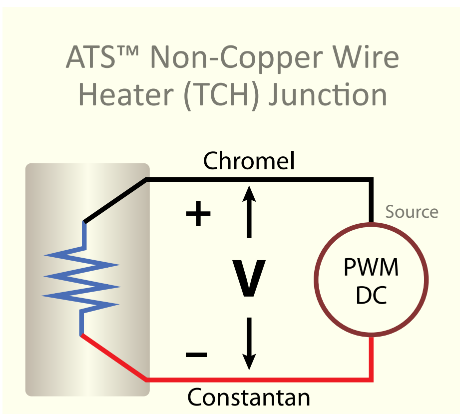
Symbol	Explanation
"NOTE"	An important detail or recommendation
	The safety alert symbol, (an exclamation point in a triangle) precedes a CAUTION or WARNING statement. A "CAUTION" safety alert is important for protecting your equipment and performance. A "WARNING" safety alert is important for protecting you, others and equipment from damage.
	Electrical Shock Hazard - Symbol (a lightning bolt in a triangle) precedes an electric shock hazard CAUTION or WARNING safety statement.
	ESD Sensitive product, use proper grounding and handling techniques when installing or servicing product.
	Do not throw in trash, use proper recycling techniques or consult manufacturer for proper disposal.
UL LISTED PROGRAMMABLE SAFETY CONTROLLER E502994	Unit is a Listed Device per Underwriters Laboratories. For more detail search for File E502994 on www.ul.com.
CE	Low Voltage (Safety) Directive. Unit passes industrial immunity levels for EMC, but additional filtering is required to pass radiated and conducted emissions. RMT is not currently CE approved.

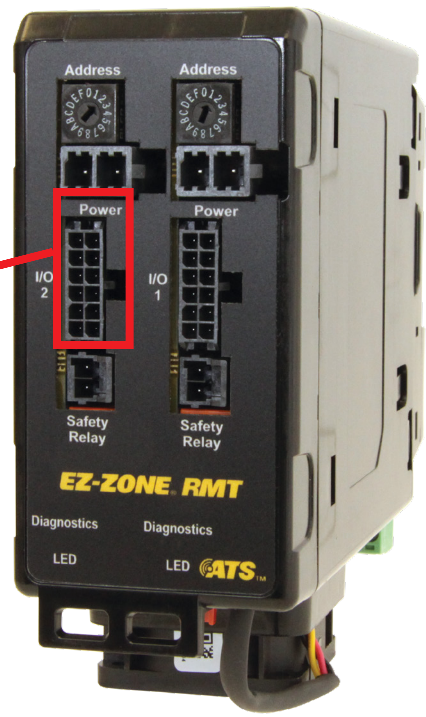
2 Overview

Overview

The RMT controller is a temperature controller with an integrated safety limit. The RMT controller must be used with Watlow STREAMLINE™ heaters. The RMT controller used in conjunction with the Watlow specific heater creates a thermal system. The thermal system allows for control of each zone, whereby the RMT controller offers up to 12 zones per module. Each zone offers both input and output circuitry. In addition, the RMT controller offers a built in certified safety limit (relay output). The safety relay is a mechanical relay that shall latch open (fail safe condition) upon an unsafe condition. A manual reset (power cycle) is required to reset the safety relay. Note: Clearing the safety can also be performed in software if user is connected to the RMT.

The safety relay shall be incorporated in series with a mechanical contactor (not provided by Watlow). The mechanical contactor shall be wired in accordance with the application's safety requirements.





Theory of Operation

The RMT controller supplies power to heaters through TC wires that also perform temperature and resistance checks while also monitoring power.
The RMT controller functions to maximize control while minimizing wiring. This is accomplished by utilizing power over thermal wiring to product specific heaters for monitor and control.

Description of Sensor Inputs

The RMT inputs are compatible with heaters that have been designed to work in conjunction with the RMT controller. Each heater is designed with thermocouple alloy wire connected to the heater element that is then connected to the RMT controller input connector(s). Only the positive and negative wires of the thermocouple wires are terminated at the RMT controller connectors. Both temperature measurement and power delivery are delivered through a single pair of thermocouple wires.

