User's Guide

omega.com™
OMEGA®

www.omega.com
e-mail: info@omega.com

CN8590 Series
1/32 DIN Temperature/Process Controllers

omega.com™
CEOMEGA®

OMEGAnet® On-Line Service www.omega.com	Internet e-mail info@omega.com

Servicing North America:

USA: ISO 9001 Certified
One Omega Drive, P.O. Box 4047
Stamford CT 06907-0047
TEL: (203) 359-1660
FAX: (203) 359-7700
e-mail: info@omega.com

Canada:
976 Bergar
Laval (Quebec) H7L5A1
TEL: (514) 856-6928
FAX: (514) 856-6886
e-mail: info@omega.ca

For immediate technical or application assistance:

USAand Canada:
Sales Service: 1-800-826-6342/ 1-800-TC-OMEGA®
Customer Service: 1-800-622-2378/ 1-800-622-BEST®
Engineering Service: 1-800-872-9436/ 1-800-USA-WHEN®
TELEX: 996404 EASYLINK: 62968934 CABLE: OMEGA

Mexico:
TEL: (001) 800-826-6342
FAX: (001) 203-359-7807
En Español: (001) 203-359-7803
e-mail: espanol@omega.com
info@omega.com.mx

Servicing Europe:

Benelux:
Postbus 8034, 1180 LAAmstelveen
The Netherlands
TEL: +31 (0)20 6418405 FAX: +31 (0)20 6434643
Toll Free in Benelux: 0800 0993344
e-mail: nl@omega.com

Czech Republic:
Rudé armády 1868, 733 01 Karviná 8
TEL: +420 (0)69 6311899 FAX: +420 (0)69 6311114
Toll Free in Czech Republic: 0800-1-66342
e-mail: czech@omega.com

France:
9, rue Denis Papin, 78190 Trappes
TEL: +33 (0)130 621 400 FAX: +33 (0)130 699 120
Toll Free in France: 0800-4-06342 e-mail: france@omega.com

Germany/Austria:
Daimlerstrasse 26, D-75392
Deckenpfronn, Germany
TEL: +49 (0)7056 3017 FAX: +49 (0)7056 8540
Toll Free in Germany: 0800 TC-OMEGA℠
e-mail: germany@omega.com

United Kingdom: ISO 9002 Certified
One Omega Drive
River Bend Technology Centre
Northbank, Irlam
Manchester M44 5EX United Kingdom
TEL: +44 (0)161 777 6611 FAX: +44 (0)161 777 6622
Toll Free in United Kingdom: 0800488488
e-mail: sales@omega.co.uk

Features

Field-Selectable Thermocouple, RTD, or Voltage Input
Current Input (with External 2.5 Ohm Resistor)
On/Off Through Full PID Operation
Autotuning - Heat or Cool
Adjustable On/Off Output Hysteresis
Dual Outputs
Field-Configurable Process or Deviation Alarms
Output % or Process Value Display
Bumpless, Auto-Manual Transfer
NEMA 4X Front Bezel
4-Digit (0.40") Alphanumeric Display
Approvals: UL, cUL, CE-compliant

Safety Warning

In addition to presenting a potential fire hazard, high voltage and high temperature can damage equipment and cause severe injury or death. When installing or using this instrument, follow all instructions carefully and use approved safety controls. Electrical connections and wiring should be performed only by suitably trained personnel.

Do not locate this instrument where it is subject to excessive shock, vibration, dirt, moisture, oil, or other liquids. The safe operating temperature range for this unit is 32°F to 140°F (0°C to 60°C).

Table of Contents

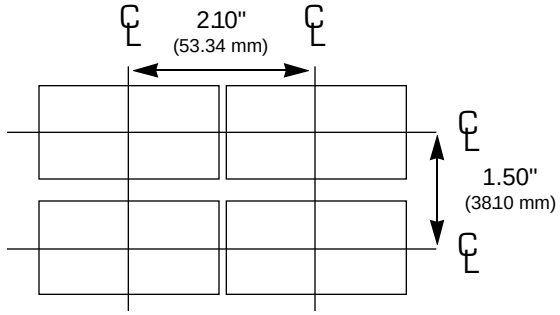
Installation

Unpacking and Inspection

Measurements between centerlines of panel cutouts are minimum recommended.

