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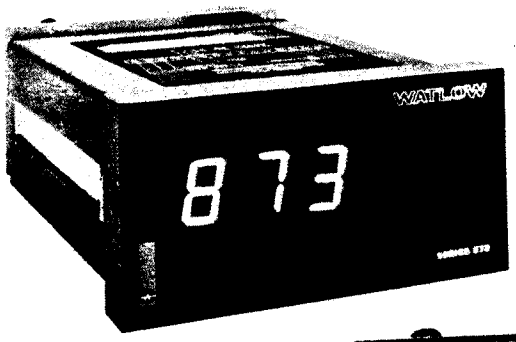
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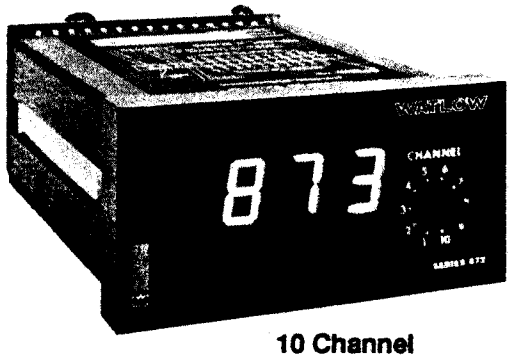
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Series 873



1 Channel



10 Channel

1/8 DIN Digital Indicator

User's Manual

WATLOW

Watlow Controls, 1241 Bundy Blvd., Winona, MN 55987 507/454-5300, Fax: 507/452-4507

W873-DA20-8935
August, 1989
Supersedes:
W873-DA10-8907

$5.00

Printed on Recycled Paper

General Description

The Watlow Series 873 is a 1/8 DIN LED digital temperature indicator featuring either single or 10 channel selection sensor inputs including T/C, RTD, or electrical process. A millivolt output signal is available for interface to other instrumentation.

Specifications

Operator Interface
- 1/2" (12.7mm) LEDs.
- 10 position switch selects which of 10 inputs to display.
- °F or °C selection, external jumper.

Input
- Thermocouple, RTD, or electrical process input available.
- Automatic cold junction compensation for thermocouple.
- RTD input 2 or 3 wire, platinum, 100 ohms @ 0°C calibrated for either of two curves:
  #3916(JIS): 0.003916 Ω/Ω/°C.
  #3850 (DIN): 0.003850 Ω/Ω/°C.
- MV process input, 5mV/digit for 3 digit temperature ranges 2mV/digit for 3-1/2 and 3-3/4 digit temperature ranges.
- Sensors may be isolated or grounded.
- Lead resistance effect for "J" type thermocouple input: 200Ω of lead resistance will cause less than 1°F error. Refer to the lead wire manufacturer's specification on ohms per douple foot for the type and gauge of wire used.

- Open Sensor Indication

	Positive	Negative
3 Digit	EEE	- - -
3-1/2 Digit	*MSD Lit	MSD Lit
3-3/4 Digit	OFL	000

*Most Significant Digit Lit

- Display Capacity Definition:

3 Digit	-99	to	999	@	5mv/LSD*
3-1/2 Digit	-1999	to	1999	@	2mv/LSD
3-3/4 Digit	000	to	3999	@	2mv/LSD

*Least Significant Digit

- Input Isolation:
  T/C input to line: DC resistance 10^{11} ohms. 50pf capacitance.
  RTD input to line: Isolated.

Auxiliary Output
- MV signal output, linearized, 5mV/digit for 3 digit ranges, 2mV/digit for 3-1/2 and 3-3/4 digit ranges.

Accuracy
- Calibration Accuracy and Sensor Conformity: ± 0.25% of span, ± 1 digit at 77°F ± 5°F (25°C ±3°C) ambient & rated line voltage ±1%.
- Accuracy Span: 1000°F or 540°C minimum.
- Temperature Stability: ± 5µV/°F (7.75µV/°C) ambient.
- Voltage Stability: ± 0.01% of span /% of rated line voltage.

Terminals
- Screw clamp strip.
- Solder terminals.

Power
- 120/240VAC ±10%, 50/60Hz.
- 6 VA.

Operating Environment
- 30 to 130°F/0 to 55°C.
- 0 to 90% RH, non-condensing.

Dimensions

• Height:	1.9 in.	(48.26 mm)
• Width:	3.8 in.	(96.52 mm)
• Overall depth:	5.5 in.	(139.7 mm)
• Behind panel depth:	4.7 in.	(119.38 mm)
• Weight:	1.3 lb.	(0.6 kg)

8 45 - 0080 - 0

Control
Series 873 = Digital temperature indicator, LED 10 channel option, 1/8 DIN.

Unit Modifications
A = Single-channel, solder terminals
B = Single-channel, screw terminals
C = Ten-channel, solder terminals
D = Ten-channel, screw terminals

Input & Range

RTD

100 = #3916	-9.9	to	99.9°F	or
	-9.9	to	99.9°C	
101 = #3916	-99	to	999°F	or
	-99	to	500°C	
102 = #3916	-199.9	to	199.9°F	or
	-199.9	to	199.9°C	
104 = #3916	0	to	399.9°F	or
	0	to	399.9°C	
120 = #3850	-9.9	to	99.9°F	or
	-9.9	to	99.9°C	
121 = #3850	-99	to	999°F	or
	-99	to	500°C	
122 = #3850	-199.9	to	199.9°F	or
	-199.9	to	199.9°C	
124 = #3850	0	to	399.9°F	or
	0	to	399.9°C	

Thermocouples

600 = K	0	to	999°F	or
	0	to	999°C	
601 = K	32	to	2480°F	or
	0	to	1360°C	
602 = J	32	to	1560°F	or
	0	to	850°C	
603 = J	0	to	999°F	or
	0	to	540°C	
604 = J	-99	to	570°F	or
	-99	to	300°C	
605 = T	-99	to	570°F	or
	-99	to	300°C	

DC Millivolts

700 = 5mV/LSD	-99	to	999	units
701 = 2mV/LSD	-1999	to	1999	units
703 = 5mV/LSD	-9.9	to	99.9	units
704 = 2mV/LSD	-199.9	to	199.9	units
709 = 5mV/LSD	-1999	to	1999	units
710 = 5mV/LSD	-199.9	to	199.9	units

Related Devices:
- Extender card: A007-1022-0000

Installation and Dimensions

Figure 1 shows the standard case dimensions with solder terminals and Figure 2 shows the case with screw terminals for the Series 873. Figure 3 on Page 5 shows the panel cutout for mounting, and 4 shows the front panel dimensions .