Description of Power to Heater Outputs

Each RMT controller output is composed of a solid-state switch capable of a maximum of 0.75 Ampere. The solid-state switch (output) delivers power to a heater that is connected via thermocouple alloy wires. Power is delivered to the RMT in the form of AC voltage. The voltage is adjustable (power conversion) based upon the process variables required (set point and load). The output turns off momentarily to measure the temperature of the heater (TC measurement created via a TC junction made in conjunction with the heater element). In addition, each RMT controller input is wired in series with a safety relay that will interrupt power to the output upon multiple safety directives determined by ISO 13849 (Category 2 and performance Level C). Some of which are listed below.

Safe Use Requirements

Each of the items listed in the table below must be reviewed for safe and proper operation.

Table 1:

Potential Failure Mode	Detectable	Potential Effect(s) of Failure	Potential Causes(s) / Mechanism(s) of Failure
Wrong sensor input type	No	Heater over temp	Incorrect configuration or heater
Reversed sensor wires	Yes	Heater over temp	Wrong heater construction
Heater connected without thermocouple alloy (constructed with copper wire)	No	Heater over temp	Wrong heater construction
Length of sensor wire from heater to controller	No	Resistance limit erroneously trips	Additional resistance from lead wire.
Shorted heater (large resistance change)	Yes	Hot spot in heater	Internal element short
Shorted heater (small resistance change)	No	Hot spot in heater	Internal element short
Shorted heater to pipe (earth ground)	No	Heater over temp caused by incorrect sensor values	Grounded mounting screw piercing heater
Shorted heater to AC supply	No	Heater over temp caused by incorrect sensor values	None identified
Shorted thermocouple lead wires	Yes	Sensor measurement incorrect	Lead wires short
Migrate controller from one system to another system	No	Over temp condition	Incorrect heater setup could cause over temp condition
Mismatched controller to heater(s)	No	Setpoint too high for heater type	Setpoint too high for heater type
Open heater	Yes	No heat	Failed heater
Open thermocouple	Yes	Same as open heater	Failed thermocouple connection
Compromised signal to the safety relay coil	Yes	Over temp - can't turn heater power off in a failure state	Trace failure
Welded contacts on safety relay	Yes	Over temp - can't turn heater power off in a failure state	Component failure
Over voltage of supply to heater	Yes	Heater over temp	User applies incorrect voltage. Hardware failure
User enters incorrect thermal offset parameters (dynamic offset)	No	Heater over temp	User enters incorrect thermal offset parameters
User enters incorrect temperature limit	No	Heater over temp	Correct temperature limit not entered correctly.

Potential Failure Mode	Detectable	Potential Effect(s) of Failure	Potential Causes(s) / Mechanism(s) of Failure
User enters incorrect resistance limits	No	Heater over temp	Correct temperature limit not entered correctly.
Calibration is incorrect	No	Heater over temp	Correct calibration
Excessive calibration drift	Yes	Heater over temp	Hardware failure
Interlock contactor not connect-ed.	No	Heater over temp	Interlock contactor not connected.
Heater/sensor over temperature	Yes	Heater over temp	Failed hardware

Description and importance of each item from the table above:

⚠ **Wrong sensor input type -** Matching the controller's thermocouple input type to the heater's thermocouple alloy(s) is required for safe and proper operation. The menu operation for the controller is parameter "Input Type" identified within the controllers' operation menu or via dashboard and the thermocouple alloy of the heater is identified by the model number.

⚠ **Reversed Sensor Wires -** Should the heater decrease in temperature upon power up (output "On"), the heater is incorrectly constructed (the sensor wires are reversed internally to the heater) and the heater must be removed from the system and replaced with a new properly constructed heater.

⚠ H**eater constructed without thermocouple alloy (heater constructed with copper wire) -** Only heaters that are constructed with thermocouple alloy can be connected to the RMT controller and must be matched to the input type of the RMT controller. Any heater that is not constructed from thermocouple alloy may result in serious damage to thermal system and connected component/equipment and associated facilities and personnel.