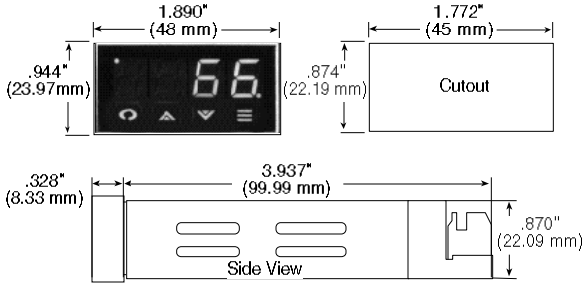
1. Inspect shipping carton for obvious signs of mishandling.
2. After removing the controller from the shipping carton, inspect it carefully for damage. Never attempt to install and use a damaged unit.
3. Verify that the ordering code number indicated on the side of the controller matches what was ordered.

Figure 1.
Recommended Panel Layout for Multiple Controllers



Dimensions

Figure 2. Case Dimensions

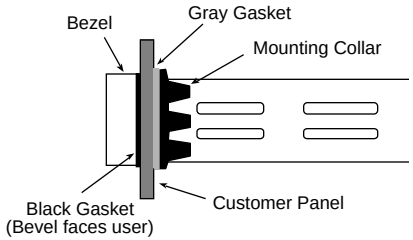


Mounting

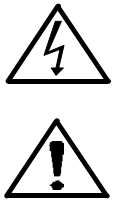
Prior to mounting the CN8590 in your panel, make sure that the cutout opening is of the right size, 0.874" x 1.772" (22.19 mm x 45.0 mm), and deburred to enable a smooth fit. A minimum of 4.5" (113 mm) of depth behind the panel is required.

Figure 3. Mounting Diagram

Insert the CN8590 through the front panel cutout and slide the mounting collar back onto the unit from behind the panel. Push the mounting collar up tight to the back of the mounting panel.



Wiring

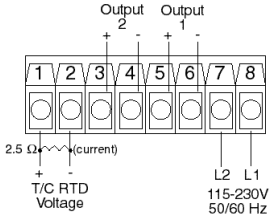


IMPORTANT: All electrical wiring connections should be made only by trained personnel, and in strict accordance with the National Electrical Code and local regulations.

The CN8590 controller has built-in circuitry to reduce the effects of electrical noise (RFI) from various sources. However, power and signal wires should always be kept separate. We recommend separating connecting wires into bundles: power; signal; alarms; and outputs. These bundles should then be routed through individual conduits. Shielded sensor cables should always be terminated at one end only.

If additional RFI attenuation is required, noise suppression devices such as an R.C. snubber at the external noise source may be used. If you wish, you may order this suppressor directly from Omega, part number 1821-101.

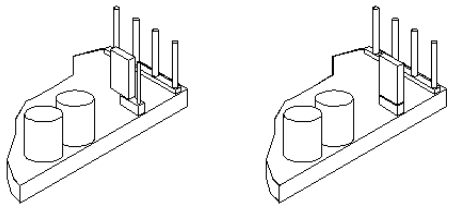
Figure 4. Contact Identification



Thermocouple circuit resistance should not exceed 100 ohms for rated accuracy; errors will occur at higher resistance values. If shielded thermocouple wire is used, terminate the shield only at one end.

When using an RTD sensor, an approximate error of 6 °F (3.3 °C) will result for each ohm of resistance encountered in the lead wires. If shielded RTD wire is used, terminate the shield only at one end.

The CN8590 accepts Type J, K, or T thermocouples, 100 ohm RTDs and linear inputs (suppressed or unsuppressed). It is shipped from the factory set for thermocouple or linear input; however, a shunt jumper is located on the PC board near the rear of the unit. This jumper (JMP01) is accessible by removing the back portion of the case. It is not necessary to remove the PC board from the case. See table below.



Input Sensor Type	Shunt Position
J,K or T Thermocouples	Shunt covers 1 post only
100 ohm RTD	Shunt covers both posts
Linear Process Inputs	Shunt covers 1 post only

Thermocouple Input Wiring

Using the appropriate thermocouple and extension wire, connect the negative lead (generally colored red in ISA-type thermocouples) to contact 2; connect the positive lead to contact 1. Extension wires must be the same polarity as the thermocouple.

RTD Wiring

Connect 2-wire, 100 ohm platinum RTD to contacts 1 and 2. Keep leads short and use copper extension wire.

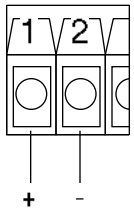
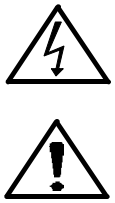


Figure 5. Thermocouple, RTD, and Voltage Connections



Process and Linear Input Wiring

Voltage Inputs: Connect the positive voltage input to contact 1 and the negative to contact 2 (Figure 5).