1. To install, turn the installation screws out to the edge of the PC edge connector. See Figure 1 or 2.
2. Carefully insert the unit into the panel cutout. See Figure 3.
3. Slide the mounting bracket back to allow the ears to spring free.
4. Tighten the installation screws to secure the unit in place.
5. To remove the unit from its enclosure, pop the lens out by inserting a small object into the lens notch and prying up. See Figure 4 on Page 5.

   The interior of the unit is held in place by the PC edge connector.

   Behind the lens is a black lever or "extractor" fastened to the lower PC board of the 873.

   By prying this out, first by fingernail, then by finger; the leverage will force the unit out of its enclosure.
6. To re-install the unit, swing the "extractor" to the left so it is flush with the PC board.

   Slide the unit into the enclosure and press firmly on the edge of the PC board until the unit is held firmly by the connector.

   Replace the lens by inserting the top in first and press in on the bottom.

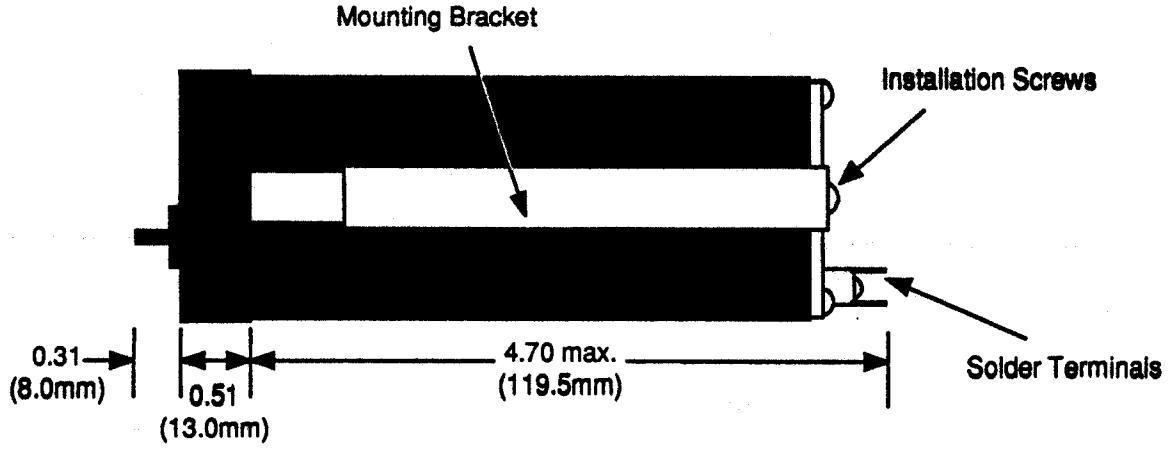


Figure 1 - Series 873 Case Dimensions (Solder Terminals)