⚠ **Length of sensor wire from heater to controller too long -** Each heater has been programmed to its' mating controller and should function under normal conditions. If the resistance error trips, it may be due to excessive lead wire length from the controller to the heater. Extra wire length should not be added to the wire harness that was shipped with the heater assembly.

⚠ **Large resistance changes in heater -** Heater parameters (resistance tolerances) should already be entered into the RMT controller. Should the resistance change significantly, a hot spot within the heater may occur. The RMT controller will detect a significant change and open the safety shutdown relay.

⚠ **Shorted heater to pipe (earth ground) -** An introduction of earth ground to the heater circuit (by way of an inadvertent short) will result in incorrect temperature measurement and thermal runaway. To assure a safe system, a standard ELCI (Electronic Leakage Circuit Interrupter) should be incorporated in series with the load.

⚠ **Shorted heater to AC voltage supply -** An introduction of AC voltage to the heater circuit by way of an inadvertent short will result in incorrect temperature measurement and thermal runaway. This condition is not detectable by the RMT controller

⚠ **Shorted thermocouple lead wires -** Should the thermocouple lead wires short, the RMT controller will recognize this as a change in resistance and will result in an Safety Shutdown Relay open relay condition.

⚠ **Migrate a controller from one system to another system -** Removing an RMT controller from one system and placing it into another system may result in unsafe and incorrect operation of the thermal system. Reviewing controller parameters to be certain the thermal system will operate safely is required. Otherwise, only factory configured (programmed specifically for the application requiring the replacement) RMT modules should be used in replacement of another RMT module.

⚠ **Mismatched controller to heater -** Only thermocouple alloy heaters may be used with the RMT controller. The thermocouple alloy must be matched to the input type of the RMT controller. In addition, all process set point values of the RMT controllers must be reviewed by the user to be certain the heater that is connected to the RMT controller has been constructed to operate at the process set point of the RMT controller.

Open Heater - If a heater opens, the RMT controller recognizes this as a large change in resistance and the safety shutdown relay opens.

Open Thermocouple - If a thermocouple circuit opens, the RMT controller recognizes this as a large change in resistance and the safety shutdown relay opens.

Compromised signal to the safety relay coil (within the RMT controller) - If the heater enters into a thermal run-away condition and the secondary system (safety loop) does not result in an "Off" condition of the output, the safety algorithm shuts off the primary output device.

Welded contacts on safety relay (within the RMT controller) - If the heater enters into a thermal run-away condition and the secondary system (safety loop) does not result in an "Off" condition of the output, the safety algorithm shuts off the primary output device.

Over voltage of supply to heater - The RMT controller has voltage input specifications (refer to Specifications section of this User's Manual.) Voltage applied to the control that exceeds the specified value will result in damaged hardware and the controller must be replaced.

User enters incorrect temperature limit - The RMT controller has multiple user-settable parameters; the user must set appropriate limits (temperature, voltage and resistance). If the temperature limit is set beyond the heater design, over-temperature conditions may occur.

User enters incorrect resistance limit - The RMT controller has multiple user-settable parameters. The user must set appropriate limits (temperature, voltage and resistance). If the resistance limit is set incorrectly compared to the heater design, over temperature conditions may occur.

Calibration is incorrect - Every RMT controller has been calibrated by a NIST traceable calibration system and process. Calibration values are stored in non-volatile memory and will not be interrupted under normal and specified operation. Should an event occur that causes corruption to the calibration data within the RMT controller, the process temperature may migrate to a thermal runaway condition. Thermal process should be audited from time to time to insure proper operation associated with temperature control. Wiring and Set Up

3 Wiring and Set Up

Wiring

Apply 24-28 Vac/dc to terminals 98 (V+) and 99 (V-) of the “C” connector.

