



Series 733/734



**Total
Customer
Satisfaction**

3 Year
Warranty

Time/Temperature Control

Service Manual



WATLOW

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Contents

This manual is a supplement to the Series 733/734 Program Manual. It is for configuring, servicing and calibrating your control. Use this manual in conjunction with the Series 733/734 Program Manual and Data Communications manual.

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Notes



Informational notes alert you to important details. When you see a note icon, look for an explanation in the margin.

Safety Information

Boldface safety information protects both you and your equipment. Please be attentive to them. Here are explanations:



The CAUTION symbol (exclamation point) in the wide text column alerts you to a "CAUTION," a safety or functional hazard which could affect *your equipment* or its performance. A full explanation is in the narrow column on the outside of the page.



The WARNING symbol (lightning bolt) in the wide text column alerts you to a "**WARNING**," a safety hazard which could affect *you and the equipment*. A full explanation is in the narrow column on the outside of the page.

Technical Assistance



If you encounter a problem with your Series 733/734 control, review all of your configuration information to verify that your selections are consistent with your application... Inputs, Outputs, Alarms, Limits, etc. If the problem persists after checking the above, you can get technical assistance by dialing: 1-507-454-5300

An Application Engineer will discuss your problem with you. Please have the following information available:

- Complete model number
- Revision number
- All configuration information
- User's manual

The model and serial numbers can be found on the outside of the case.

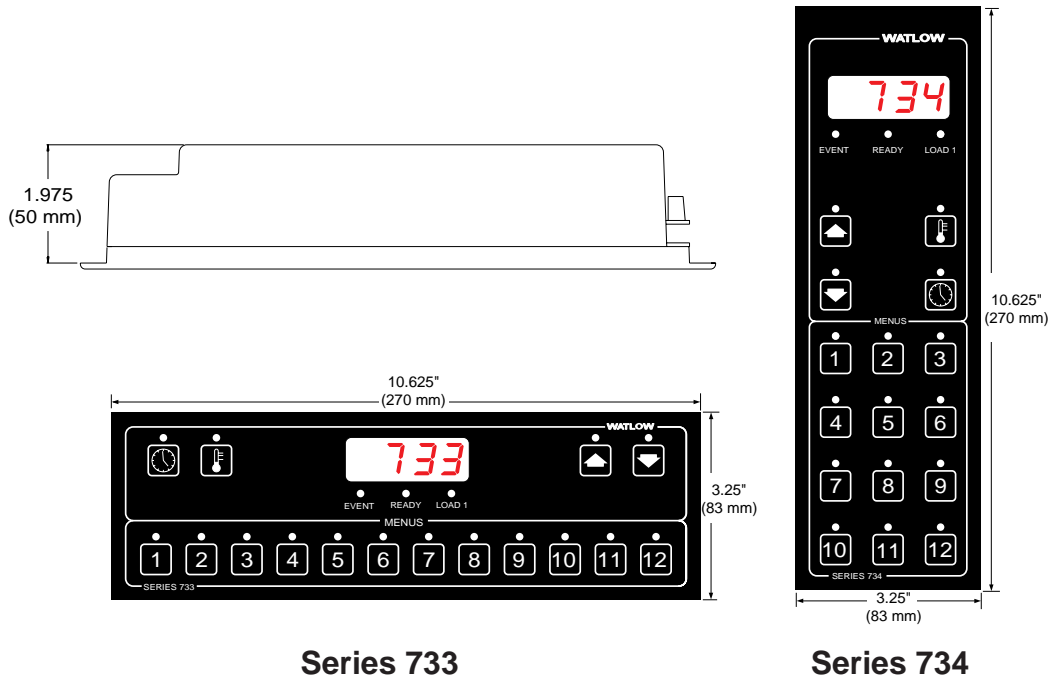
Your Feedback

Your comments or suggestions on the manual are welcome, please send them to: Technical Writer, Watlow Controls, 1241 Bundy Blvd., P.O. Box 5580, Winona, MN 55987-5580, or phone 507/454-5300. The Watlow Series 733/734 Service Manual and integral software are copyrighted by Watlow Winona, Inc., © 1995, with all rights reserved.

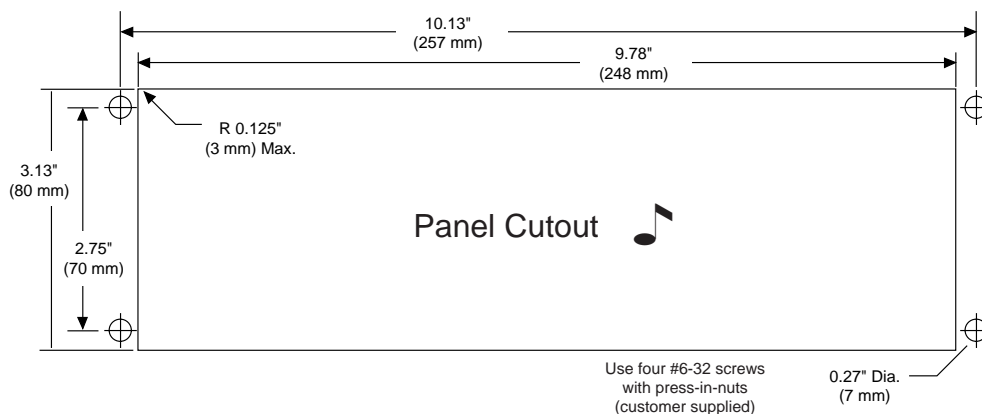
Chapter 1

Install and Wire the Series 733/734

Front panel mounting for ease of installation and service.



**Figure 1 -
Series 733 and 734
Dimensions.**



**Figure 2 -
Panel Cutout.**

1. Make a panel cutout per the dimensions given above.
2. Drill four 0.265 (7mm) diameter holes per the dimensions given above.. See Figure 2.
3. Mount the Series 733 or 734 with four #6-32 screws using press-in-nuts, weld nuts, or equivalent...

NOTE:
For Series 734
orientation (verti-
cal), rotate the panel
cutout 90°.

How to Wire the Series 733/734

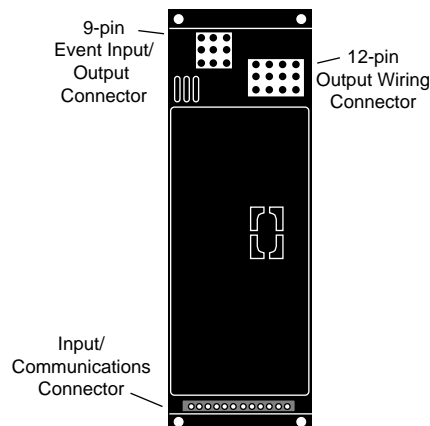
The Series 733/734 wiring is illustrated by model number option. Check the terminal designation sticker on the control and compare your model number to those shown here and also the model number breakdown on the inside back cover of this manual.

When you apply power without sensor inputs on the terminal strip, the Series 733/734 display alternates parameter data and Er07 at a 3 second rate.

This error indicates an open sensor or A/D error. Remove power to the control and connect the sensor properly. All wiring and fusing must conform to the National Electric Code and to any locally applicable codes as well.

Use Figure 6 as a location reference when wiring your unit.

**Figure 6 -
Series 733/734
Rear View.**



Power Wiring

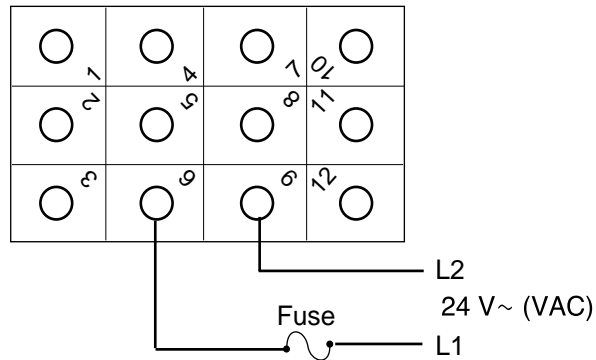


Figure 7 -
24V~ (VAC) Power
Wiring.



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

Input Wiring

Use this wiring connector as a reference for terminal orientation. Each individual wiring breakdown will only show the terminals used. This connector **only** applies to input wiring and communications wiring.

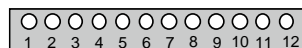


Figure 8 -
Input Wiring Con-
nector.



CAUTION:
Input power limited to 15 watts maximum. All components are rated for a maximum of 15 watts.

Input Wiring

Thermocouple Input


 **NOTE:**
Dual-zone thermocouple units require at least one ungrounded thermocouple.

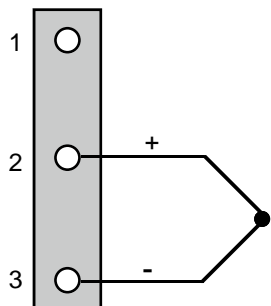
Figure 9 - Thermocouple Wiring.


73XX-**1**XXX-XXXX

73XX-**4**XXX-XXXX

73XX-**6**XXX-XXXX

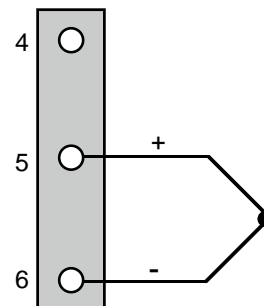
Zone 1



 (Dual Zone Only)

73XX-**4**XXX-XXXX

Zone 2



RTD Input

73XX-**2**XXX-XXXX

73XX-**5**XXX-XXXX

Zone 1

3 Wire RTD

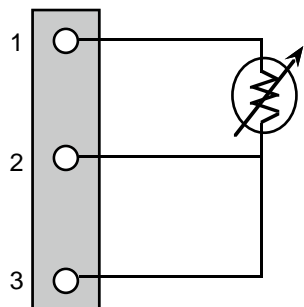
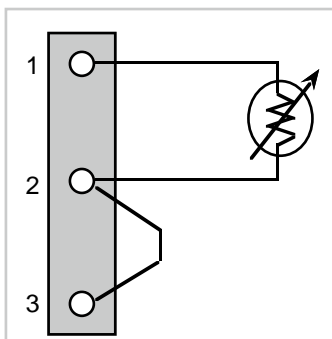


Figure 10 - 2 or 3 Wire RTD Wiring.