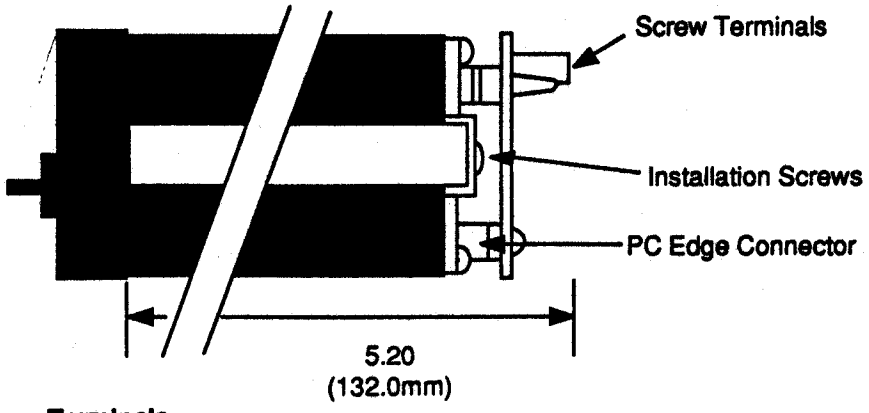


Figure 2 - Series 873 Screw Terminals

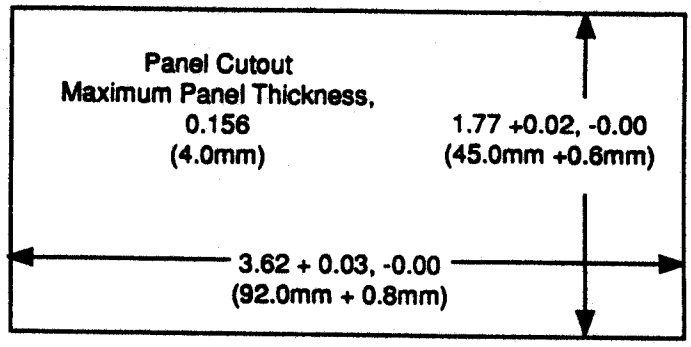


Figure 3 - Series 873 Panel Cutout

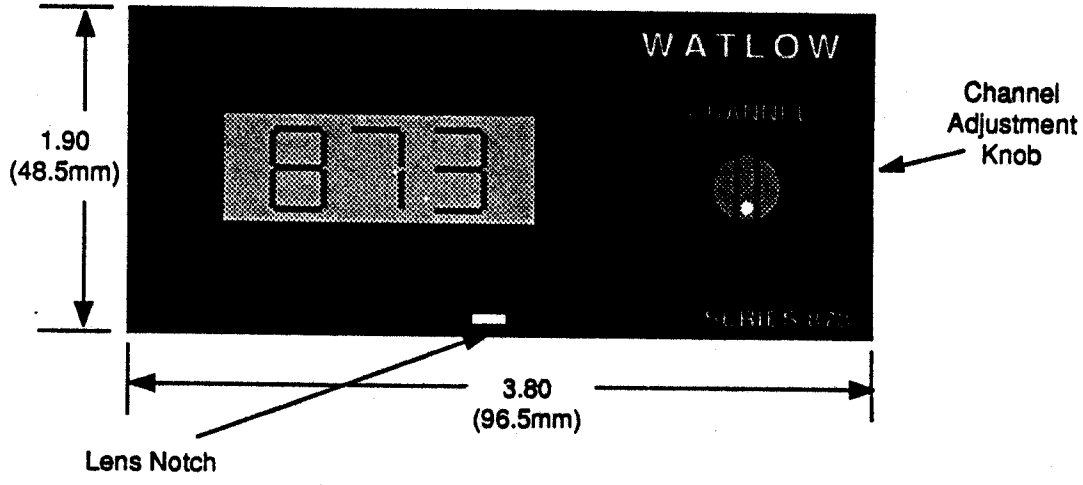


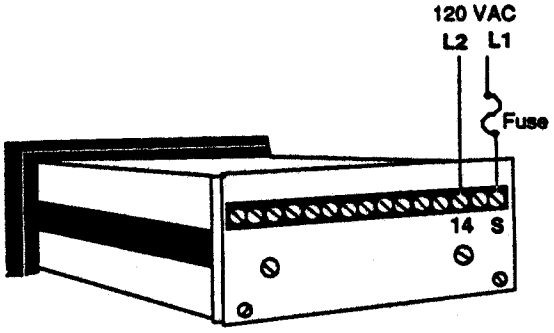
Figure 4 - Series 873 Front Panel Dimensions

Line Voltage

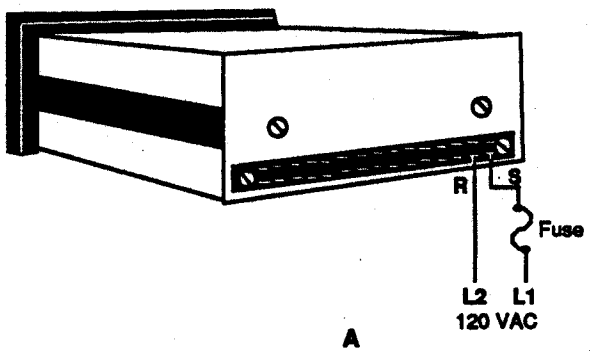
WARNING:

To avoid potential electric shock, use National Electric Code safety practices when wiring and connecting this unit to a power source and to electrical sensors or peripheral devices.

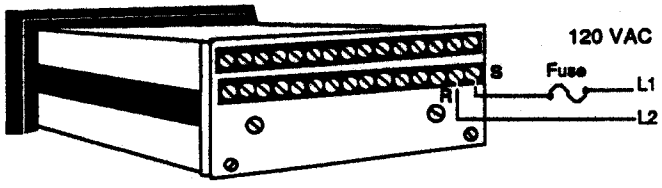
All wiring and fusing should conform to the National Electric Code NFPA 70 and to any locally applicable codes also.



1 Channel Screw Terminals (8B45-0080-0XXX)

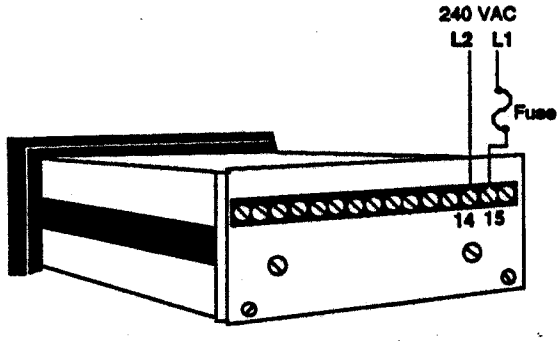


A
Solder Terminals (8X45-0080-0XXX)
C

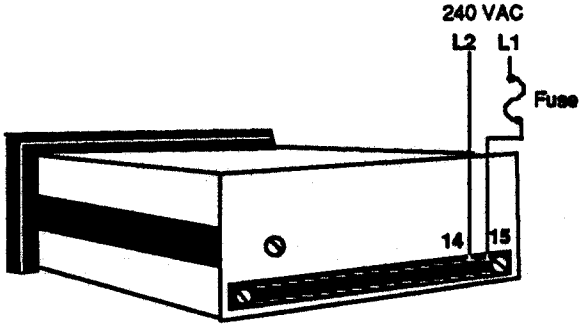


10 Channel Screw Terminals (8D45-0080-0XXX)

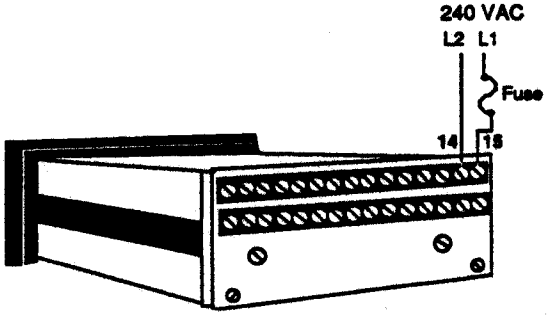
Figure 5 - 120 VAC Power Wiring



1 Channel Screw Terminals (8B45-0080-0XXX)



A
Solder Terminals (8X45-0080-0XXX)
C



10 Channel Screw Terminals (8D45-0080-0XXX)

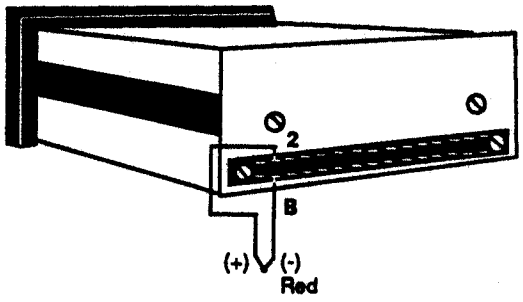
Figure 6 - 240 VAC Power Wiring

Wire your unit according to the figures showing the correct input.

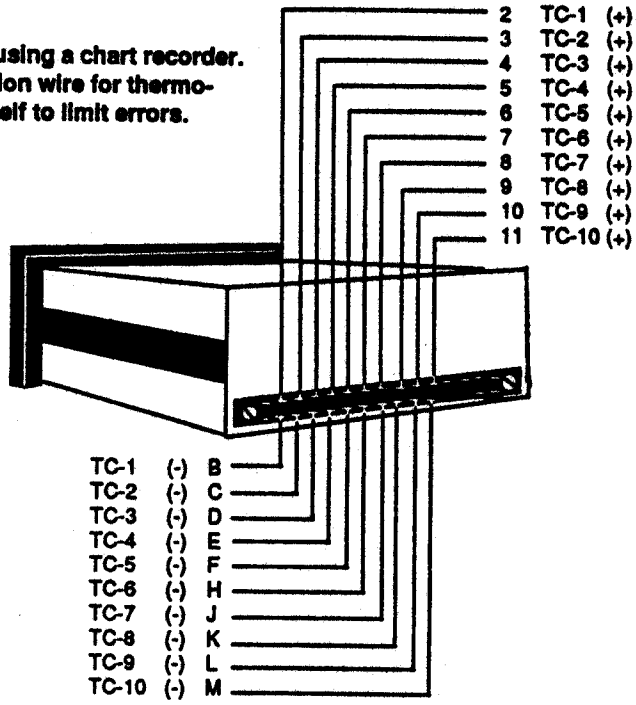
Thermocouple Input Wiring

NOTE:

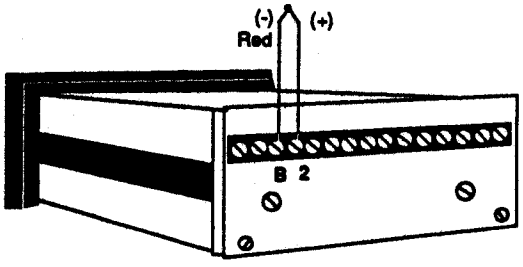
You must use an isolated or ungrounded thermocouple if using a chart recorder. Circuit common is not isolated from earth ground. Extension wire for thermocouples must be of the same alloy as the thermocouple itself to limit errors.



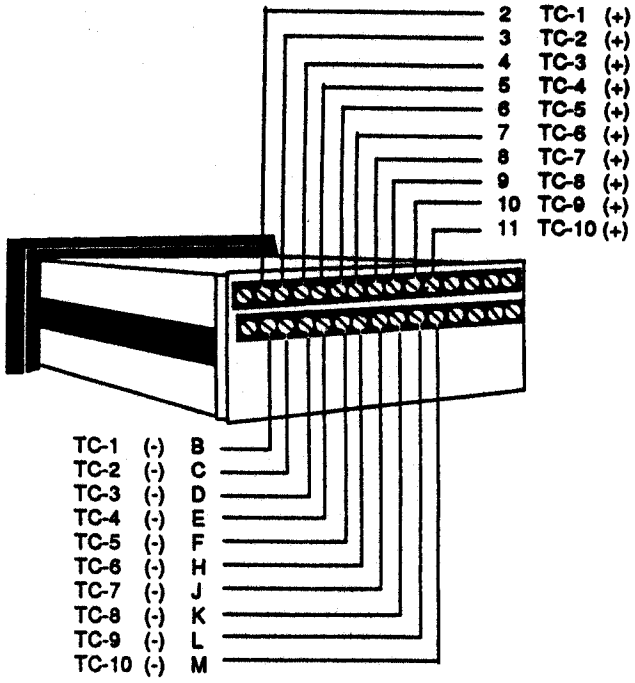
1 Channel Solder Terminals (8A45-0080-06XX)



10 Channel Solder Terminals (8C45-0080-06XX)



1 Channel Screw Terminals (8B45-0080-06XX)



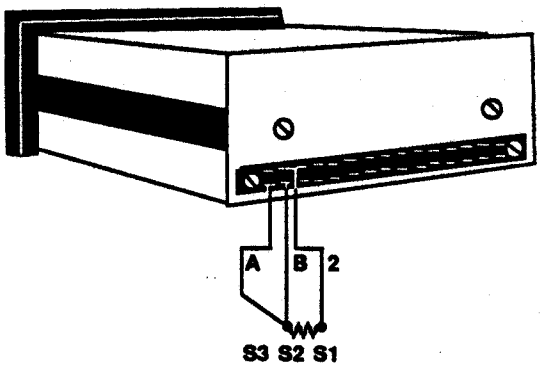
10 Channel Screw Terminals (8D45-0080-06XX)

Figure 7 - Thermocouple Input

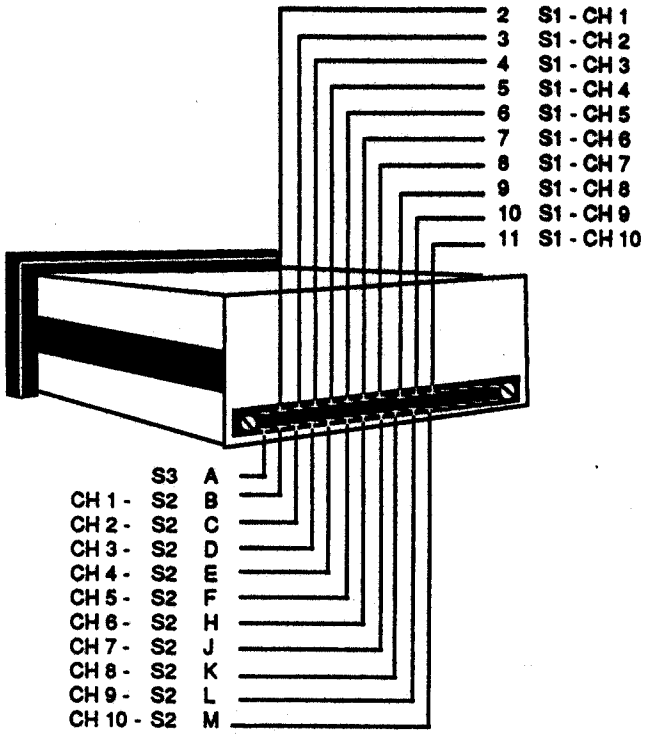
RTD Input Wiring

NOTE:

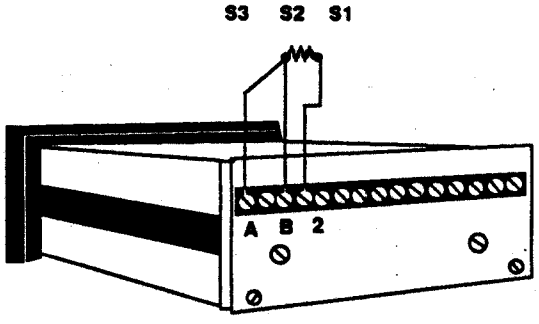
On single channel controls, connect S2 to S3 for a two wire sensor.