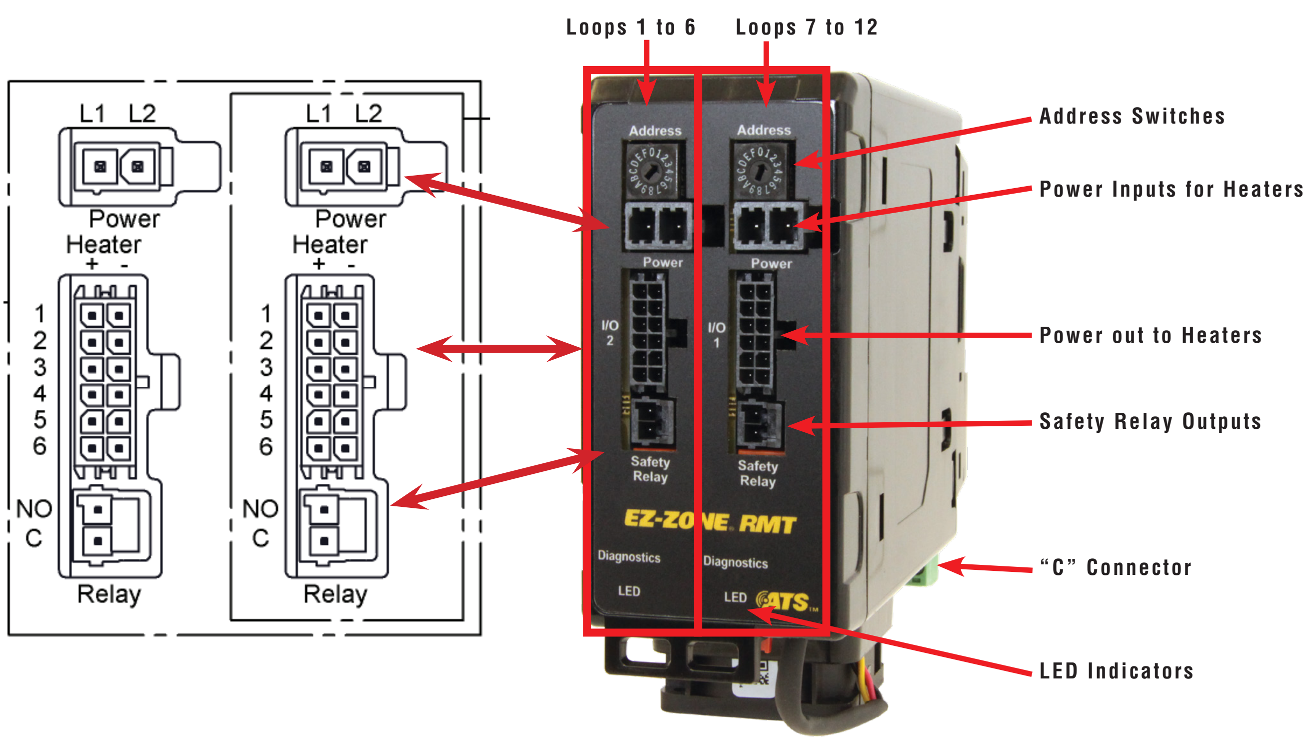
RMT load power 200-240 Vac 10% mating connector - Use 171692-0102 connector, Molex® 76823-0321 14 AWG pins.

Connect heater connectors to mating connectors of the RMT module using heater connector Molex® 43025 (1200 or 1208), with Molex® 43030 series pins.

Connect the safety relay output to system contactor that is responsible for interrupting power to the entire system or whatever mechanism is deemed as a safe environment. This will eliminate the opportunity for current flow that may result in risk of electrical hazard such as shock or fire. Mating connector - Use Molex® 172256-1002, with Molex® 172253 family of pins with Molex® 1722643002 strain relief.

Power and Communications

Slot C	Terminal Function
98	Power input: ac or dc+
99	Power input: ac or dc-
CF	No connection
CD	No connection
CE	No connection
CZ	Inter-module bus
CX	Inter-module bus
CY	Inter-module bus



LED

There is a bi-colored LED on the front of the RMT controller. A full “On” green LED is normal operating condition. Blinking green for code update and a solid red LED indicates a safety condition.