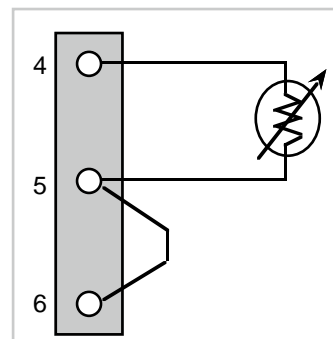
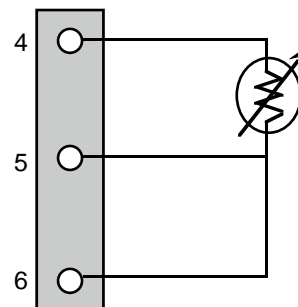
2 Wire RTD

(Dual Zone Only)

73XX-**5**XXX-XXXX

Zone 2

3 Wire RTD



2 Wire RTD

0-5VDC or 0-10VDC Process Input

Model # 73XX-**6**XXX-XXXX (Dual Zone Only)

Zone 2

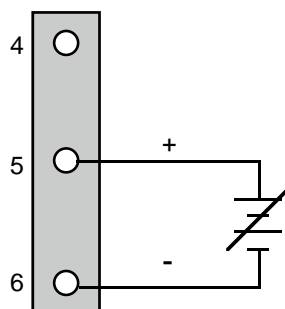


Figure 11 -
0-5VDC or 0-10VDC
Process Input
Wiring.

0-20mA or 4-20mA Process Input

Model # 73XX-**6**XXX-XXXX (Dual Zone Only)

Zone 2

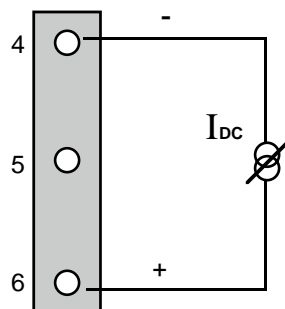


Figure 12 -
0-20mA or 4-20mA
Process Input
Wiring.

Output 1 Wiring

AC Output Wiring - Zone 1

Solid State Relay *with* Contact Suppression

Form A, 0.4 Amps
Off state impedance: 20K max.
73XX-XBXX-XXXX

Solid State Relay *without* Contact Suppression

Form A, 0.4Amps
Off state impedance: 31M max.
73XX-XKXX-XXXX

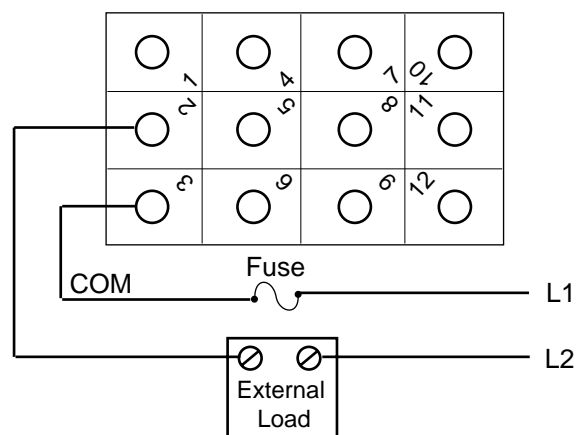
Mechanical Relay *with* Contact Suppression

Form A, 1 Amp
Off state impedance: 20K min.
73XX-XDXX-XXXX

Solid State Relay *without* Contact Suppression

Form A, 1 Amp
Off state impedance: 20k max.
73XX-XEXX-XXXX

Figure 13 -
AC Output 1 Wiring.



DC Output Wiring - Zone 1

Switched DC (Open Collector)

Non-isolated
Minimum load resistance: 500
73XX-XCXX-XXXX

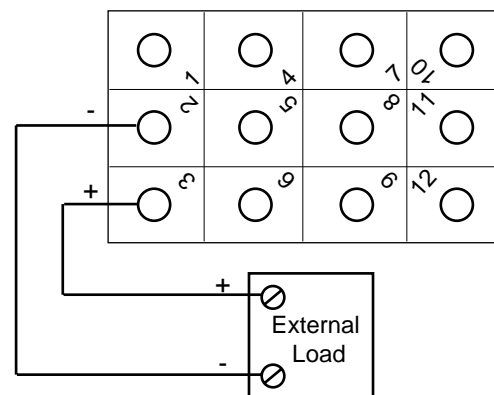
4-20mA Process Output

Non-isolated
Load impedance: 600 max.
73XX-XFXX-XXXX

0-5V~ (VDC) Process Output

Non-isolated
Load impedance: 10K min.
73XX-XHXX-XXXX

Figure 14 -
DC Output 1 Wiring.



AC Output Wiring - Zone 2

Solid State Relay *with* Contact Suppression

Form A, 0.4 Amps
Off state impedance: 20K max.
73XX-XXBX-XXXX

Mechanical Relay *with* Contact Suppression

Form A, 1 Amp
Off state impedance: 20K min.
73XX-XXDX-XXXX

Solid State Relay *without* Contact Suppression

Form A, 0.4 Amps
Off state impedance: 31M max.
73XX-XXKX-XXXX

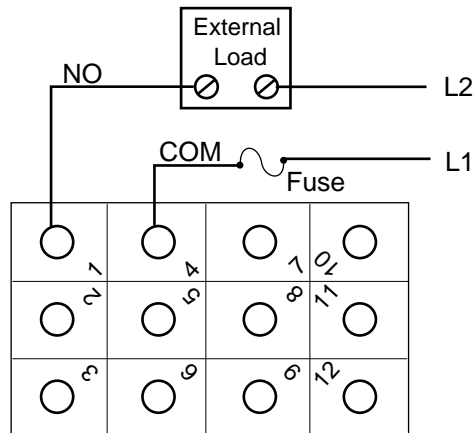


Figure 15 -
AC Output 2 Wiring.

DC Output Wiring - Zone 2

Switched DC (Open Collector)

Non-isolated
Minimum load resistance: 500
73XX-XXCX-XXXX

4-20mA Process Output

Non-isolated
Load impedance: 600 max.
73XX-XXFX-XXXX

0-5V= (VDC) Process Output

Non-isolated
Load impedance: 10K min.
73XX-XXHX-XXXX

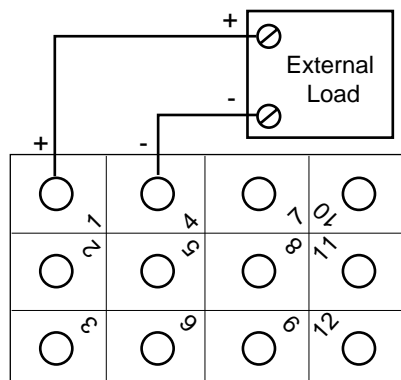


Figure 16 -
DC Output 2 Wiring.

Optional Wiring

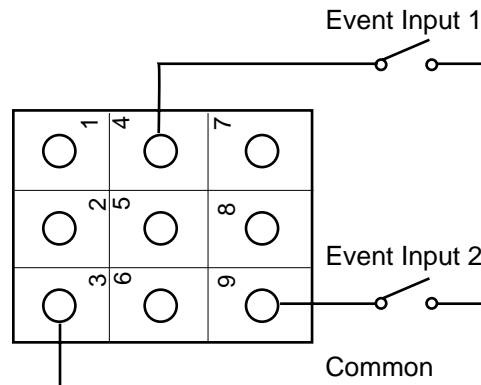


NOTE:
Event Input is not available on standard Series 733/734 controls. Consult factory for more information.

Figure 17 -
Event Input Wiring.

Event Input Wiring

2 Event Inputs
Non-isolated
73XX-XXX1-XXXX



Event Output Wiring

4 Event Outputs
Open Collector, Non-isolated
5mA Maximum Per Event
73XX-XXX1-XXXX

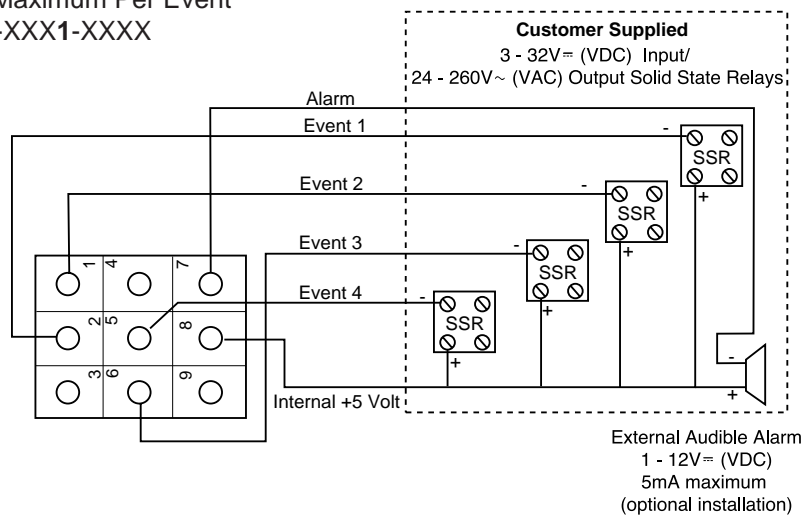


Figure 18 -
Event Output Wiring.

Alarm Wiring

Single Alarm
Mechanical Relay with
Contact Suppression
Form A, 1 Amp
73XX-XXXX-DXXX