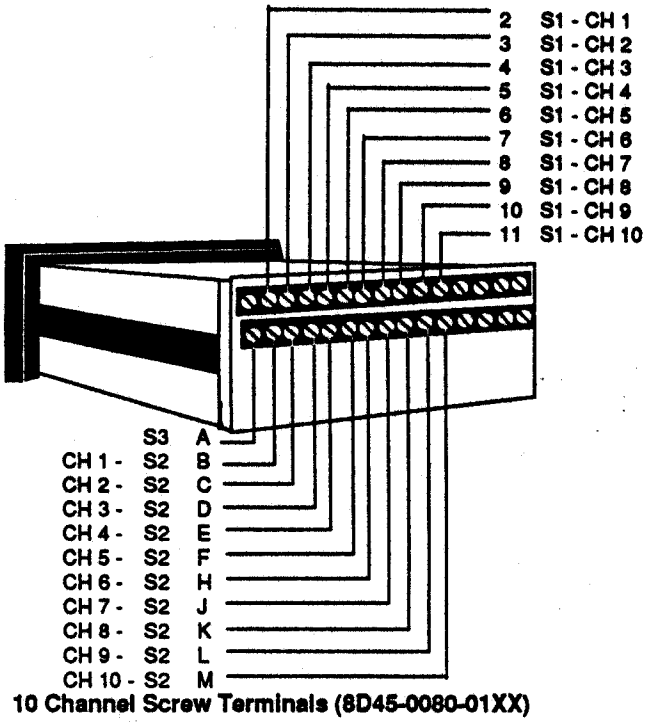
1 Channel Solder Terminals (8A45-0080-01XX)



10 Channel Solder Terminals (8C45-0080-01XX)



1 Channel Screw Terminals (8B45-0080-01XX)

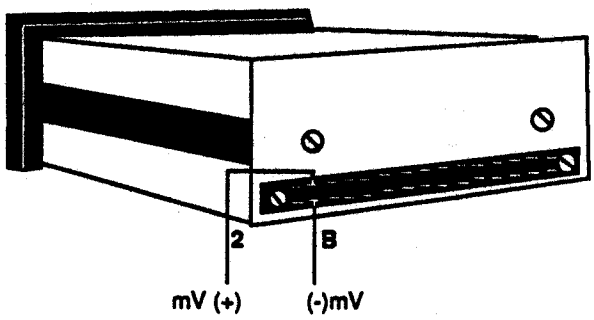


10 Channel Screw Terminals (8D45-0080-01XX)

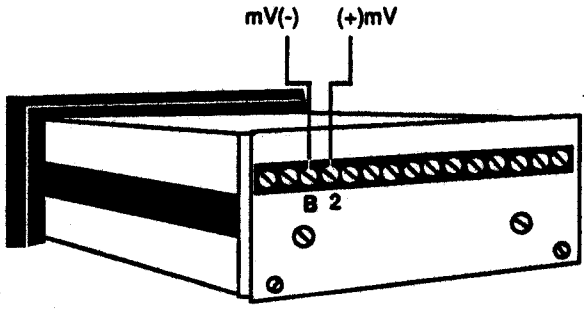
Figure 8 - RTD Input

NOTE:

Long RTD lead lengths create electrical resistance. There will be approximately +2°C input error for every 1Ω of lead length resistance, when using a two wire RTD. That resistance, when added to the resistance of the RTD element, can result in erroneous input to the instrument. To overcome this problem, use a three wire RTD sensor, which compensates for lead length resistance. When extension wire is used for a three wire RTD, all three extension wires must have the same electrical resistance. (i.e. same gauge, copper stranded wire).



1 Channel Solder Terminals (8A45-0080-07XX)

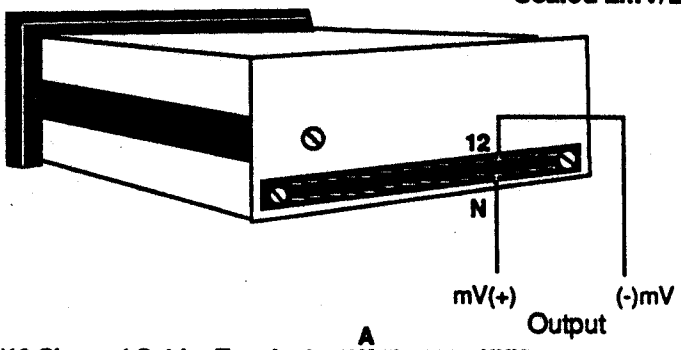


1 Channel Screw Terminals (8B45-0080-07XX)

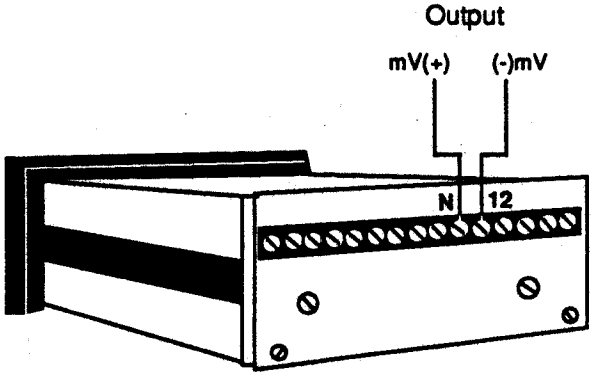
Figure 9 - Millivolt Input

Chart Recorder Output

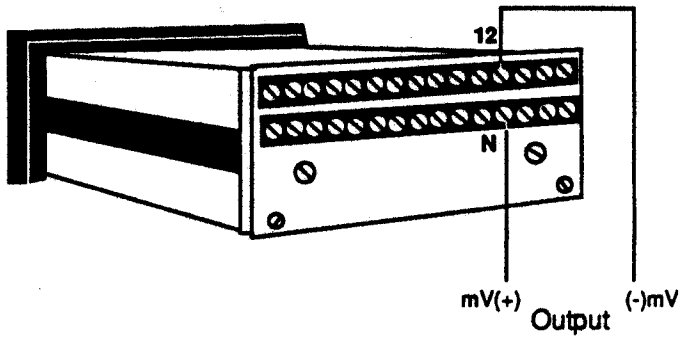
Scaled 5mV/LSD for 3 digit ranges
Scaled 2mV/LSD for 4 digit ranges



A
1/10 Channel Solder Terminals (8X45-0080-0XXX)
C



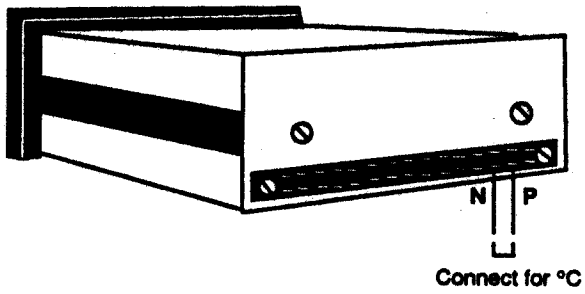
1 Channel Screw Terminals (8B45-0080-0XXX)