RMT Safety Limit

This feature is available on every RMT PCBA. The safety limit output is a mechanical relay. The relay ratings are as follows:

- 2 Amps resistive 24 – 240 VAC or 30 VDC
- 125 VA Pilot Duty 120/240 VAC, 25 VAC at 24 VAC.

  The Safety Relay is intended to be wired in series with the coil of a system level contactor that interrupts the thermal system in a safe way. An error code is available via communications, user intervention is required to clear the latched limit status.

Product Compatibility

- EZ-ZONE RMA PLUS
- EZ-ZONE RM (C, E, H, L, S) version 9.0+
- RM (F, G, UH, Z)
- POWERGLIDE

Software Compatibility

Ethernet and USB available when used with EZ-ZONE RMA PLUS.

Software	USB	Ethernet
Dashboard	X	X
LabVIEW	X	X
Watbus DLL	X	X

Firmware Updates

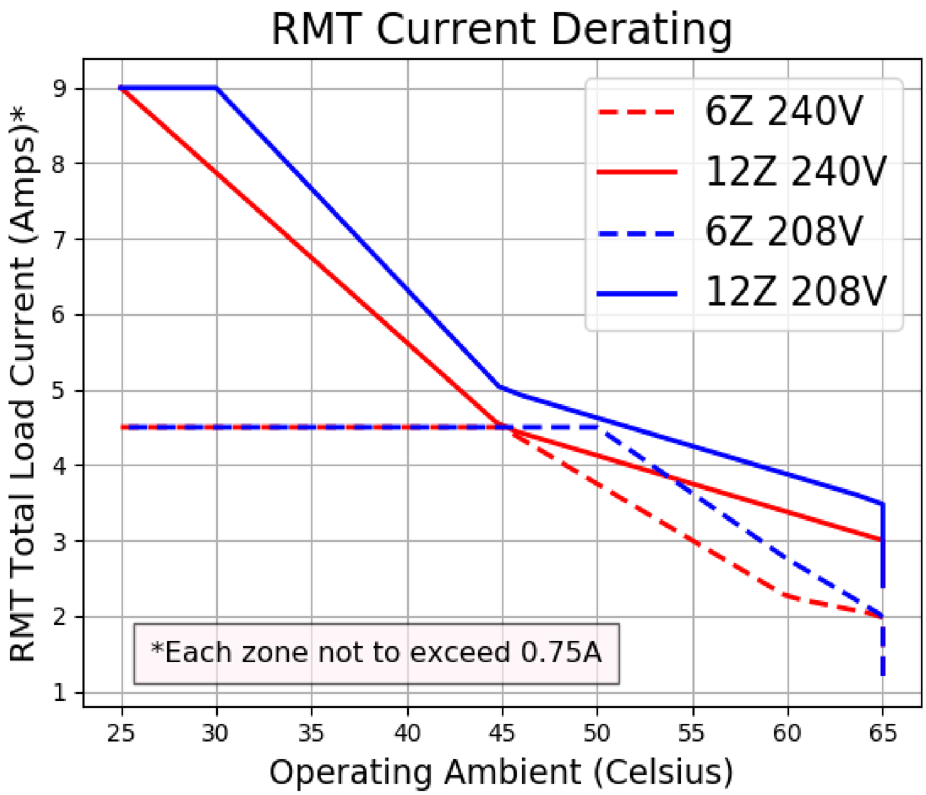
RMT firmware can be updated by connecting to another RM device with Ethernet or USB connection and using either Watbus Flash Loader Utility or Dashboard to push an updated to the RMT over high-speed Watbus.

Once the program has completed sending the update to the RMT, the RMT must be power cycled for the update to complete.

Control Modes

Off - No output activity= sensing circuit is working. Does not evaluate faults.
Auto - Normal operating condition= PID control, sensing circuit is active and faults will be initiated if present.
Manual - Operates in percent power mode; sensing circuit is active and faults will be initiated if present.