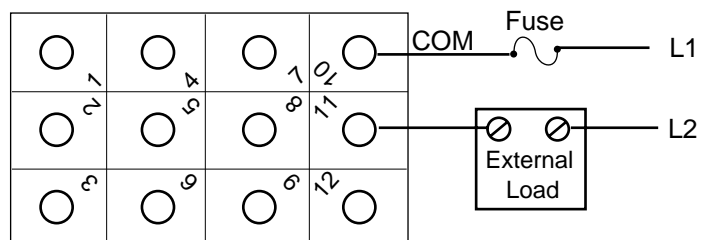
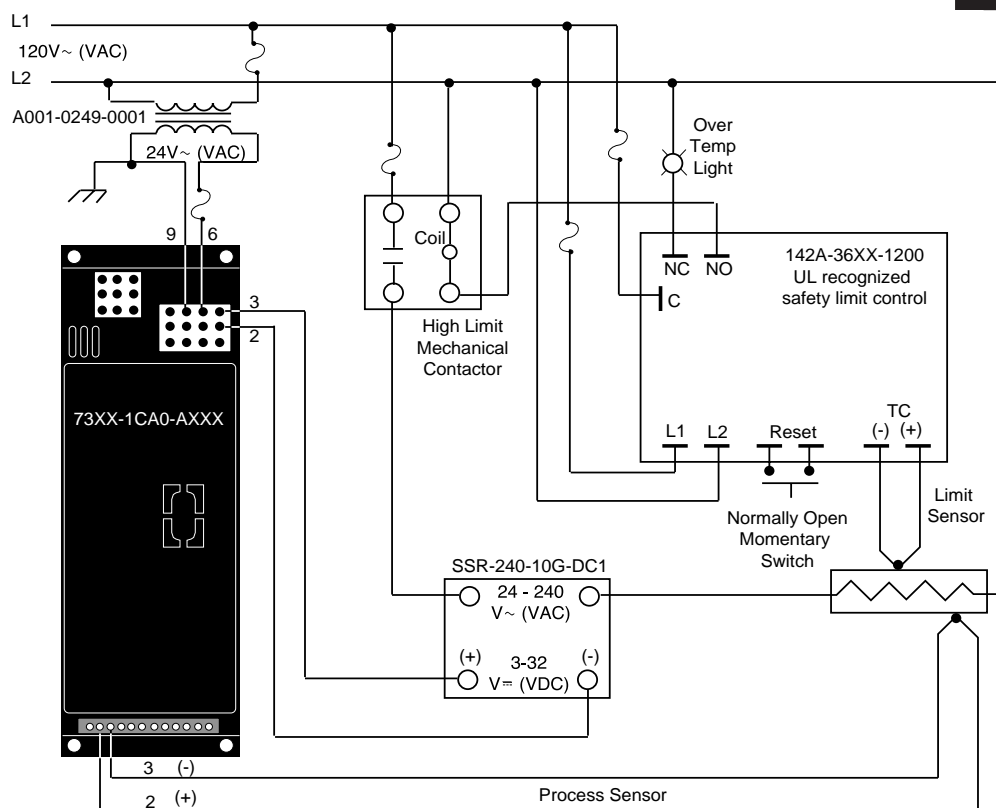
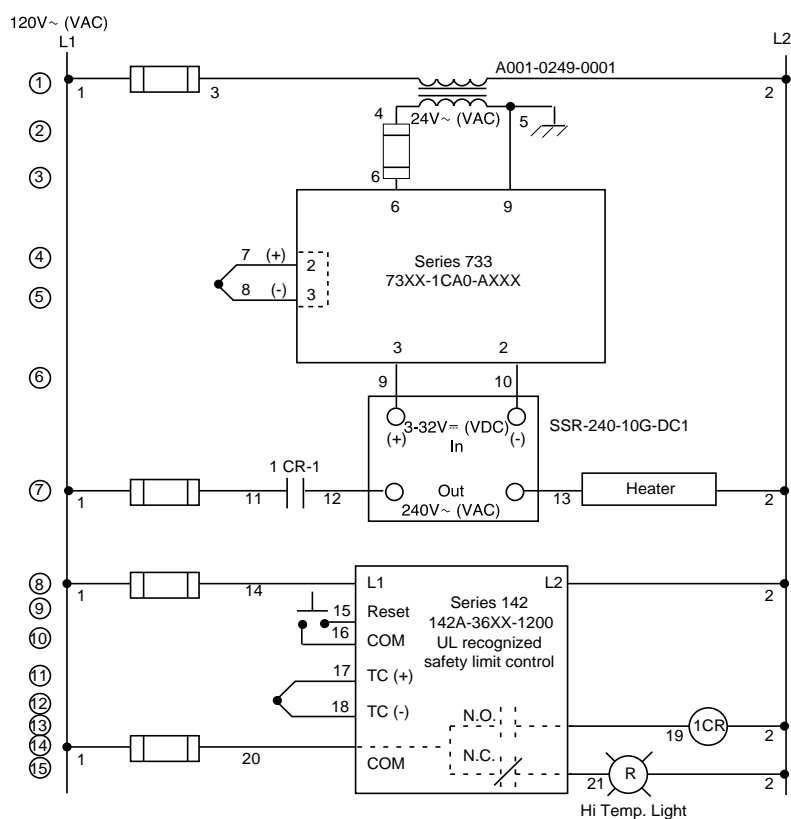


Figure 19 -
Alarm Wiring.

System Example



**Figure 20 -
System Wiring
Example.**



**Figure 21 -
Series 733/734
Ladder Diagram
Example.**

Chapter 2

The Setup Mode

Use the key sequence below to enter the Setup Mode.



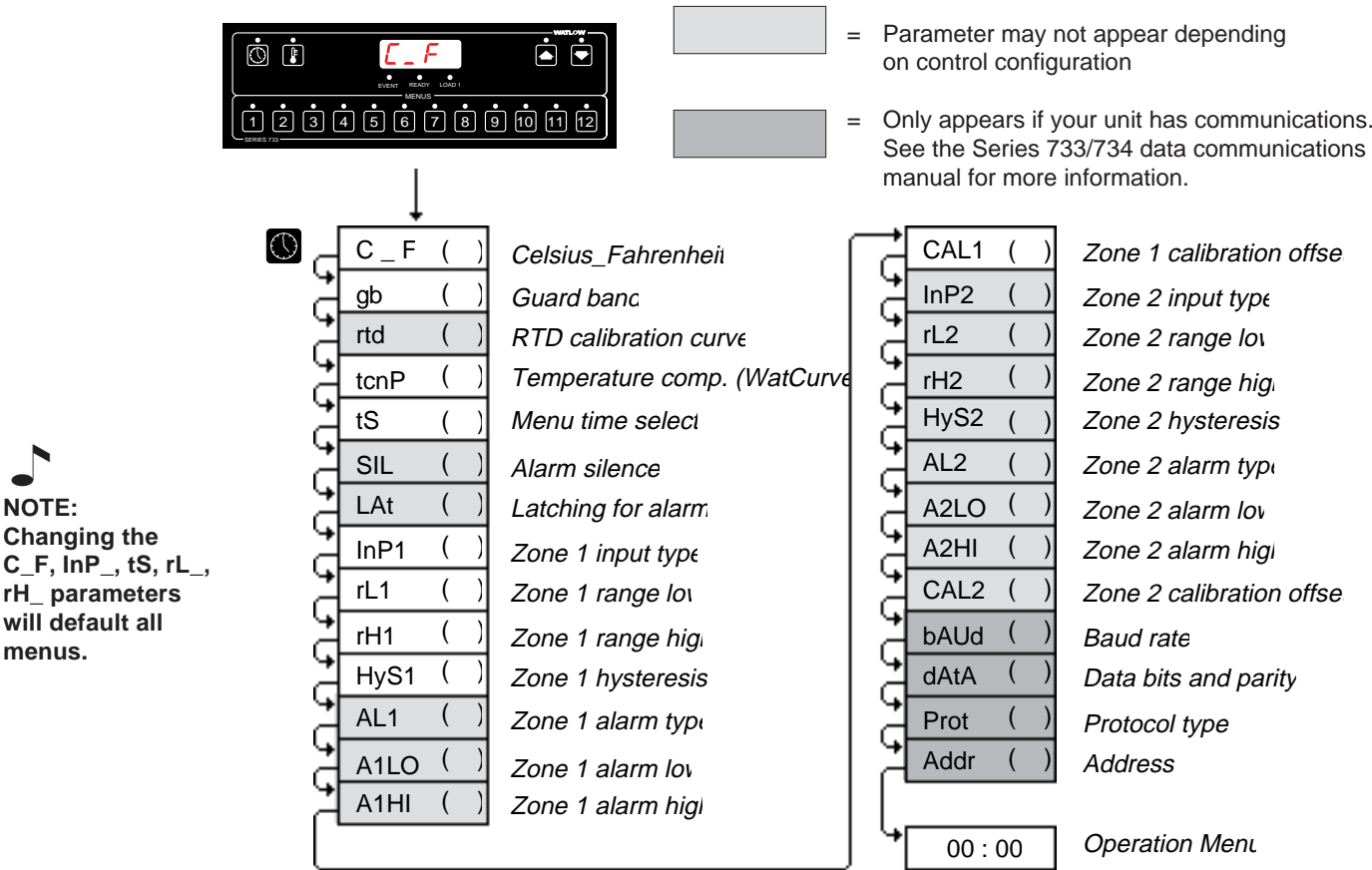
Advancing Through The Setup Mode

Press the TIME key

Select or Change Setup Data Within The Mode

Use the UP/DOWN keys . After 1 minute with no key activations, the Series 733/734 reverts to the Operation mode **0000**.

Figure 22 -
Setup Mode
Key Flow.



Setup Parameters

Celsius_Fahrenheit: Selects the units of temperature measurement.

Range: F or C

Default: F

Guard Band: Determines the process operating window (deviation) that both Zone 1 & 2 must be within before a menu is allowed to run. If you are within the guard band the READY LED is on and a menu can be run. If you are out of the guard band, the READY LED is OFF and the menu will not run.

Range: 1 to 4000°F/2222°C

Default: 4000°F/2222°C

RTD Calibration Curve: Selects the RTD calibration curve for RTD inputs.

Appears if InP1 = rtd for Zone 1, or InP2 = rtd for Zone 2. This parameter only appears if you have a unit with RTD input.

JIS = 0.003916 / °C, DIN = 0.003850 / °C

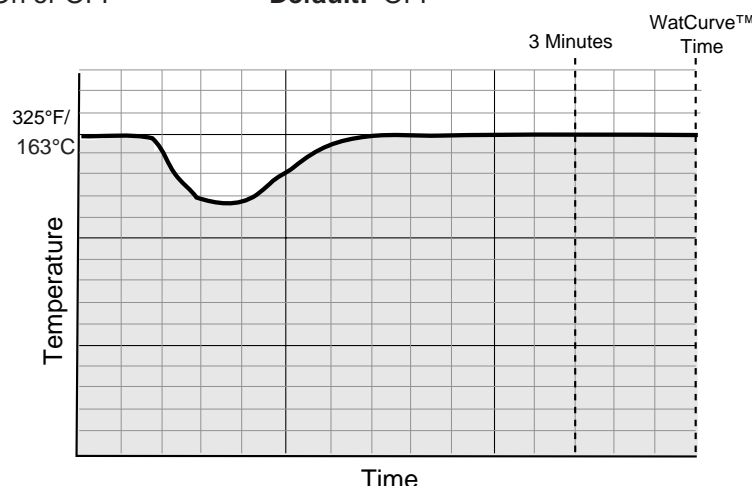
Range: din or JIS

Default: din

Temperature Compensation (WatCurve™): Automatically re-calculates and adjusts a menu cooking time as a result of a disturbance — such as, opening the oven door. WatCurve™ is a Watlow innovation. Enabled when tcnP = On.

Range: On or OFF

Default: OFF



In this example, a process is running at 325°F/163°C. A basket of french fries is dropped into the oil, which dropped the process temperature to 240°F/116°C. The fries normally take 3 minutes to cook, but since the temperature dropped, the cooking time must be extended. WatCurve™ determines the amount of time which must be added in relation to the drop in process temperature and the rate of rise.

Time Select: Selects the time base used for the menu time, and remaining time for each zone. Can be expressed in either hours:minutes or minutes:seconds.

Range: hrnn or nnSc

Default: nnSc

Alarm Silence: Enables or disables the alarm silence function. This parameter only appears if your unit has alarms, and AL1 no and AL2 no.