Current Inputs: (Figure 6) Connect the positive current input to contact 1 and the negative current input to contact 2. *Connect an external 2.5 ohm shunt resistor across the contacts.*

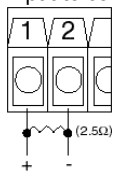


Figure 6. Current Input Wiring

The CN8590 accepts both 85 to 265 Vac and 120 to 375 Vdc line power without any switch settings or polarity considerations. All connections should be made in accordance with the National Electrical Code and local regulations, using only NEC Class 1 wiring for all power terminals.

Both of the incoming power lines should be fused with 2AG, 0.5 amp maximum rated fuses. Be sure that only instrument power input is fused — not power to the load.

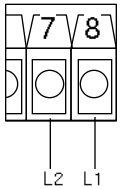


Figure 7. Power Wiring Connection

Output Types

The Type "R" output is a mechanical device and subject to wear. To extend the life of the relay, set the Cycle Time for the relay output to the longest duration that still affords good control.

When you ordered your CN8590 controller, a specific output device combination was specified. See page 40 for the ordering code, and compare it to the part number on the controller label. Your controller was also configured at the factory with either one or two output actions. Generally, output 1 is used as a reverse-acting (heat) function and output 2 is a direct-acting (cool) function. However, the CN8590 provides the option of having either or both outputs configured as reverse or direct acting. For best results, follow the recommendations given below for setting cycle times. A brief description of output devices follows on the next page.

For Control Output Type —	Select Cycle Time (in seconds)
R (Output 1 Only)	15
DC	0
T	15

Output Types

Output 1

O	None
R	Electromechanical relay, 5A @ 120/240 Vac, normally open, used for switching resistive loads.
DC	DC logic output @ 5 Vdc pulsed
T	Solid-state relay, zero voltage-switched and optically isolated from drive signal. Resistive loads to 1 A @ 120/240 Vac may be controlled directly. Larger loads may be controlled using an external contactor.

Output 2

O	None
DC	DC logic output @ 5 Vdc pulsed
T	Solid-state relay, zero voltage-switched and optically isolated from drive signal. Resistive loads to 1 A @ 120/240 Vac may be controlled directly. Larger loads may be controlled using an external contactor.

Operation

Figure 8. Front Panel Controls and Indicators

Output Indicator
Used to indicate activation of Output 1.

Four-Digit LED Display
Displays measured process value, setpoint, or parameter labels and settings.

Output Indicator
Used to indicate activation of Output 2.

Mode/Enter Key
Used to enter Parameter selections, access operating modes, silence latched alarms, and index through menu items.

Lower Key
Used to decrease values.
(Hold for fast-step progression)

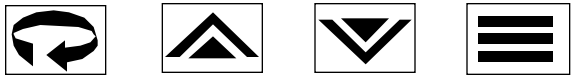
Raise Key
Used to increase values.
(Hold for fast-step progression)

Menu Access Key
Used to enter or exit the menu system, index to the next menu, and enter the Security Level menu.

Power On

The CN8590 controller's functional hierarchy is organized into three distinct user-programmable groupings: Security Level, Menu System, and Operating Mode.

Please provide the software version number, along with the controller's full model number, when contacting us regarding your controller.



When power is first applied to the CN8590, all segments of the LED display will be momentarily illuminated while the instrument goes through a series of diagnostic checks to verify proper operation. A software version number will then be displayed, e.g.,  , followed by the measured process value. IMPORTANT: On initial startup, there is a possibility that outputs may be activated. We recommend placing the unit in Standby mode until you have configured the controller according to your application requirements. To place the controller in Standby, follow this procedure:

1) Press Mode/Enter ☰ key once.
2) Press Raise ▲ key once.
3) Press Mode/Enter ☰ key again. (The display will alternate between and process value.

Operations Overview

The user interface of the CN8590 allows you to use menus to set up the instrument, set the desired security level, change the setpoint, and conveniently change operating modes. Figure 9 on page 16 provides a functional representation of the user interface and the key presses necessary to perform the basic functions.

Security Levels

The controller's initial security level, set at the factory, is Configuration CnFG *. When you have completed configuring the instrument, we recommend the security level be set to the most restrictive level suitable for your application.*

The security level feature allows you to limit access to the menus, setpoint, and operating mode selection according to the needs of your application. The five security levels provided are Key Lockout, Setpoint, User, Configuration, and Factory. To view or change security level, press and hold the Menu Access key for approximately ten seconds. The controller will alternately display ACCL (Access Level) and the current security level label, e.g., USEr. Use the Raise or Lower keys to index through the security levels. Press the Mode/Enter key to select the new security level desired and return to the Process Value display.