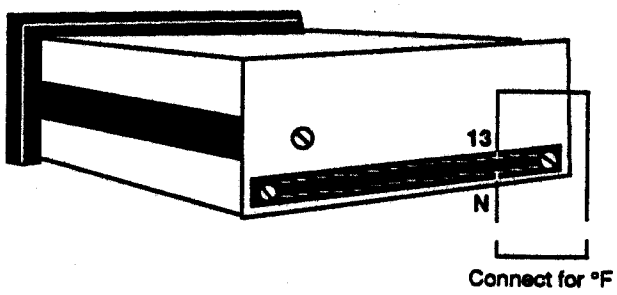


10 Channel Screw Terminals (8D45-0080-07XX)

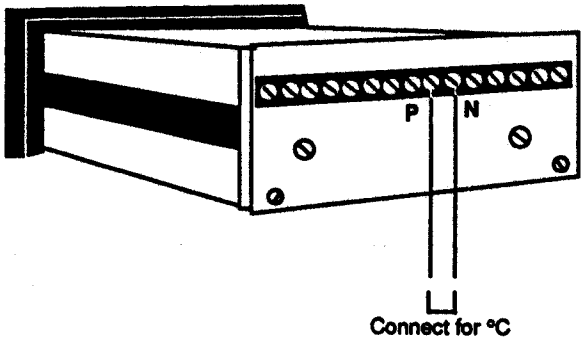
Figure 10 - Chart Recorder

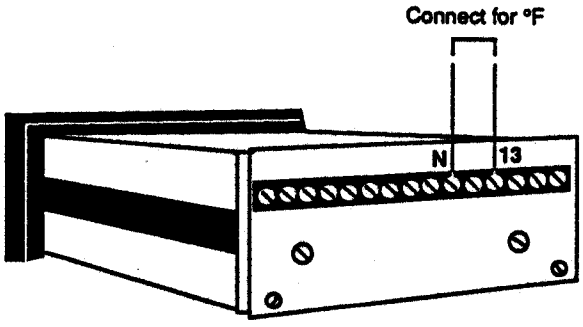
C/ F Selection



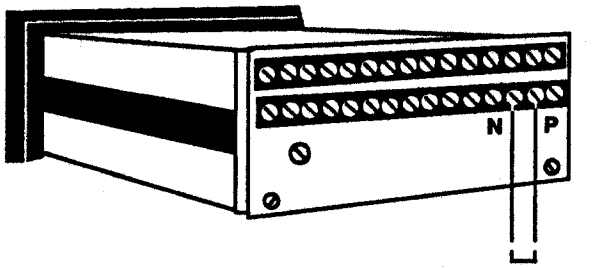


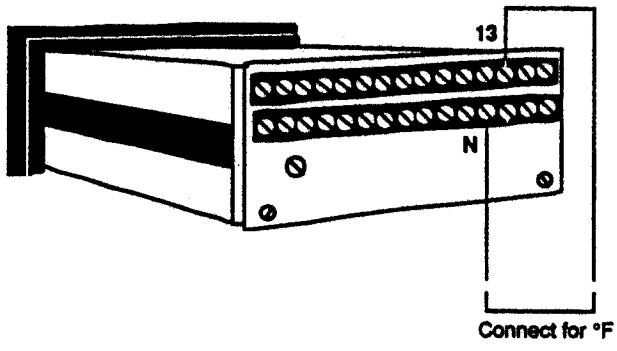
1 or 10 Channel Solder Terminals (8X45-0080-0XXX)





1 Channel Screw Terminals (8B45-0080-0XXX)





10 Channel Screw Terminals (8D45-0080-0XXX)

Figure 11 - °C Selection

Figure 12 - °F Selection

1. **Closed Loop** - Control system that has a sensing device for process variable feedback.

2. **Cold Junction** - Point of connection between thermocouple metals and the electronic instrument.

3. **Cold Junction Compensation** - Electronic means used to compensate for the effect of temperature at the cold junction.

4. **DIN** - Deutsche Industrial Norms, a widely recognized German standard for engineering units.

5. **ON/OFF** - The output is turned full ON below set point and stays turned on until the process temperature reaches set point, then the controller turns the output full OFF. At this point depending on the design of the thermal system, the process temperature will overshoot the set point temperature by some degree.

6. **RTD** - Resistance Temperature Detector. Resistive sensing device displaying resistance versus temperature characteristics. Displays positive temperature coefficient.

7. **Set Point** - Intended value of the process variable.

8. **Switching Sensitivity or Differential** - The output will de-energize when the actual temperature reaches the set point temperature. The switching sensitivity or differential is the change in temperature (°F/°C) required to re-energize the output.

9. **Thermal System** - A regulated environment consisting of a heat source, heat transfer medium, sensing device and a process variable control instrument.

10. **Thermocouple** - Temperature sensing device that is constructed of two dissimilar metals wherein a measurable, predictable voltage is generated corresponding to temperature.

11. **Thermocouple Break Protection** - Fail-safe operation that assures output shutdown upon an open thermocouple condition.

12.  or  - Musical Notes are used to alert you to important details.

13.  - The Stop Sign alerts you to a **"WARNING,"** a safety hazard which could affect you and the equipment.

14.  - The Deer Crossing Sign alerts you to a **"CAUTION,"** a safety or functional hazard which could affect your equipment or its performance.

T/C Field Calibration Procedure

NOTE:

This calibration information is provided as a service. Proper field calibration can be achieved by following this procedure. If your control is in warranty, that warranty will be void if this field calibration is performed improperly.

NOTE:

All millivolt values given are referenced to 0°C for °C range and 32°F for °F ranges.

Thermocouple Input
Equipment Required:

- Precision Millivolt Source.
- 3 - 1/2 digit, Digital Voltmeter (DVM).
- Reference compensator with reference junction at 32°F/0°C.
- Extender board may be used for ease of servicing, Watlow P/N A007-1022-0000.

Procedure:
Refer to Table 1 for the values that apply to your unit's range code. Refer to Figure 14 on Page 15 for potentiometer locations.

1. Connect the millivolt source to the reference compensator, and the compensator leads to the T/C inputs, Terminals 2 (+) and B (-). Jumper Terminals P to N for °C operation. Connect the DVM to Terminals 12 (-) and N (+).