Range: On or OFF

Default: OFF

Display alternates between parameter and programmed data.

C_F

F

gb

4000

rtd

din

tcnP

OFF



NOTE:
Countdown time will speed up or slow down depending on WatCurve™ algorithm.

Figure 23 -
WatCurve™
Example.



NOTE:
All menus will have the same time base (hours/minutes, or minutes/seconds).

tS

nnSc

SIL

OFF

Setup

Display alternates between parameter and programmed data.

LA_t
nL

Alarm Latching: Selects whether the alarm output is latching or non-latching. This parameter only appears if your unit has alarms, and AL1 no and AL2 no.
Range: LA or nL **Default:** nL

InP1
J

Input Type 1: Selects the sensor input type for Zone 1. Only those input types which are compatible with your unit will appear. See the model number information on the inside back cover for your type.
Range: J, K (appears as H), E, rtd **Default:** J or rtd

rL1
32

Range Low 1: Selects the low end of the operating range for Zone 1. This parameter determines the low end of the set point and alarms. See the model number and specification information on the inside back cover, and Table 1 on Page 14 for sensor range values.
Range: Sensor range low to rH1 **Default:** Low limit of sensor type

rH1
1382

Range High 1: Selects the high end of the operating range for Zone 1. This parameter determines the high end of the set point and alarms. See the model number and specification information on the inside back cover, and Table 1 on Page 14 for sensor range values.
Range: Sensor range high to rL1 **Default:** High limit of sensor type

HYS1
3

Hysteresis 1: Selects the switching hysteresis for Zone 1 when Pb1 = 0 (ON/OFF). See Page 17 for the Pb1 parameter.
Range: 1 to 99°F/1 to 55°C **Default:** 3°F

AL1
Pr

Alarm Type 1: Determines whether the alarm type for Zone 1 is process (Pr), deviation (dE), or none (no). A process alarm is set at an absolute temperature. A deviation alarm follows or tracks the set point. This parameter only appears if your unit has alarms.
Range: Pr, dE, no **Default:** Pr

A1LO
32

Alarm 1 Low: Represents the low process alarm or low deviation alarm for Zone 1. This parameter only appears if your unit has alarms, and AL1 no.
If AL1 = dE: **Range:** 0 to -999°F/0 to -555°C **Default:** -999°F
If AL1 = Pr: **Range:** rL1 to A1HI **Default:** rL1

A1HI
1382

Alarm 1 High: Represents the high process alarm or high deviation alarm for Zone 1. This parameter only appears if your unit has alarms, and AL1 no.
If AL1 = dE: **Range:** 0 to 999°F/0 to 555°C **Default:** 999°F
If AL1 = Pr: **Range:** A1LO to rH1 **Default:** rH1

CAL1
0

Calibration Offset 1: Adds or subtracts degrees from the Zone 1 input signal.
Range: -99 to 99°F/-55 to 55°C **Default:** 0

InP2
J

Input Type 2: Selects the sensor input type for Zone 2. Only those input types which are compatible with your unit will appear. This parameter only appears if you have a dual zone control. See the model number information on the inside back cover and Table 1 on Page 6 for your input type.
Range: J, K (appears as H), E or rtd or 0-5, 420, 010, 020
Default: J or rtd or 0-5

Range Low 2: Selects the low end of the operating range for Zone 2. This parameter determines the low end of the process input, set point and alarms. See the model number and specification information on the inside back cover, and Table 1 below for sensor range values. 0.0VDC, 0mA or 4mA represent Range Low (rL) for process inputs and outputs. The process input is linearly scaled between rL and rH. This parameter only appears if you have a dual zone control.

Range: Sensor range low to rH2 **Default:** Low limit of sensor type

Display alternates between parameter and programmed data.

rL2

32

Range High 2: Selects the high end of the operating range for Zone 2. This parameter determines the high end of the process input, set point and alarms. 5.0VDC, 10.0VDC, or 20mA represent Range High (rH2) for process inputs and outputs. The process input is linearly scaled between rL and rH. This parameter only appears if you have a dual zone control.

Range: Sensor range high to rL2 **Default:** High limit of sensor type

rH2

1382

Hysteresis 2: Selects the switching hysteresis for Zone 2 when Pb2 = 0 (ON/OFF). See Page 17 for the Pb2 parameter. This parameter only appears if you have a dual zone control.

Range: 1 to 99°F/1 to 55°C/1 to 99 Units **Default:** 3°F

HYS2

3

Alarm Type 2: Determines whether the alarm type for Zone 2 is process (Pr), deviation (dE), or none (no). A process alarm is set at an absolute temperature. A deviation alarm follows or tracks the set point. This parameter only appears if you have a dual zone control and has alarms.

Range: Pr, dE, no

Default: Pr

AL2

Pr

Alarm 2 Low: Represents the low process alarm or low deviation alarm for Zone 2. This parameter only appears if you have a dual zone control, alarms, and AL2 no. If AL2 = dE:

Range: 0 to -999°F/0 to -555°C/0 to -999 Units **Default:** -999°F

If AL2 = Pr:

Range: rL2 to A2HI

Default: rL2

A2LO

32

Alarm 2 High: Represents the high process alarm or high deviation alarm for Zone 2. This parameter only appears if you have a dual zone control, alarms, and AL2 no. If AL2 = dE:

Range: 0 to 999°F/0 to 555°C/0 to 999 Units **Default:** 999°F

If AL2 = Pr:

Range: A2LO to rH2

Default: rH2

A2HI

1382

Calibration Offset 2: Adds or subtracts degrees from the Zone 2 input signal. This parameter only appears if you have a dual zone control.

Range: -99 to 99°F/-55 to 55°C/-99 to 99 Units **Default:** 0

CAL2

0

Parameters that appear after CAL2 are related to data communications. For more information see **How to Use Data Communications with the Watlow Series 733/734**.

Input Type	Sensor Range Low	Sensor Range High
J	32°F/0°C	1382°F/750°C
K (appears as H)	32°F/0°C	2282°F/1250°C
E	32°F/0°C	1220°F/660°C
rtd (1°)	32°F/0°C	1112°F/600°C
0-5 or 010 (VDC)	-500	3500
020 or 420 (mA)	-500	3500

Table 1 - Input Ranges.

**Table 2 -
Setup Mode
Parameters and
Descriptions.**

Setup Mode

Use this page as a master copy for your Series 733/734 Setup mode parameters.

Do not enter any values here; make photocopies instead.

Parameter	Value	Range	Factory Default	Appears If:
C_F		C or F	F	
gb		1 to 4000°F/2222°C	4000°F/2222°C	
rtd		JIS or din	din	Input type is RTD
tncP		On or OFF	OFF	
tS		hrnn or nnSc	nnSc	
SIL		On or OFF	OFF	Unit has alarms, AL1 no & AL2 no
LA_t		LA or nL	nL	Unit has alarms, AL1 no & AL2 no
InP1		J, K (appears as H), E or rtd	J or rtd	Dependent on model number information
rL1		Sensor range low to rH1	Low limit sensor type	
rH1		Sensor range high to rL1	High limit of sensor type	
HYS1		1 to 99°F/1 to 55°C	3°F	
AL1		Pr, dE or no	Pr	Unit has alarms
A1LO		<i>If AL1 = dE:</i> 0 to -999°F/ 0 to -555°C <i>If AL1 = Pr:</i> rL1 to A1HI	-999°F rL1	Unit has alarms & AL1 no
A1HI		<i>If AL1 = dE:</i> 0 to 999°F/ 0 to 555°C <i>If AL1 = Pr:</i> A1LO to rH1	999°F rH1	Unit has alarms & AL1 no
CAL1		-99 to 99°F/-55 to 55°C/-99 to 99Units	0	
InP2		J, K (appears as H), E or rtd or 0-5, 420, 010, 020	J or rtd or 0-5	Dependent on model number information
rL2		Sensor range low to rH2	Low limit sensor type	Hardware is present
rH2		Sensor range high to rL2	High limit of sensor type	Hardware is present
HYS2		1 to 99°F/1 to 55°C/ 1 to 99 units	3°F	Hardware is present
AL2		Pr, dE or no	Pr	Hardware is present
A2LO		<i>If AL2 = dE:</i> 0 to -999°F/ 0 to -555°C/0 to -999 Units <i>If AL2 = Pr:</i> rL2 to A2HI	-999°F rL2	Hardware is present & AL2 no
A2HI		<i>If AL2 = dE:</i> 0 to 999°F/ 0 to 555°C/0 to 999 Units <i>If AL2 = Pr:</i> A2LO to rH2	999°F rH2	Hardware is present & AL2 no
CAL2		-99 to 99°F/-55 to 55°C/-99 to 99Units	0	Hardware is present

Chapter 3



The Service Mode

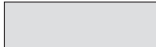
Enter the Service mode by pressing the key sequence illustrated below.



The display shows the **AUT 1** parameter.

Move through the Service mode by pressing the TIME key .

Use the UP/DOWN   keys to select data. After 1 minute without key activations, the Series 733/734 reverts to the Operation mode **0000**.

 = Parameter may not appear depending on control configuration

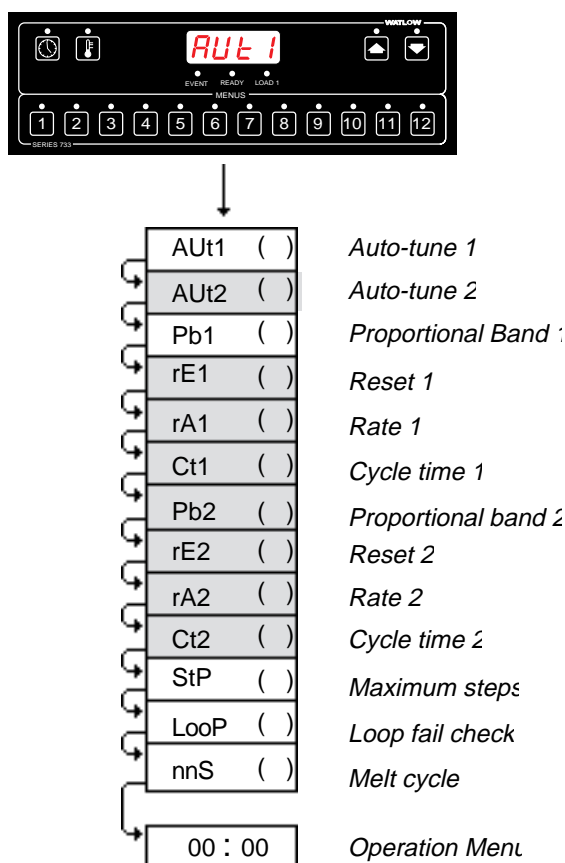


Figure 23 - Service Mode Key Flow.