Security Levels and Access Restrictions

Loc.O Key Lockout	Highest security level. No access to any controller functions. To escape, follow instructions above for changing security levels.
SP Setpoint	No access to menus. Only allows setpoint value, output percentage (manual mode), or operating mode to be changed.
USEr User	All "Setpoint" level privileges as well as access to Autotune and Control menus.
CnFG Configuration	All "User" level privileges as well as Input, Output, Display, and Supervisor menus.
FACt Factory	All "Configuration" level privileges as well as access to Calibration menu.

Menu System

If a key press is not sensed within five minutes, the controller automatically exits the Menu System and reverts to the Process Value display.

The Menu System is organized into seven menus: Control, Autotune, Input, Output, Display, Supervisor, and Calibration. Pressing the Menu Access key indexes from menu to menu. Pressing the Mode/Enter key indexes through the parameters in a particular menu. The Raise and Lower keys are used to modify the visible menu parameter.

Each menu contains a logical group of parameters related to one another. Furthermore, the sequence of the menus has been carefully chosen to put the most frequently used menus first. For example, provided access is permitted, the first menu presented upon entering the Menu System is the Setpoint Menu.

Menu System

Figure 9. CN8590 Functional Diagram

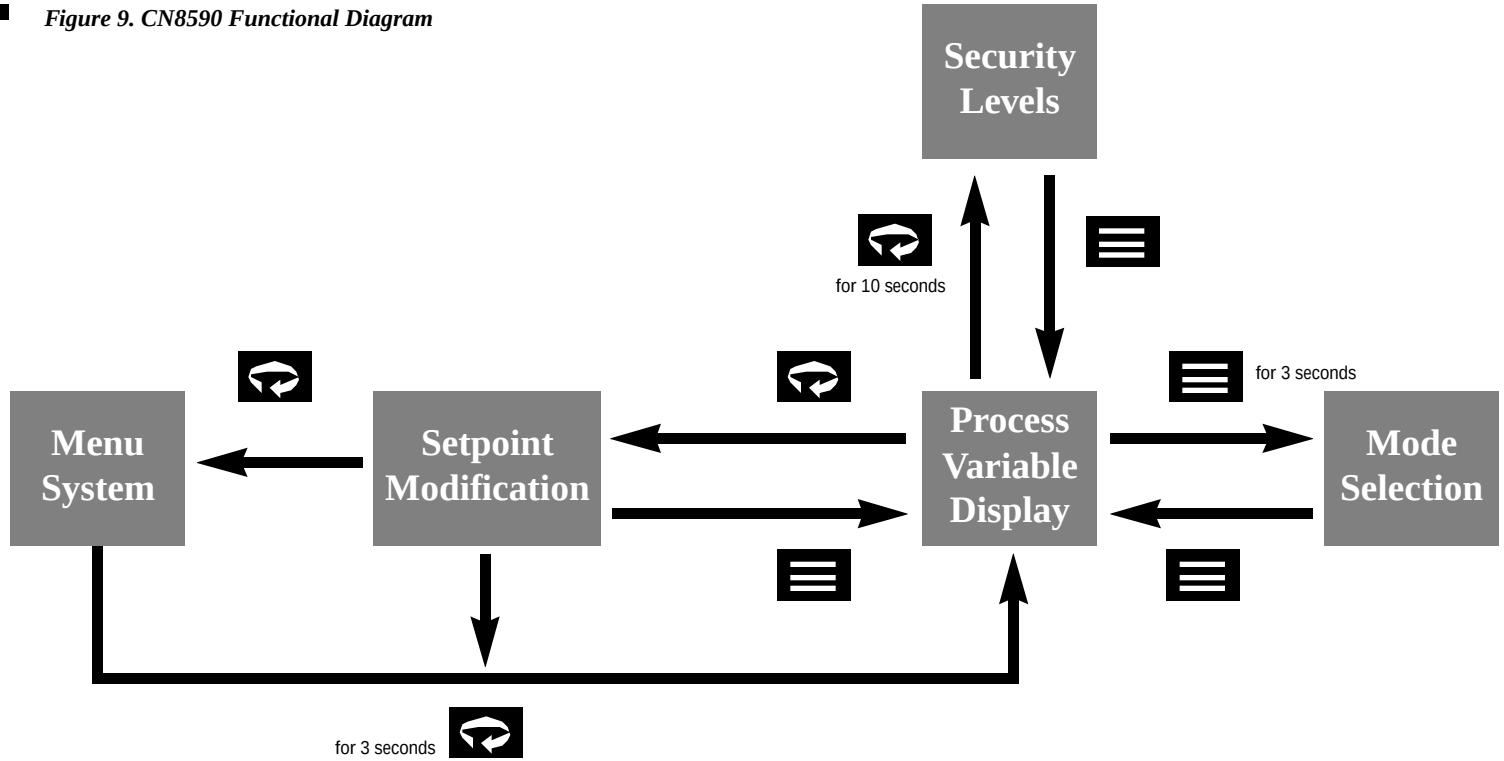
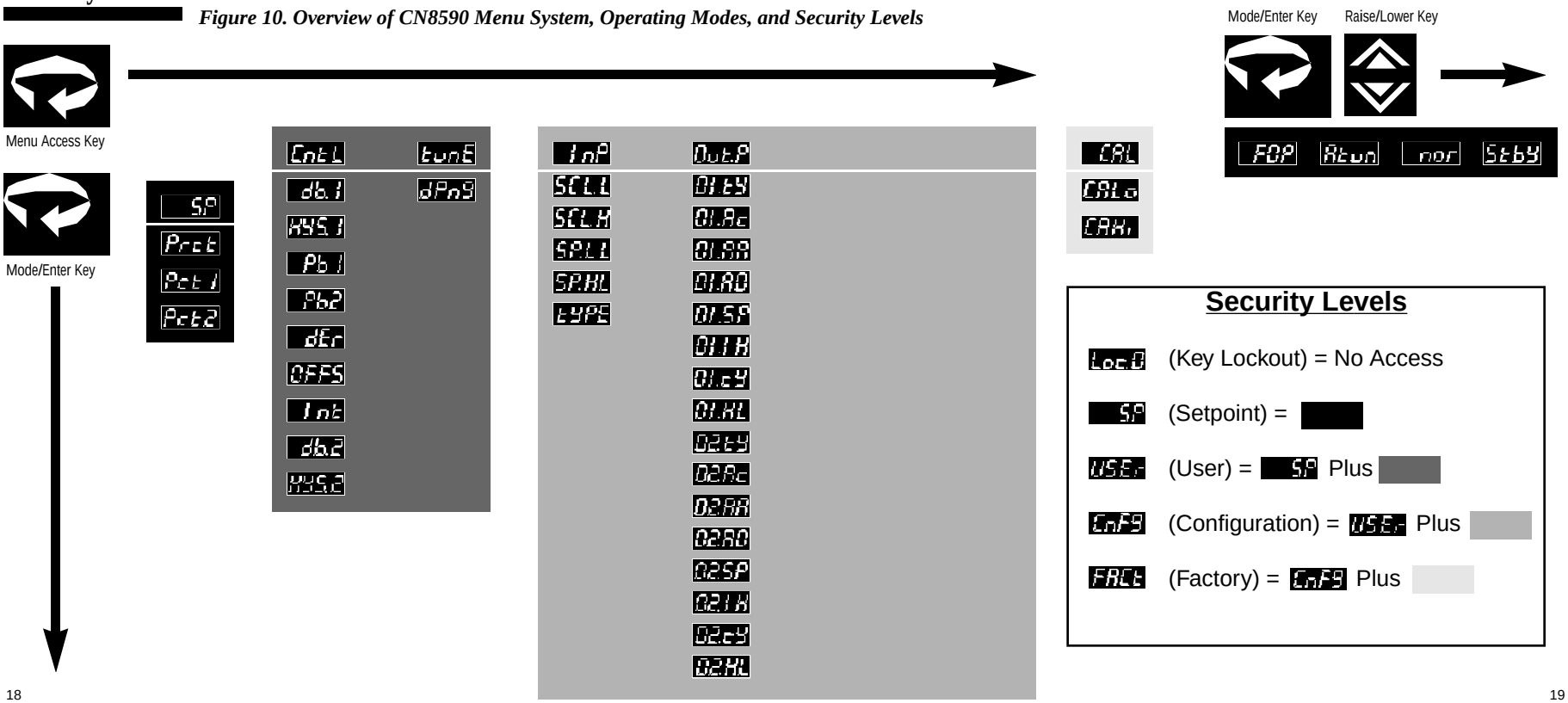


Figure 10. Overview of CN8590 Menu System, Operating Modes, and Security Levels



Security Levels

- Loc.O (Key Lockout) = No Access
- SP (Setpoint) =
- USEr (User) = SP Plus
- CnFG (Configuration) = USEr Plus
- FACt (Factory) = CnFG Plus

Initial Setup Sequence

If a key press is not sensed within five minutes, the Menu System is automatically exited and the controller reverts to the Operating Mode/ Process Value display.