   Install the extender board, if one is in possession, into the case, and the control into the extender board.

2. Connect power to the control. Let the control stabilize before calibration begins.

3. Set the millivolt source to _____ Lo °C mV. Adjust the °C Lo pot for _____ Lo °C volts on the DVM.

4. Set the millivolt source to _____ Hi °C mV. Adjust the °C Hi pot for _____ Hi °C volts on the DVM.

5. Repeat Steps 3 and 4 until all of the readings are correct with no further adjustment necessary for °C.

6. Remove power from the control. Remove the jumper from Terminals P and N and apply it across Terminals 13 and N for °F operation. Re-apply power to the control.

7. Set the millivolt source to ____ Lo °F mV. Adjust the °F Lo pot for ____ Lo °F on the DVM.

8. Set the millivolt source to _____ Hi °F mV. Adjust the °F Hi pot for _____Hi °F volts on the DVM.

9. Repeat Steps 7 and 8 until all of the readings are correct with no further adjustment necessary.

For units with 602 range code, do Steps 11 and 13 only.

10. Set the millivolt source to _____ Lo °F mV. Adjust the Zero pot for _____ Zero Temp.

11. Set the millivolt source to Hi °F mV. Adjust the FS pot for _____ FS Temp.

12. Repeat Steps 9 and 10 until all of the readings are correct with no further adjustment necessary.

13. Check the midpoint calibration by setting the mV source to mid mV. The display should read _____ mid temperature ± 0.25% of span.

Table 1 - Thermocouple Input Calibration Ranges

Range			Millivolt vs. Temperature											
Code	Low/ High	TC Type	Lo °C mV	Lo °C Volts	Hi °C mV	Hi °C Volts	Lo °F mV	Lo °F Volts	Hi °F mV	Hi °F Volts	Zero Temp	FS Temp	Mid mV	Mid Temp
600	0 - 999°F 0 - 999°C	K	0.000 0°C	0.00	40.88 990°C	4.95	0.000 32°F	0.160	22.01 990°F	4.950	32°F	990°F	10.56	500°F
601	32 - 2480°F 0 - 1360°C	K	0.397 10°C	0.02	52.40 1300°C	2.60	0.397 50°F	0.100	52.40 2372°F	4.744	50°F	2372°F	22.77	1022°F
602	32 - 1560°F 0 - 850°C	J	0.507 10°C	0.02	42.28 750°C	1.50	0.507 50°F	0.100	42.28 1382°F	2.764	N/A	1382°F	23.28	799°F
603	0 - 999°F 0 - 540°C	J	0.000 0°C	0.00	29.20 532°C	2.66	0.000 32°F	0.160	29.20 990°F	4.950	32°F	990°F	14.11	500°F

NOTE:

This calibration information is provided as a service. Proper field calibration can be achieved by following this procedure. If your control is in warranty, that warranty will be void if this field calibration is performed improperly.

Platinum RTD Input

Equipment Required:

- 100Ω decade resistance box.
- 3 - 1/2 digit Digital Voltmeter (DVM).
- Extender board may be used for ease of servicing, Watlow P/N A007-1022-0000.

Procedure:

See Table 2 on the next page for values that apply to your unit's range code. Refer to Figure 14 on the next page for potentiometer locations.

1. Connect the decade resistance box to the input on Terminals S1 and S2, with S2 and S3 jumpered at the control and the decade box. Jumper Terminals P to N for °C operation. Connect the DVM Negative (-) to Terminal 12 and DVM Positive (+) to Terminal N. Refer to Page 8 for input wiring.

   Install the extender board into the case, if one is in possession; install the control into the extender board.

2. Connect power to the control. Let the control stabilize before calibration begins.

3. Set the decade box to _____ Lo °C ohms. Adjust the °C Lo pot for _____ Lo °C volts on the DVM.

4. Set the decade box to _____ Hi °C ohms. Adjust the °C Hi pot for _____ Hi °C volts on the DVM.

5. Repeat Steps 3 and 4 until all readings are correct with no further adjustment necessary for °C.

6. Remove power from the control. Remove the jumper from Terminals P to N and apply it across Terminals 13 and N for °F operation. Apply power to the control.

7. Set the decade box to _____ Lo °F ohms. Adjust the °F Lo pot for _____ Lo °F volts on the DVM.

8. Set the decade box to _____ Hi °F ohms. Adjust the °F Hi pot for _____ Hi °F volts on the DVM.

9. Repeat Steps 7 and 8 until all of the readings are correct with no further adjustment necessary.

For units with 104 and 124 range codes, do steps 10 through 13. For all other units do steps 11 and 13 only.

10. Set the decade box to _____ Lo °F ohms adjust the Zero pot for _____ Zero Temp.

11. Set the decade box to _____ Hi °F ohms. Adjust the FS pot for _____ FS Temp.

12. Repeat Steps 10 and 11 until all readings are correct with no further adjustments necessary.

13. Check the midpoint calibration by setting the decade box to _____ Mid °F ohms. The display should read _____ Mid Temp ± 0.25% of span.

RTD Field Calibration Procedure

Table 2 - RTD Input Calibration Values

Range		Ohms vs. Temperature											
Code	Low/ High	Lo °C Ohms	Lo °C Volts	Hi °C Ohms	Hi °C Volts	Lo °F Ohms	Lo °F Volts	Hi °F Ohms	Hi °F Volts	Zero Temp	FS Temp	Mid °F Ohms	Mid °F Temp
Temperature Curve #3916 (JIS)													
100	-9.9 - 99.9°F -9.9 - 99.9°C	100.00 0°C	0.00	135.30 90.0°C	4.50	92.93 0°F	0.00	112.75 90.0°F	4.50	N/A	90.0	103.97	50.0
101	-99 - 999°F -99 - 500°C	100.00 0°C	0.00	294.91 500°C	2.66	100.00 32°F	0.16	294.91 990°F	4.95	N/A	990	199.37	500
102	-199.9 - 199.9°F -199.9 - 199.9°C	100.00 0°C	0.00	173.40 190.0°C	3.80	100.00 32.0°F	0.64	134.44 190.0°F	3.80	N/A	190.0	110.56	80.0
104	0 - 399.9°F 0 - 399.9°C	100.00 0°C	0.00	246.08 390.0°C	7.80	100.00 32.0°F	0.64	176.73 390.0°F	7.80	32.0°F	390.0	136.59	200.0
Temperature Curve #3850 (DIN)													
120	-9.9 - 99.9°F -99 - 99.9°C	100.00 0°C	0.00	134.70 90.0°C	4.50	93.03 0°F	0.00	112.53 90.0°F	4.50	N/A	90.0	103.90	50.0
121	-99 - 999°F -99 - 500°C	100.00 0°C	0.00	291.56 500°C	2.66	100.00 32°F	0.16	291.56 990°F	4.95	N/A	990	197.69	500
122	-199.9 - 1999°F -199.9 - 999°C	100.00 0°C	0.00	172.16 190°C	3.80	100.00 32.0°F	0.64	133.86 190.0°F	3.80	N/A	190.0	110.38	80.0
124	0 - 399.9°F 0 - 399.9°C	100.00 0°C	0.00	243.59 390.0°C	7.80	93.03 32.0°F	0.64	175.43 390.0°F	7.80	32.0°F	390.0	135.97	200.0