Service

Display alternates
between parameter and
programmed data.

AUt1

0

AUt2

0

Pb1

25

rE1

0.00

rA1

0.00

Ct1

5

Pb2

25

rE2

0.00

rA2

0.00

Service Parameters

Auto-tune Zone 1: Initiates auto-tune for Zone 1. For more information on tuning, see Chapter 4, Page 19.

Range: 0 = off, 1 = slow, 2 = medium, 3 = fast

Default: 0

Auto-tune Zone 2: Initiates auto-tune for Zone 2. For more information on tuning, see Chapter 4, Page 19.

Range: 0 = off, 1 = slow, 2 = medium, 3 = fast

Default: 0

Proportional Band 1: A proportional band expressed in degrees F or C, within which a controller proportioning function is active for Zone 1. When Pb1 = 0, it functions as an ON/OFF control. The switching differential is then determined by the HYS1 parameter in the Setup mode. See Page 15.

Range: 0 to 999°F/0 to 555°C

Default: 25°F

Reset 1: A reset (integral) control action for Zone 1 automatically eliminates offset, or "droop," between set point and actual process temperature in a proportional control. This parameter only appears if Pb1 = 0.

Range: 0.00 to 9.99 repeats/minute

Default: 0.00

Rate 1: The rate (derivative) function for Zone 1 which affects the speed or rate at which the process temperature approaches the set point to minimize overshoot and/or undershoot. The rate is determined by how fast the error is changing. This parameter only appears if Pb1 = 0.

Range: 0.00 to 9.99 minutes

Default: 0.00

Cycle Time 1: Expressed in seconds, time for a controller to complete one ON/OFF cycle for Zone 1. Time between successive turn ons. This parameter only appears if Pb1 = 0.

Range: 1 to 60 seconds

Default: 5

Proportional Band 2: A proportional band expressed in degrees or process units, within which a controller proportioning function is active for Zone 2. When Pb2 = 0, it functions as an ON/OFF control. The switching differential is then determined by the HYS2 parameter. This parameter only appears if you have a dual zone control.

Range: 0 to 999°F/0 to 555°C/0 to 999 units

Default: 25°F

Reset 2: A reset (integral) control action for Zone 2 automatically eliminates offset, or "droop," between set point and actual process temperature in a proportional control. This parameter only appears if your unit has a secondary output and Pb2 = 0.

Range: 0.00 to 9.99 repeats/minute

Default: 0.00

Rate 2: The rate (derivative) function for Zone 2 which affects the speed or rate at which the process temperature approaches the set point to minimize overshoot and/or undershoot. The rate is determined by how fast the error is changing. This parameter only appears if your unit has a secondary output and Pb2 = 0.

Range: 0.00 to 9.99 minutes

Default: 0.00

Service

Display alternates between parameter and programmed data.

Cycle Time 2: Expressed in seconds, time for a controller to complete one ON/OFF cycle for Zone 2. Time between successive turn ons. This parameter only appears if you have a dual zone control, and Pb2 = 0.

Range: 1 to 60 seconds

Default: 5

Ct2
5

Menu Steps: Determines the maximum number of steps allowed in a menu.

Range: 1 to 3

Default: 3

StP
3

Loop Fail Check: This parameter checks for an open or shorted sensor and enables the error code function. This parameter only functions in the proportional control mode (Pb1 = 0 /ON/OFF).

Range: On or OFF

Default: OFF

LooP
OFF

Melt Cycle: Enable or disables the melt cycle function. When enabled and the process value is less than 212°F/100°C, the corresponding zone output will go to a percent power duty cycle.

Range: On or OFF

Default: OFF

nnS
OFF

Service Mode

Use this page as a master copy for your Series 733/734 Service mode parameters.

Do not enter any values here; make photocopies instead.

**Table 3 -
Service Mode
Parameters and
Descriptions.**

Parameter	Value	Range	Factory Default	Appears If:
AUt1		0 - 3	0	
AUt2		0 - 3	0	Hardware is present
Pb1		0 to 999°F/0 to 555°C	25°F	
rE1		0.00 to 9.99 repeats/minute	0.00	Pb1 = 0
rA1		0.00 to 9.99 minutes	0.00	Pb1 = 0
Ct1		1 to 60 seconds	5	Pb1 = 0
Pb2		0 to 999°F/0 to 555°C/0 to 999 Units	25°F	Hardware is present
rE2		0.00 to 9.99 repeats/minute	0.00	Hardware is present Pb2 = 0
rA2		0.00 to 9.99 minutes	0.00	Hardware is present Pb2 = 0
Ct2		1 to 60 seconds	5	Hardware is present Pb2 = 0
StP		1 to 3	3	
LooP		On or OFF	OFF	
nnS		On or OFF	OFF	

Chapter 4 Tuning

Auto-tuning

Auto-tuning applies to Zone 1 or 2.

The auto-tuning procedure operates on a thermal response value — slow, medium, or fast. Use the slow thermal response when your process does not reach set point too rapidly, or if it usually does not exceed set point a lot. A fast thermal response produces a rapid temperature change over a short period of time.

Once the auto-tune sequence has begun, the Zone 1 or 2 proportional band is set to 0 and the control goes into an ON/OFF mode of control at 90% of the established set point. The displayed set point remains unchanged. The display alternates between At _ and the current parameter.

Once the control learns the thermal system response, it returns to a standard PID control using the PID values automatically set as a result of auto-tuning. Any change of the set point, while in auto-tune, re-initiates the auto-tune procedure.

In order for the 733/734 to successfully complete auto-tune, the process must cross the 90% value of set point four times within 80 minutes after auto-tune has started. If this does not happen within the 80 minute time limit, the Pb remains at 0 and the control functions in an ON/OFF mode.

NOTE:
An **X** applies to either Zone 1 or Zone 2.

NOTE:
In dual zone applications, allow Zone 1 to complete before tuning Zone 2.

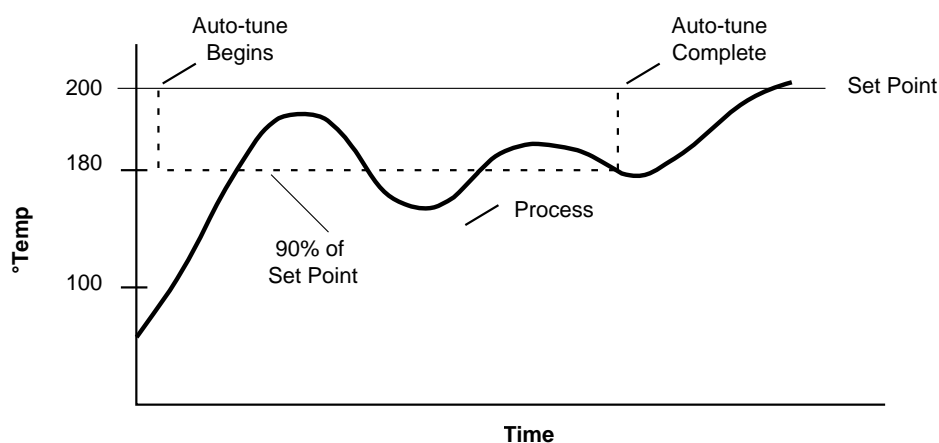


Figure 24 -
Auto-tuning at a Set
Point of 200°F.

To start auto-tuning:

1. Enter the Service mode by pressing the key sequence . **AUT 1** appears in the display.

To auto-tune Zone 2, press the Time key and **AUT 2** appears.

2. **Select a thermal response value** using the UP/DOWN keys, 1=slow, 2=medium, and 3=fast. A thermal response value of 2 satisfactorily tunes most thermal systems.
3. **When tuning is complete**, the display returns to its previous state and **AUtX** reverts to 0. The 733/734 installed appropriate PID tuning parameters and saved them in the non-volatile memory. **If a mechanical relay or contactor is switching power to the load, a longer cycle time may be desirable to minimize wear on the mechanical components. Typical life of a mechanical relay is 100,000 cycles at rated load.**

To abort auto-tuning, the operator must reset the **AUtX** parameter to 0, or cycle power off and on, or enter the Calibration mode. In all cases, aborting auto-tune restores all values to those previous to auto-tuning.

Manual Tuning

For optimum control performance, tune the Series 733/734 to your thermal system. The tuning settings here are for a broad spectrum of applications; your system may have somewhat different requirements. **NOTE: This is a slow procedure, taking from minutes to hours to obtain optimum values.**

1. **Apply power to the Series 733/734** and enter a set point. Begin with these Service parameters: **Pb** = 1, **rE** = 0.00, **rA** = 0.00, **Ct** = 5, **CAL** = 0, **AUt** = 0.
2. **Proportional Band Adjustment** : Gradually increase **Pb** until the displayed temperature stabilizes to a constant value. The process temperature may not be right on set point because the initial reset value is 0.00 repeats per minute.
3. **Reset Adjustment**: Gradually increase **rE** until the displayed temperature begins to oscillate or "hunt." Then slowly decrease **rE** until the temperature stabilizes again near set point.
4. **Cycle Time Adjustment**: Set **Ct** as required. Faster cycle times sometimes achieve the best system control. However, if a mechanical contactor or solenoid is switching power to the load, a longer cycle time may be desirable to minimize wear on the mechanical components. Experiment until the cycle time is consistent with the quality of control you want. **Ct** does not effect units with a process output.
5. **Rate Adjustment**: Increase **rA** to 1.00 minute. Raise set point by 20° to 30°F, or 11° to 17°C, observe the system's approach to set point. If the load temperature overshoots set point, increase **rA** to 2.00 minutes.

Next raise set point by 20 to 30°F, or 11 to 17°C and watch the approach to the new set point. If you increase **rA** too much, approach to set point will be very sluggish. Repeat as necessary until the system rises to the new set point without overshooting or approaching the set point too slowly.

6. **Calibration Offset Adjustment**: You may want your system to control to a temperature other than the value coming from the input sensor. If so, measure the difference between that temperature (perhaps at another point in the system) and the process value showing in the display. Then enter the **CAL** offset value you want. Calibration offset adds or subtracts degrees from the value of the input signal.



NOTE:

Tune each zone at a set point above ambient temperature.

Chapter 5 The Calibration Mode

Before attempting to calibrate, make sure you have the proper equipment called for in each procedure.

Use the key sequence below to enter the Calibration Mode.