Make sure that the 2-position setswitch is set properly for the input type being used (see page 8).

These setup instructions apply to PID-type control outputs. Alarm or on/off output settings and displays will be different. Refer to Output menu description on page 26.

Many of the menu parameters you will need to set up the controller for your application are interdependent. We recommend following the steps below when configuring your CN8590.

1) Place the unit in Standby Mode as follows. Press the Mode/Enter key for three seconds. Display will indicate FOP. Press the Raise key to select Standby. Press Mode key again and the display will alternate between Stby and the process value.

2) Input Type. Press Menu Access key repeatedly until InP is displayed. Then press Mode/Enter key until tYPE appears. Use Raise or Lower key to select Input Type. If Input Type is set to linear USUP or SUP, use the Mode/Enter key to scroll to scaling limits, SCLL and SCLH, before proceeding. Use the Raise or Lower key to set low and high scaling limits.

3) Output Type. Press the Menu Access key to display OUtP. Use the Mode/Enter key to index to the Output Type parameter. Using the Raise or Lower keys, select the correct Output Type for your application. Follow these steps (using the Mode/Enter and Raise or Lower keys) to set the Output Action, Cycle Time, and High Limit parameters for all control outputs.

4) Set Control Menu parameters by pressing the Menu Access key to display CntL. Then, use the Mode/Enter key to index through the available selections and the Raise or Lower keys to select the appropriate setting.

Menus and Parameters

IMPORTANT: Upon entering a new value, you MUST either press the Mode/Enter key, the Menu Access key, or index to a different parameter in order for the new value to register. The CN8590 controller will NOT accept new values without a key press.

5) Return to Process Variable Display. Press and hold the Menu Access key for three seconds to return to PV display.

6) Adjust setpoint. Press the Menu Access key once to display SP and use the Raise or Lower key to enter the desired setpoint. Press the Mode/Enter key to return to the Standby/Process Value display. Wait for process to stabilize before proceeding, e.g., in the case of a heating process, return to ambient temperature. If autotuning the controller, make sure the Autotune Damping tunE parameter is set to normal nL and proceed to Step 4 on page 33.

7) Security Level. Press and hold the Menu Access key for approximately ten seconds. Using the Raise or Lower keys, set the most restrictive level suited to your application.

Menus and Parameters

SP or Prct	Setpoint or % Output	Used to change the setpoint or Fixed Output Percentage (Manual operating mode).
CntL	Control	Used to select parameters associated with the control methods.
tunE	Autotune	Used to set the autotune damping parameter.
InP	Input	Used to select sensor-related parameters, such as input type, limits, and scaling.
OutP	Output	Used to specify output usage, control methods, and alarms.
dSPL	Display	Used to set or change decimal position and display units.
SUPr	Supervisor	Used to set the failsafe state of the controller.
CAL	Calibration	Used to calibrate the controller.

Setpoint Menu

In Manual mode, the setpoint display is replaced by the manually controlled output percentage display.

Display	Parameter	Selection	Default
SP	Setpoint	Setpoint limits	72° F

NOTE: In Manual operating mode, setpoint is not displayed.

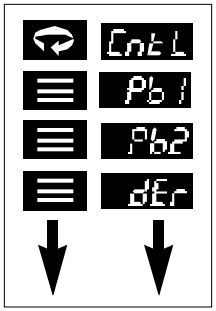
Pct	Manually controlled output percent when not configured for two same-acting outputs.	0...High limit	Bumpless
Pct1	Manually controlled output percent for output 1 when configured for two same-acting outputs.	0...High limit	Bumpless
Pct2	Manually controlled output percent for output 2 when configured for two same-acting outputs.	0...High limit	Bumpless

NOTE: Output percent parameters are not displayed unless the controller is in Manual operating mode.

Control Menu

Setting Derivative (Rate) or Integral (Reset) to 0 *disables that aspect of PID control.*

If BOTH outputs are set to direct-acting or BOTH outputs are set to reverse-acting, then only one proportional band selection will be displayed. The second proportional band is not required.