Calibration Offset

NOTE:

Depending on your unit, you may not have a top board or a four digit display. This figure shows all possible potentiometer locations.

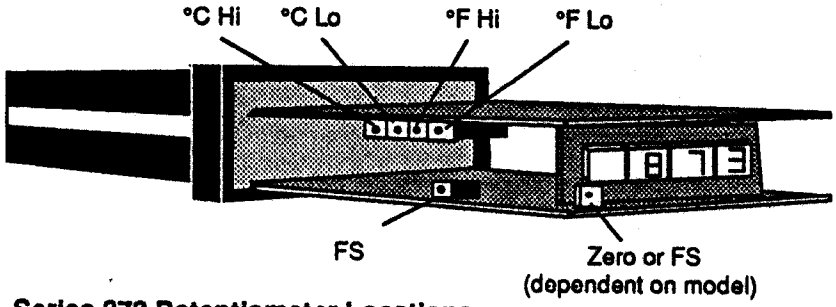


Figure 14 - Series 873 Potentiometer Locations

1. To adjust the Zero pot, remove the lens from the unit.
2. Turn the Zero pot clockwise (CW) to increase the display temperature.
3. Turn the Zero pot counter-clockwise (CCW) to decrease the display temperature. Replace the lens by inserting the top in first and press in on the bottom.

NOTE:

This calibration information is provided as a service. Proper field calibration can be achieved by following this procedure. If your control is in warranty, that warranty will be void if this field calibration procedure is performed improperly.

Millivolt Signal Input

Equipment Required:

- Precision millivolt source.
- Digital voltmeter (DVM).

Procedure:

1. Connect the millivolt source to input terminals 2 (+) and B (-). Connect power to the control.
2. Set the millivolt source to ____ V. Adjust the Zero pot for ____ on the display of the control. See Page 15 for potentiometer locations.
3. Set the millivolt source to ____ V. Adjust the FS pot to ____ on the display of the control.
4. Repeat Steps 2 and 3 until all of the readings are correct with no further adjustments necessary.
5. Set the millivolt source to ____ V. The display should read ____.

Table 1 - Millivolt Input Calibration Ranges

Range			Millivolt vs. Temperature					
Code	Low/High	Input Scaling	Lo Volts	Mid Volts	Hi Volts	Low Display	Mid Display	High Display
700	-99 to 999 units	5mV/LSD	0.00	2.50	4.95	000	500 ± 2	990
701	-1999 to 1999 units	2mV/LSD	0.00	2.000	3.900	0000	1000 ± 5	1950
703	-9.9 to 99.9 units	5mV/LSD	0.00	2.50	4.95	00.0	50.0 ± 0.2	99.0
704	-199.9 to 199.9 units	2mV/LSD	0.000	2.000	3.900	000.0	100.0 ± 0.5	195.0
709	-1999 to 1999 units	5mV/LSD	0.000	5.00	9.95	0000	1000 ± 5	1990
710	-199.9 to 199.9 units	5mV/LSD	0.000	5.00	9.95	000.0	100.0 ± 0.5	199.0

Troubleshooting Chart

Problem	Probable Cause	Action
No display.	Check for presence or proper connection of AC input. 1. If not present or proper ...	Connect per Line Voltage. See Page 6.
	2. If present and proper ...	Contact the factory.
A display error.	1. Check for °C/°F jumper. If not present ...	Connect per °C/°F Selection. See Page 10, Figures 11 & 12.
	2. If °C/°F jumper present, check sensor connection. If not connected properly ...	Connect per Input Wiring. See Pages 7 - 9. Observe TC type and polarity.
	3. If sensor is connected properly, check for a faulty sensor ...	A. Thermocouple - Place jumper wire across TC terminals. If display indicates room temperature, indicator is functioning properly. B. RTD - Place 100Ω resistor across sensor terminals. If display indicates approximately 32°F/0°C, indicator is functioning properly. Check the sensor location, connections, and the sensing element. Repair or replace the sensor as required.
	4. If the indication problem is not resloved ...	Contact the factory.

Returns

The following procedure must be used on any returns of product to the factory:

1. You must call Watlow Customer Service, 507/454-5300, for a Return Material Authorization (RMA) number before returning any item for repair. We need this information:
   - Ship to address
   - Bill to address
   - Contact name
   - Phone number
   - Ship via
   - Your P.O. number
   - Symptoms and/or special instructions
   - Name and phone number of person returning the material.

   We will not accept a return without an RMA number. The RMA number must appear on the outside of the carton and on all paperwork. Cartons without RMA numbers will be returned. Ship on a freight prepaid basis.

2. You need prior approval and an RMA number from the Customer Service Department when you are returning an unused product for credit. Also, we must apply a 20 percent restocking charge for all returned stock controls and accessories.

3. After we receive your return, we will enter a repair order, replacement order, or issue credit for material.

4. In cases of manufacturing defect, we will return it to you with a letter of explanation. Repair costs will not exceed 50 percent of the original cost.

Warranty

The Watlow Series 873 is warranted to be free of defects in material and workmanship for 24 months after delivery to the first purchaser for use, providing that the units have not been misapplied.

Since Watlow has no control over their use, and sometimes misuse, we cannot guarantee against failure. Watlow's obligations hereunder, at Watlow's option, are limited to replacement, repair or refund of purchase price, and parts which upon examination prove to be defective within the warranty period specified. This warranty does not apply to damage resulting from transportation, alteration, misuse or abuse.

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