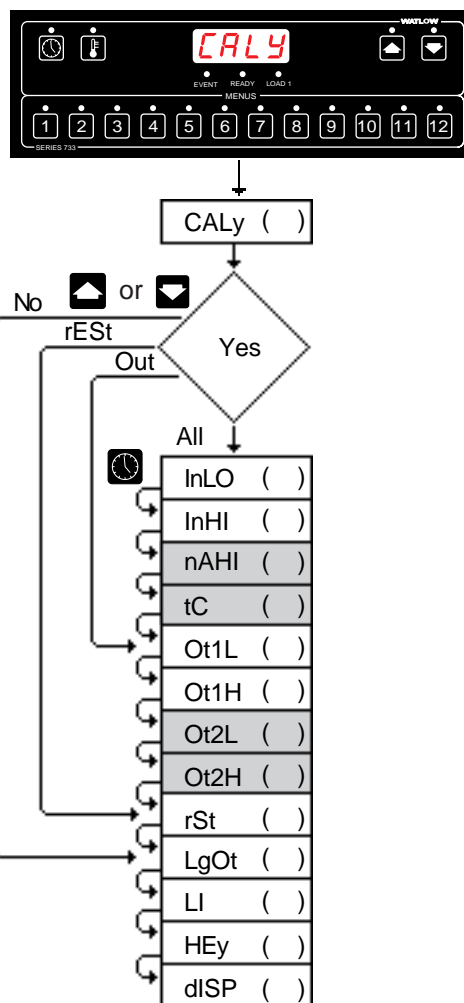


In the Calibration Mode, various input signals must be supplied in order for the control to go through its auto calibration.

Press the TIME key to advance through the Calibration Menu.

Use the UP/DOWN keys to change data. After 1 minute with no key activations, the Series 733/734 reverts to the Operation mode **0000**.

Figure 25 -
Calibration Mode
Parameters.



NOTE:
While in the Calibra-
tion Mode, all
control outputs are
OFF.



**Before attempting to calibrate,
make sure you have the proper
equipment called for in each procedure.**

**The Series 733/734 is calibrated and tested
before leaving the factory.**

Calibration Parameters

Calibrate: Determines which parameters, if any are to be calibrated. Choose one of the options below:

CALy

- ALL All parameters are calibrated. The next parameter is InLO.
- OUT Only the process outputs are calibrated. The display skips to the Ot1L parameter.
- no No parameters are calibrated. The display skips to the LgOt parameter.
- rEST Restores factory calibration parameters. See Page 26 for more information.

Input Low: The low calibration point for each zone. Input 0.00mV uncompensated for thermocouple and process units. Input 100 for RTD units.

InLO

Input High: The high calibration point for each zone. Input 50mV for single and dual t/c versions, **or** input 317.33 for RTD units, **or** input 10V for dual input t/c and process units on Zone 2.

InHI

mA Input High: Represents the high current calibration point for Zone 2, input 20mA. Applies only to thermocouple and process input. Only applies to Zone 2 inputs.

nAHI

Thermocouple Compensator: Used to calibrate the thermocouple reference compensator for units with thermocouple input. Input 0.00mV compensated through Type J reference compensator (32°F/0°C).

tC

4-20mA Output Low (Zone 1): Represents the process output low current calibration point for Zone 1. Applies to 0-5VDC and 4-20mA outputs only.

Ot1L

4-20mA Output High (Zone 1): Represents the process output high current calibration point for Zone 1. Applies to 0-5VDC and 4-20mA outputs only.

Ot1H

4-20mA Output Low (Zone 2): Represents the process output low current calibration point for Zone 2. Applies to 0-5VDC and 4-20mA outputs only. This parameter only appears if you have a dual zone control.

Ot2L

4-20mA Output High (Zone 2): Represents the process output high current calibration point for Zone 2. Applies to 0-5VDC and 4-20mA outputs only. This parameter only appears if you have a dual zone unit.

Ot2H

Calibration

rSt

Restore : Restores factory calibration parameters. See below for more information.

LgOt

Logic Output Test: Used to test all the control and logic outputs.

0	=	All outputs OFF	1	=	Output #1 ON
2	=	Output #2 ON	3	=	Alarm ON
4	=	Event #1 ON	5	=	Event #2 ON
6	=	Event #3 ON	7	=	Event #4 ON
8	=	Audible output ON			

LI

Logic Inputs: This parameter reads all the board option jumpers and the event inputs. Factory use only.

HEy











Keyboard: Used to read all the keys in hexadecimal.

dISP

Display Test: Performs a display test. A sequence of characters will move across the seven-segment displays and LED's. This parameter will continue until you advance.

Restoring Factory Calibration

The rSt parameter restores the factory calibration values to the Series 733/734. If you calibrate your control incorrectly, you have the option to default to the original values. Once you leave the CAL menu, the values are entered.

1. Enter the Calibration mode by using the key sequence      .
2. **CALY** appears. Press the Up key  until the **RESET** parameter appears.
3. Press the Time key , the **rSt** parameter is displayed.
4. Press the Up key  once and **YES** will appear. Press the Time key .
5. The Series 733/734 will beep and advance to the **LgOt** parameter.

This procedure is only to be used to restore calibration. It is not meant to default any other values.

Thermocouple Field Calibration Procedure (Single & Dual Thermocouple Only)

For model #'s: 73XX-1XXX-XXXX 73XX-4XXX-XXXX

Equipment Required:

- Type "J" Reference Compensator with reference junction at 32°F/0°C **OR** Type "J" Thermocouple Calibrator set at 32°F/0°C.
- Precision millivolt source, 0-50mV min. range, 0.01mV resolution

Two millivolt sources and two compensators **OR** two thermocouple calibrators are required for dual zone controls.

Setup And Calibration

1. Connect the AC line voltage L1 and L2 to the proper terminals.
2. For Zone 1, connect the millivolt source to Terminal #2 Positive and Terminal #3 Negative on the Series 733/734 terminal strip. Use regular 20-24 gauge wire.

For Zone 2, connect the millivolt source to Terminal #5 Positive and Terminal #6 Negative on the Series 733/734 terminal strip. Use regular 20-24 gauge wire.

3. Apply power to the unit and allow it to warm up for 15 minutes. **After warm-up** put the unit in the CAL menu. See the beginning of this chapter.
4. At the CALy parameter, select ALL. At the InLO prompt, enter 0.00 mV from the millivolt source to the control for each zone. Allow at least 10 seconds to stabilize. Press the Time key.
5. At the InHI prompt, enter 50.0mV from the millivolt source, for each zone. Allow at least 10 seconds to stabilize. Press the Time key.
6. At the tc prompt, disconnect the millivolt source, and connect the reference compensator or t/c calibrator to Terminal #2 Positive, and Terminal #3 Negative for Zone 1, and to Terminal #5 Positive and Terminal #6 Negative for Zone 2. If using a compensator, turn on and short the input wires. If using "J" calibrator, set to simulate 32°F/0°C. Allow 10 seconds for the control to stabilize.

To conclude the t/c calibration, press the Time key to advance through the Calibration mode. To continue calibrating your outputs, press the Time key once. The unit will leave the Calibration mode if 1 minute passes between key activations and retains all changed values.



NOTE:

Before calibration on an installed control, make sure all data and parameters are documented. See Setup, and Service Tables, Pages16 and 19.



NOTE:

Always press the Time key to advance to the next parameter before changing the calibration equipment.

RTD Field Calibration Procedure (Single & Dual RTD Only)

For model #'s: 73XX-2XXX-XXXX 73XX-5XXX-XXXX



NOTE:

Before calibration on an installed control, make sure all data and parameters are documented. See Setup, and Service Tables, Pages 16 and 19.




NOTE:

Always press the Time key to advance to the next parameter before changing the calibration equipment.

Equipment Required:

- 1K precision decade resistance box with 0.01 resolution. For dual zone units, two decade boxes are required.

Setup And Calibration

1. Connect the AC line voltage L1 and L2 to the proper terminals.
2. Connect the decade resistance box to Terminal #1, 2 and 3 for Zone 1. For Zone 2 units connect the decade resistance box to Terminal #4, 5, 6 on the terminal strip. Use regular 20 - 24 gauge wire of the same length and type.
-  3. Apply power to the unit and allow it to warm up for 15 minutes. **After warm-up** put the unit in the Calibration mode. See the beginning of this chapter.
4. At the CALy parameter, select ALL. Press the Time key. At the InLO prompt, set the decade resistance box to 100.0. Allow at least 10 seconds to stabilize. Press the Time key.
5. At the InHI prompt, set the decade resistance box to 317.33. Allow at least 10 seconds to stabilize. Press the Time key.

To conclude the RTD calibration, press the Time key to advance through the Calibration mode. To continue calibrating your outputs, press the Time key once. The unit will leave the Calibration mode if 1 minute passes between key activations and retains all changed values.

Thermocouple/Process Input Field Calibration Procedure

For model #: 73XX-6XXXX-XXXX


Equipment Needed

- Type "J" Reference Compensator with reference junction at 32°F/0°C **OR** Type "J" Thermocouple Calibrator set at 32°F/0°C.
- Precision millivolt source, 0-50mV min. range, 0.01mV resolution
- Precision voltage source 0-10 volt minimum range with 0.001 volt resolution.
- Precision current source 0 - 20mA minimum range with 0.001 volt resolution.

Setup And Calibration

1. Connect the AC line voltage L1 and L2 to the proper terminals.
2. For Zone 1, connect the millivolt source to Terminal #2 Positive and Terminal #3 Negative on the Series 733/734 terminal strip. Use regular 20-24 gauge wire.

For Zone 2, connect the voltage source to Terminal #5 Positive and Terminal #6 Negative on the Series 733/734 terminal strip. Use regular 20-24 gauge wire.

-  3. Apply power to the unit and allow it to warm up for 15 minutes. **After warm-up** put the unit in the CAL menu. See the beginning of this chapter.
4. At the CALy parameter, select ALL. At the InLO prompt, enter 0.00 mV from the millivolt source to the control for each zone. Allow at least 10 seconds to stabilize. Press the Time key.
5. At the InHI prompt, enter 50.0mV from the millivolt source for Zone 1. For Zone 2, enter 10.00V from the voltage source. Allow at least 10 seconds to stabilize. Press the Time key.
6. At the nAHI prompt, remove the voltage source from Zone 2. Connect the current source to Terminal #6 Positive, and Terminal #4 Negative. Enter 20.00mA from the current source. Allow at least 10 seconds to stabilize. Press the Time key.
7. At the tc prompt, disconnect the millivolt source, and connect the reference compensator or t/c calibrator to Terminal #2 Positive, and Terminal #3 Negative for Zone 1. If using a compensator, turn on and short the input wires. If using "J" calibrator, set to simulate 32°F/0°C. Allow 10 seconds for the control to stabilize.

To conclude the t/c calibration, press the Time key to advance through the Calibration mode. To continue calibrating your outputs, press the Time key once. The unit will leave the Calibration mode if 1 minute passes between key activations and retains all changed values.