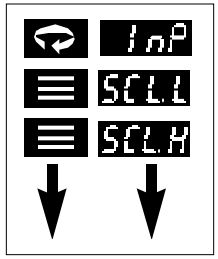
Display	Parameter	Selection	Default
The following parameters are only available if their related outputs are set for PID.			
Pb1	Proportional Band 1	1...to span of sensor	Span
NOTE: Only available if Output 1 has been set for PID control.			
Pb2	Proportional Band 2	1...to span of sensor	Span
NOTE: Only available if Output 2 has been set for PID control.			
dEr	Derivative Action (Rate)	0 to 2400 seconds	0 seconds
OFFS	Manual Reset	-100% to 100%	Off
NOTE: When OFF is selected for the Manual Reset parameter, the Integral Action (Int) parameter is active.			
Int	Integral Action (Reset)	0 to 9600 seconds	0 seconds
The following parameters are only available if their related outputs are set for ON/OFF.			
db1	Deadband 1	1...to span of sensor	1° F
HYS1	Hysteresis Output 1	1...to span of sensor	1° F
db2	Deadband 2	1...to span of sensor	1° F
HYS2	Hysteresis Output 2	1...to span of sensor	1° F

Autotune Damping Menu

Display	Parameter	Selection	Default
dPnS	Damping	Lo nL (normal) Hi	Normal

Note: The damping parameter is an autotune feature that allows you to modify the calculated PID control method used to tune the controller to suit your specific application requirements. The low setting provides faster recovery, but with the possibility of overshoot; the high setting a slower recovery, but with no overshoot.

Input Menu



Changing Low Scale or High Scale for linear inputs will reset the following parameters: Setpoint High Limit, Setpoint Low Limit, Output 1 Alarm Setpoint, Output 2 Alarm Setpoint, Proportional Bands.

High Scale and Low Scale cannot be adjusted to less than two display units from each other.

Input Menu

Display	Parameter	Selection	Default
SCLL	Low Scale	-1999 to 9999	0
SCLH	High Scale	-1999 to 9999	9999

NOTE: Only available if one of the two linear input formats has been selected.

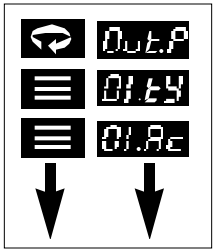
SP.LL	Lower Setpoint Limit	Span of Sensor	low scale
SP.HL	Upper Setpoint Limit*	Span of Sensor	high scale
type	Input Type	J	Type J thermocouple (Default)
		cA	Type K thermocouple
		t	Type T thermocouple
		rtd	100 ohm platinum RTD
		rtd	100 ohm decimal RTD
		0.50	0-50 mVdc or 0-20 mAdc
		50	10-50 mVDC or 4-20 mAdc

Changing Input Type will reset the following parameters to their default settings:
Setpoint
Proportional Band 1
Proportional Band 2
Output 1 Deadband
Output 1 Hysteresis
Output 2 Deadband
Output 2 Hysteresis
Output 1 Alarm Setpoint
Output 2 Alarm Setpoint.

*Note: The SP.HL parameter is the maximum setpoint that can be entered. This parameter is limited to 392° F when displaying process temperature with 0.1 degree accuracy (Available only with 100-ohm decimal RTD Input Type).

Output Menu

Parameters not associated with Output 1 Type or Output 2 Type selection will not be displayed. Ex., Alarm parameters will not be displayed when PID control output is selected.



Display	Parameter	Selection	Default
O1.tY	Output 1 Type	Pid onof OFF ALr	Pid
O1.Ac	Output 1 Action	rE (Reverse-acting) dir (Direct-acting)	rE
O1.AA	Output 1 Alarm Action	OFF LAt (Latching) nor (Normal)	OFF
O1.AO	Output 1 Process/ Deviation	Pro (Process Low) ProH (Process High) inb (Inverse Band) norb (Normal Band) dE (Deviation Low) dEH (Deviation High)	Pro
O1.SP	Output 1 Alarm Setpoint	Span of Sensor	25° C
O1.iA	Output 1 Alarm Inhibit	dIS (Disabled) En (Enabled)	dIS
O1.cY	Output 1 Cycle Time	0 to 120 seconds	0=300 ms
NOTE: Only available if Output 1 has been set to PID.			
O1.HL	Output 1 High Limit	1-100%	100%

Output Menu

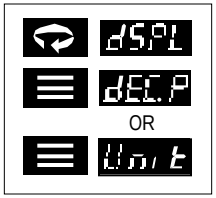
Setting output cycle time to 0 initiates a 300 ms cycle time. The proper cycle time setting is required for smooth proportional action. Too long a setting will cause proportional ripple; too short will decrease relay contactor life.

When changing thermocouple types, be sure to check/adjust upper and lower setpoint limit values.

If both outputs are set to OFF , the CN8590 will function as a noncontrolling indicator. Control outputs will be disabled and the Operating Modes will not be displayed.