Output Derating



4 Faults and Troubleshooting

Indications and Faults

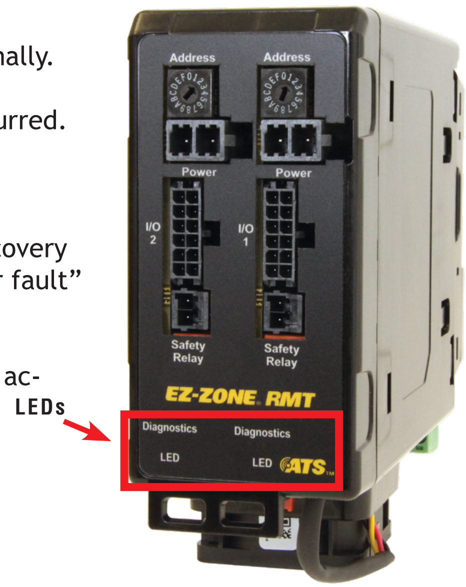
A green LED (full "ON") indicates the controller is operating normally.

A red LED (full "ON") indicates a detectable unsafe fault has occurred.

A flashing green LED will occur when updating firmware.

Manual intervention is required to reset the fault condition. (Discovery of the fault, clearing the fault by power cycle or sending a "clear fault" signal via comms)

A deviation alarm should be set for each channel /output. This is accomplished by entering the value of which the temperature has become too cold or too hot for the process.



Troubleshooting

Heater is not heating up	• Check RMT fault codes from the RMT Controller. • Check wiring to heater
RMT fan has stopped working	Each RMT Controller has a fan mounted to the bottom side of the enclosure. The fan is not field repairable. If fan problems occur contact the Watlow Service Department NOTE: Should the fan stop operating, the output devices will self-manage their thermal properties to keep them from self-destructing. Increased ambient conditions will increase without the fan operating and the RMT Controller may not operate at full output capacity.

5 Specifications

Specifications

Controller Power	24 to 28Vac/dc
Heater Power Input Voltage	100 to 240VAC -15%/+10%
Heater Outputs	Maximum 0.75A on any one output, multiple outputs follow derating curve "Output Derating" on page 11.
Ambient Rating	-18 to 65°C. (Refer to derating curve "Output Derating" on page 11.)
Humidity	0 - 90% non-condensing
Altitude	Maximum 2,000 meters
Safety Relay	2 Amps resistive 24 - 240 VAC or 30 VDC. 125 VAC Pilot Duty 120/240 VAC, 25 VAC at 24 VAC.
Safety Limit Output	• Mechanical relay common and normally open terminals • Energized (closed) in safe conditions, open on fault.
Installation Category	Installation category II, pollution degree category 2. No maintenance requirements or field serviceable parts apply to the RMT Controller.
Fan Specifications	• Operating Temperature: -20°C N +65°C • Storage Temperature: -20°C N + 75°C • Life Expectancy: 65,000 Hours (Ll0 at 45°C) • Available Options Tachometer Output Alarm Output IP Ratings • Weight: 0.07 lbs

Agency Compliance

https://www.watlow.com/Resources-and-Support/Additional-Support/Agency-Approvals Search keyword: "RMT"

6 Appendix

Ordering Information

Part Number

① ② EZ-ZONE Rail Mount	③ Primary Product	④ Future Option	⑤ ⑥ Control/Limit	⑦ ⑧ Heater Technology	⑨ Future Option	⑩ Future Option	⑪ ⑫ Customization
RM	T	A			A	A	

③	Primary Product Function
T =	TC heater sensor with integrated limit

④	Future Option
A =	Standard product

⑤⑥	Control/Limit Loops
06 =	6 control loops (1 module card installed)
12 =	12 control loops (2 module cards installed)

⑦⑧	Heater Technology
CL =	Cloth heaters
SR =	Silicone rubber heaters

⑨	Future Option
A =	Standard product

⑩	Future Option
A =	Standard product

⑪⑫	Customization
AA =	Standard product
XX =	Any two letters or number for custom non-critical options

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