NOTE:
Before calibration on an installed control, make sure all data and parameters are documented. See Setup and Service Tables, Pages 16 and 19.



NOTE:
Always press the Time key to advance to the next parameter before changing the calibration equipment.

The calibration procedure for Zone 1 and Zone 2 are the same except use the Ot2L and Ot2H parameters for Zone 2.

Zone 1 4-20mA Output Field Calibration Procedure


For model #: 73XX-XFXX-XXXX 73XX-XXFX-XXXX
 73XX-XFFX-XXXX

Equipment Required

- 300 Ω , 1/2 watt 10% resistor.
- 4 - 1/2 digit Digital Multimeter.

Setup And Calibration

1. Connect the AC line voltage L1 and L2 to the proper terminals of the 733/734.
2. Connect the multimeter in series with the 300 Ω resistor to Output connector #2 Negative and #3 Positive for Zone 1.
3. Apply power to the unit and allow it to warm up for 15 minutes. **After warm-up** put the unit in the Calibration mode. See the beginning of this chapter At the CALy parameter, select OUT. Press the Time key.
4. At the Ot1L prompt, the multimeter should read approximately 4mA. Allow at least 10 seconds to stabilize.
5. Use the Up/Down keys (reverse acting) to adjust the reading on the multimeter for $3.85\text{mA} \pm 0.10\text{mA}$. Press the Time key.
6. At the Ot1H prompt, the multimeter should read approximately 20mA. Allow at least 10 seconds to stabilize.
7. Use the Up/Down keys (reverse acting) to adjust the reading on the multimeter for $20.15\text{mA} \pm 0.10\text{mA}$.
8. For dual 4-20mA output control, connect the multimeter in series with the 300 Ω resistor to Output connector #4 Negative and #1 Positive. Use regular 20 - 24 gauge wire. Repeat steps 4 through 7 using the Ot2L and Ot2H prompts.


NOTE:
Before calibration on an installed control, make sure all data and parameters are documented. See Setup and Service Tables, Pages 16 and 19.

The calibration procedure for Zone 1 and Zone 2 are the same except use the Ot2L and Ot2H parameters for Zone 2.

Zone 1 0-5V \Rightarrow (VDC) Output Field Calibration Procedure

For model #'s: 73XX-XHXX-XXXX 73XX-XXHX-XXXX
 73XX-XHHX-XXXX

Equipment Required

- 20K 1/4 watt 10% resistor.
- 4 - 1/2 digit Digital Multimeter.

Setup And Calibration

1. Connect the AC line voltage L1 and L2 to the proper terminals of the 733/734.
2. Connect the multimeter across the 20K resistor to Output connector #2 Negative and #3 Positive for Zone 1.
3. Apply power to the unit and allow it to warm up for 15 minutes. **After warm-up** put the unit in the Calibration mode. See the beginning of this chapter At the CALy parameter, select OUT. Press the Time key.
4. At the Ot1L prompt, the multimeter should read approximately 0V. Allow at least 10 seconds to stabilize.
5. Use the Up/Down keys (reverse acting) to adjust the reading on the multimeter for $-0.2 \pm 0.1V$. Press the Time key.
6. At the Ot1H prompt, the multimeter should read approximately 5V. Allow at least 10 seconds to stabilize.
7. Use the Up/Down keys (reverse acting) to adjust the reading on the multimeter for $5.2V \pm 0.1V$.
8. For dual 0-5V output control, connect the multimeter across the 20K resistor to Output connector #4 Negative and #1 Positive. Use regular 20 - 24 gauge wire. Repeat steps 4 through 7 using the Ot2L and Ot2H prompts.



NOTE:

Before calibration on an installed control, make sure all data and parameters are documented. See Setup and Service Tables, Pages 16 and 19.

Glossary, A - I

Alarm: A condition, generated by a controller, indicating that the process has exceeded or dropped below a predetermined alarm set point.

Alarm Silence: Disables the alarm relay output.

Anti-reset: Control feature that inhibits automatic reset action outside the proportional band. Also known as "reset windup inhibit."

Automatic prompts: Data entry points where a microprocessor-based control "prompts" or asks the operator/programmer for information input.

Auto-tune: Automatically tunes the Series 733/734PID parameters to fit the characteristics of your particular thermal system.

Closed loop: Control system that has a sensing device for process variable feedback.

Cold junction: Point of connection between thermocouple metals and the electronic instrument.

Cold junction compensation: Electronic means to compensate for the ambient temperature at the cold junction.

Combi-oven: Combination convection and steam oven that cooks large amounts of food in substantially reduced time.

Conveyor Oven: Oven with a conveyor that passes the food through it for a prescribed time. It may have doors located along its length for adding food at different points, thus varying cooking time for individual products.

Cook and Hold Oven: Slow cooker that cooks food (typically large pieces of meat) over a period of several hours at one temperature, and then holds the food at another temperature.

Cycle time: The time necessary to complete a full ON-through-OFF period in a time proportioning control system.

Deck Oven: Stackable, multiple chamber oven.

Derivative: Anticipatory action that senses the rate of change of the process, and compensates to minimize overshoot and undershoot. Also "rate."

Deviation alarm: An alarm referenced at a fixed number of degrees, plus or minus, from set point.

Default parameters: The parameters permanently stored in memory to provide a data base.

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

Droop: Difference in temperature between set point and stabilized process temperature.

Duty cycle: Percentage of "load ON time" relative to total cycle time.

Form A: Single Pole Single Throw relay that only utilizes the N.O. and Common contacts. These contacts close when the relay coil is energized. The contacts open when power is removed from the control.

Form B: Single Pole Single Throw relay that only utilizes the N.C. and Common contacts. These contacts will open when the relay coil is energized. The contacts will close when power is removed from the control.

Form C: Single Pole Double Throw. Utilizes the N.O., N.C. and Common contacts. The user has the option of wiring for a Form A or Form B contact. Refer to Form A & Form B above for more information.

Fryer: Fryers cook foods in hot oil.

Griddle: Flat cooking surface for cooking foods. May be one-sided or have a top plate that is lowered to cook food from both sides simultaneously/

Guard Band: A feature on a cooking control that creates a temperature "window" around set point, where you cannot start a menu. A guard band prevents undercooking or overcooking.

Holding Cabinets: Cabinets to keep foods warm and moist after they are cooked.

Hysteresis: In ON/OFF control, the temperature change necessary to change the output from full OFF to full ON again.

Hunting: Oscillation or fluctuation of process temperature about the set point.

Idle and Idle Exit: A feature in a restaurant fryer for slow-use periods to run fryers at a lower temperature, thus saving cooking oil and energy.

Input: Process variable information being supplied to the instrument.

Integral: Control action that automatically eliminates offset, or "droop," between set point and actual process temperature. Also "reset."

Isolation: Electrical separation of sensor or other device from high voltage circuitry. Allows for application of grounded or ungrounded sensing element.

JIS Japanese Industrial Standards. Also Japanese Industrial Standards Committee (JISC). Establishes standards on equipment and components.

Melt Cycle: A fryer feature for melting congealed oil. The control will duty cycle power until the oil melts. The melt cycle prevents burning the oil during start-up.

ON/OFF control: Control of temperature about a set point by turning the output full ON below set point and full OFF above set point in the heat mode.

Open loop: System with no sensory feedback.

Output: Action in response to difference between set point and process variable.

Overshoot: Condition where temperature exceeds set point due to initial power up or process changes.

Parameter: A physical property whose value determines the response of an electronic control to given inputs.

PID control: Proportioning control with auto-reset and rate. Also known as 3 mode control.

Pressure Fryer: Fries food under pressure.

Proofer: Cabinet for raising breads and pastries.

Process variable: Thermal system element to be regulated, such as time, temperature, relative humidity, etc.

Proportional band: Span of temperature about the set point where time proportional control action takes place.

Rate: Anticipatory action that senses the rate of change of temperature and compensates to minimize overshoot. Also "derivative."

Reset: Control action that automatically eliminates offset, or "droop," between set point and actual process temperature. Also "integral."

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

Set point: Intended value of the process variable.

Shelf Timing: Convection ovens typically have more than one shelf. Each shelf can have a separate timer for food added at different times.

Slow Start/Fast Start: A feature in cooking equipment that provides an option for a one hour ramp-to-set point temperature; reduces power demands.

Split Vat Fryer: Split vat fryers have two side-by-side fryer vats (same piece of equipment) that can run at different times and temperature for different recipes.

Steamer: Chamber that uses steam to cook foods for a prescribed period of time.

Switching sensitivity: In ON/OFF control, the temperature change necessary to change the output from full ON to full OFF.

Thermal system: A regulated environment consisting of a heat source, heat transfer medium, sensing device and a process variable control instrument.

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

Thermocouple break protection: Fail-safe operation that assures output shutdown upon an open thermocouple condition.

Time Proportioning Control: Action which varies the amount of ON time when "close" to the set point, i.e., in the proportional band. This variance is proportional to the difference between the set point and the actual process temperature. In other words, the amount of time the output relay is energized depends on the system temperature.

Warm Start: Start-up condition where all program information is remembered by the instrument's memory back-up protection.

WatCurve™: Feature that automatically re-calculates and adjusts a menu cooking time as a result of a disturbance — usually, opening the oven door. WatCurve™ is a Watlow innovation.

Zero switching: Action that provides output switching only at the zero voltage crossing points of the AC line.

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Warranty

The Watlow Series 733/734 is warranted to be free of defects in material and workmanship for 36 months after delivery to the first purchaser for use, providing that the units have not been misapplied. This excludes mechanical relays which are warranted for 100,000 cycles.

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.

Watlow Controls

Watlow Controls is a division of Watlow Electric Mfg. Co., St. Louis, MO, a manufacturer of industrial electric heating products, since 1922. Watlow begins with a full set of specifications and completes an industrial product that is manufactured totally in-house, in the U.S.A. Watlow products include electric heaters, sensors, controls and switching devices. The Winona operation has been designing solid state electronic control devices since 1962, and has earned the reputation as an excellent supplier to original equipment manufacturers. These OEMs depend upon Watlow Controls to provide compatibly engineered controls which they can incorporate into their products with confidence. Watlow Controls resides in a 100,000 square foot marketing, engineering and manufacturing facility in Winona, Minnesota.

Returns

1. 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
 - Contact name
 - Ship via
 - Symptoms and/or special instructions
 - Name and phone number of person returning the material.
 - Bill to address
 - Phone number
 - Your P.O. number
2. Prior approval and an RMA number, from the Customer Service Department, is needed when returning any unused product for credit. Make sure the RMA number is on the outside of the carton, and on all paperwork returned. Ship on a Freight Prepaid basis.
3. After we receive your return, we will examine it and determine the cause for your action.
4. In cases of manufacturing defect, we will enter a repair order, replacement order, or issue credit for material. A 20 percent restocking charge is applied for all returned stock controls and accessories.
5. If the unit is unrepairable, it will be returned to you with a letter of explanation. Repair costs will not exceed 50 percent of the original cost.

Shipping Claims

When you receive your Watlow control, examine the package for any signs of external damage it may have sustained enroute. If there is apparent damage either outside the box or to its contents, make a claim with the shipper immediately. Save the original shipping carton and packing material.

Specifications

Control Mode

- Single or dual input, single or dual output, single alarm.
- EIA/TIA-422A, EIA/TIA-423A, or EIA/TIA-485 data communications.
- ON/OFF: Determined by the HYSX parameter for Outputs 1 and 2.
- PID Parameters:
 - Proportional band: 0 to 999°F/0 to 555°C/0 to 999 units.
 - Reset: 0.00 to 9.99 repeats per minute.
 - Rate: 0.00 to 9.99 minutes.
 - Cycle time: 1 to 60 seconds.

Operator Interface

- Membrane front panel.
- Single, four-digit 0.56" (14 mm) LED displays.
- TIME, TEMPERATURE, UP/DOWN & 1-12 menu keys.

Input

- Thermocouple, RTD and electrical process input.
- Automatic cold junction compensation for thermocouple.
- RTD input, 2- or 3-wire, platinum, 100 @ 0°C, software selectable: JIS curve #3916 (0.003916 / °C) or DIN curve #3850 (0.003850 / °C).
- Sensor break protection de-energizes control outputs to protect system.
- Grounded or ungrounded sensors. (Dual input requires at least one ungrounded t/c. See Chapter 1 of the *Series 733/734 Service Manual*.)
- °F, °C or process variable units are user selectable.
- Operating ranges user selectable.

J t/c:	32 to	1382°F	or	0 to	750°C
K t/c:	32 to	2282°F	or	0 to	1250°C
E t/c:	32 to	1220°F	or	0 to	660°C
RTD:	32 to	1112°F	or	0 to	600°C
Process:	-500 to	3500 units			

Primary Output (Zone 1)

- Solid-state Relay, Form A, 0.4A @ 120/208/240V~ (VAC), 30VA pilot duty @ 120/208/240V~ (VAC), opto-isolated, zero-cross switching. Off state impedance is 20K minimum with contact suppression, 31M without contact suppression.
- Electromechanical Relay, Form A, 1A @ 24/120/208/240V~ (VAC), 1/8 hp. @ 120/240V~ (VAC), 125VA pilot duty @ 24/120/208/240V~ (VAC). Off state impedance is 20K minimum. 200m contact resistance, maximum.
- Switched DC, 500 minimum load resistance, 1K load, 9mA minimum, 22mA maximum, non-isolated.
- 0-20mA/4-20mA reverse or direct into a 600 maximum load impedance, non-isolated.
- 0-5V= (VDC)/0-10V= (VDC) reverse or direct into a 10K minimum load impedance, non-isolated.

Secondary Output (Zone 2)

- Solid-state Relay, Form A, 0.4A @ 120/208/240V~ (VAC), 30VA pilot duty @ 120/208/240V~ (VAC), opto-isolated, zero-cross switching. Off state impedance is 20K minimum with contact suppression, 31M without contact suppression.
- Electromechanical Relay, Form A, 1A @ 24/120/208/

240V~ (VAC), 1/8 hp. @ 120/240V~ (VAC), 125VA pilot duty @ 24/120/208/240V~ (VAC). Off state impedance is 20K minimum. 200m contact resistance, maximum.

- Switched DC, 500 minimum load resistance, 1K load, 9mA minimum, 22mA maximum, non-isolated.
- 0-20mA/4-20mA reverse or direct into a 600 maximum load impedance, non-isolated.
- 0-5V= (VDC)/0-10V= (VDC) reverse or direct into a 10K minimum load impedance, non-isolated.

Alarms

- Electromechanical Relay, Form A, 1A @ 24/120/208/240V~ (VAC), 1/8 hp. @ 120/240V~ (VAC), 125VA pilot duty @ 24/120/208/240V~ (VAC). Off state impedance is 20K minimum. 200m contact resistance, maximum.
- Latching or non-latching.
- Process or deviation.
- Separate high and low values.
- Alarm silencing (inhibit) on power up for alarm.

Event Outputs

- Switched DC, non-isolated, 5V= (VDC), 5mA maximum.

Accuracy

- Calibration Accuracy & Sensor Conformity: $\pm 0.1\%$ of span, $\pm 1\text{LSD}$, $77^\circ\text{F} \pm 5^\circ\text{F}$ ($25^\circ\text{C} \pm 3^\circ\text{C}$) minimum.
- Accuracy Span: Normally 1000° minimum span.
- Temperature Stability: $< 0.2^\circ\text{F}/^\circ\text{F}$ ($0.2^\circ\text{C}/^\circ\text{C}$) change in ambient.
- Voltage Stability: $\pm 0.01\%$ of span / % of rated line voltage.

Communications

- Serial data communications.
- EIA/TIA-422A or EIA/TIA-423A (EIA/TIA-232C compatible) or EIA/TIA-485.
- ANSI X3.28 protocol, or XON/XOFF protocol.
- Isolated.

Agency Approvals

- UL® 873, File #E43684.
- CSA Certified, File #LR30586, C22.2.
- Select models CE approved. Consult factory for details.
- Electronic Incorporated Class III Control, Type 2 action.

Connectors

- Compression type screw terminals and universal Mate-n-Lok.

Power

- 24V~ (VAC) +10%, - 15%.
- 50 to 60 Hz $\pm 3\%$.
- Consumption 6 - 10VA.
- For CE-approved models, input power limited to 15 watts maximum. All components are rated for a maximum of 15 watts.

Operating Environment

- 32 to 176°F/0 to 80°C.
- 0 to 90% RH, non-condensing.

Dimensions

733A-xxxx-xxxx (horizontal) models:

- | | | |
|-----------|--------|--------|
| • Height: | 3.28" | 83 mm |
| • Width: | 10.66" | 271 mm |
| • Depth: | 2.00" | 51 mm |

734A-xxxx-xxxx (vertical) models:

- | | | |
|-----------|--------|--------|
| • Height: | 10.66" | 271 mm |
| • Width: | 3.28" | 83 mm |
| • Depth: | 2.00" | 51 mm |

7 3 A - - - - A A

733/734 = One or two channel microprocessor-based, time and temperature control; 24V~ (VAC) power input.
*Order power supply and connector kit(s) separately below.

Display Orientation

- 3 = Horizontal
- 4 = Vertical

Display Location

- A = Integral (local)

Input Type

- 1 = Single thermocouple (type J, K, E)
- 2 = Single RTD 1°, curve selectable
- 4 = Dual thermocouple (type J, K, E); *Order output types 1 & 2*
- 5 = Dual RTD 1°, curve selectable; *Order output types 1 & 2*
- 6 = Dual Input: Channel 1 thermocouple (type J, K, E); and Channel 2 process (0-5V= (VDC), 0-10V= (VDC), 0-20mA, 4-20mA), *Order output types 1 & 2*

Dual-zone units must use ungrounded thermocouples.

Output 1 Type

- B = Solid-state relay with RC suppression, form A, 0.4A
- C = Switched DC, open collector, non-isolated
- D = Mechanical relay, form A, 1A, with suppression
- E = Mechanical relay, form A, 1A, without suppression
- F = Process, 4-20mA, non-isolated
- H = Process, 0-5V= (VDC), non-isolated
- K = Solid-state relay without RC suppression, form A, 0.4A

Output 2 Type

- A = None
- B = Solid-state relay with RC suppression, form A, 0.4A
- C = Switched DC, open collector, non-isolated
- D = Mechanical relay, form A, 1A, with suppression
- E = Mechanical relay, form A, 1A, without suppression
- F = Process, 4-20mA, non-isolated
- H = Process, 0-5V= (VDC), non-isolated
- K = Solid-state relay without RC suppression, form A, 0.4A

Event Inputs/Outputs

- 0 = None
- 1 = 4 Event outputs, switched DC, non-isolated (custom only)

Alarm

- A = None
- D = Single mechanical relay, form A, 1A, with suppression

Communications (Isolated)

- A = None
- B = EIA/TIA-422 or EIA/TIA-423
- D = EIA/TIA-485

Options

- AA = Standard Single Display

Power Supply, Power Connector and Event Input/Output Accessory Kits (Order separately here.)

Part No.	Description
A001-0249-0001 =	120V~ (VAC) - 24V~ (VAC), stepdown transformer, Class 2, quick connect terminals included.
A001-0249-0002 =	208/240V~ (VAC) - 24V~ (VAC), stepdown transformer, Class 2, quick connect terminals included.
A001-0250-0012 =	Power input connector kit, 12-pin connector assembly, wire not included.
A001-0250-0009 =	Event input/output connector kit, 9-pin connector assembly, wire not included.

Declaration of Conformity

WATLOW CONTROLS

124 1 Bundy Boulevard
Winona, Minnesota 55987
USA

Declares that the following product:

Designation:	Series 733 / 734
Model Number:	733A-4BB1-AAAG
Classification:	Electronic Incorporated Class III temperature controller, Type 2C action, for use in light industrial environment
Rated Voltage:	24V~ (VAC)
Rated Current:	0.250A
Rated Frequency:	50/60 Hz
Maximum Power Input:	15 Watts

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

89/336/EEC Electromagnetic Compatibility Directive

EN **50082-1**: 1992 EMC Generic immunity standard, Part 1: Residential, commercial, and light industry

IEC 801-3: 1984 Radiated immunity

IEC 801-5: 1991 Surge immunity

EN 50082-2: 1995 EMC Generic immunity standard, Part 2: Industrial environment

EN 6 1000-4-2: 1995 Electrostatic discharge

EN 6 1000-4-4: 1995 Electrical fast transients

ENV 50141: 1993 Conducted immunity

EN **50081-2**: 1994 EMC Generic emission standard, Part 2: Industrial environment

EN 55011: 1991 Limits and methods of measurement of radio disturbance characteristics of industrial, **scientific** and medical radio-frequency equipment (Class B)

73/23/EEC Low- Voltage Directive

EN 60730-1: 1993 Automatic electrical controls for household and similar use, Part 1: General requirements

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Norman L. Ganion

Name of Authorized Representative

Manager, Quality Assurance

Title of Authorized Representative


Signature of Authorized Representative

Notes



Watlow Series 733/734 Service Manual

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