O2.tY	Output 2 Type	Pid onof OFF ALr	ALr
O2.Ac	Output 2 Action	rE (Reverse-acting) dir (Direct-acting)	dir
O2.AA	Output 2 Alarm Action	OFF LAt (Latching) nor (Normal)	OFF
O2.AO	Output 2 Process/ Deviation	Pro (Process Low) ProH (Process High) inb (Inverse Band) norb (Normal Band) dE (Deviation Low) dEH (Deviation High)	ProH
O2.SP	Output 2 Alarm Setpoint	Span of Sensor	25° C
O2.iA	Output 2 Alarm Inhibit	dIS (Disabled) En (Enabled)	dIS
O2.cY	Output 2 Cycle Time	0 to 120 seconds	0=300 ms
NOTE: Only available if Output 2 has been set to PID.			
O2.HL	Output 2 High Limit	1-100%	100%

Display and Supervisor Menu



The Failsafe State is only enforced when a problem is detected with the process input. It is not reliably enforceable in instances of internal circuitry failure such as EEPROM problems.

Output % High Limits are ignored when the unit enters a Failsafe State.

Display	Parameter	Selection	Default
dEC.P	Decimal Position	0 1 2	0

NOTE: This parameter selection is available only for the "100-ohm decimal RTD" Input Type. It does not appear for thermocouple or non-decimal 100-ohm platinum RTD inputs (see page 25). Changing Decimal Position will cause changes in the following parameters: Setpoint High Limit, Setpoint Low Limit, Low Scale, High Scale, Setpoint, Proportional Bands, Hysteresis.

Unit	Display Units	F C	F

NOTE: Does not appear for linear inputs.

Supervisor Menu

Display	Parameter	Selection	Default
FSS	Failsafe State	OFF rE (Reverse-acting) dir (Direct-acting)	OFF

NOTE: The Failsafe State is used when an open-sensor, over range, or underrange condition exists. The "OFF" setting deactivates both outputs. The "rE" setting activates reverse-acting outputs and deactivates direct-acting outputs.The "dir" setting activates direct-acting outputs and deactivates reverse-acting outputs.

Note on Calibration Menu:

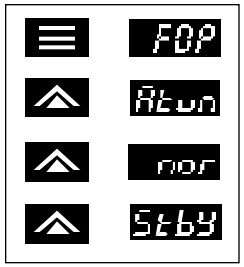
Your CN8590 was calibrated at the factory. If recalibration should become necessary, see page 41.

Operating Modes

Remember to press the Mode/Enter key after making your selection.

If both outputs are set to OFF *or* AL, *the CN8590 will function as a non-controlling indicator. Control outputs will be disabled and the Operating Modes will not be displayed.*

The CN8590 features four operating modes: Manual, Standby, Normal, and Autotune. To select a different operating mode, press the Mode/Enter key for three seconds. The first option displayed is Manual (Fixed Output Percentage) Mode FOP. To index through the available operating modes, press the Raise ^ or Lower v keys. When the desired mode is displayed, press the Mode/Enter ≡ key once to select the mode.



A description of the available operating modes is provided on the next page.

Operating Modes

Manual operating mode overrides automatic control, allowing you to control the outputs using a fixed percentage of output power, regardless of the process variable or setpoint.

An Output High Limit, which restricts the output percentage possible in Manual mode may be entered in the Output OUTP *menu.*

If current automatic control is PID, transfer to Manual mode is "bumpless."

FOP Manual	Used to set control output percentage (Fixed Output Percentage) independent of Process Value. To set percentage, use the Menu Access key to select PCT and the Raise or Lower keys to set the value. If BOTH outputs are direct-acting or BOTH outputs are reverse-acting, then two FOP percentages will be displayed. PCT1 and PCT2 .
STBY Standby	Used to disable control outputs.
NOR Normal	Normal automatic control.
ATUN Autotune	Used to initiate the autotuning sequence (from Standby only).

Alarms

Four types of alarms are available on both Output 1 and Output 2: Process, Deviation, Inverse Band, and Normal Band. Both output alarms may be configured to be inhibited on power-up (until the process reaches setpoint for the first time).

Deviation, Inverse Band, and Normal Band Alarm track with setpoint.

Process Alarm:	Activates at preset value, independent of setpoint. "High" process alarm activates at and above alarm setting. "Low" process alarm activates at and below alarm setting.
Deviation Alarm:	Activates at a preset deviation value from setpoint. "High" or "Low" deviation alarm activates above or below setpoint according to the preset deviation value.
Inverse Band Alarm:	Activates when the process is within a specified band centered around the setpoint.
Normal Band Alarm:	Activates when the process exceeds a specified band centered around the setpoint.

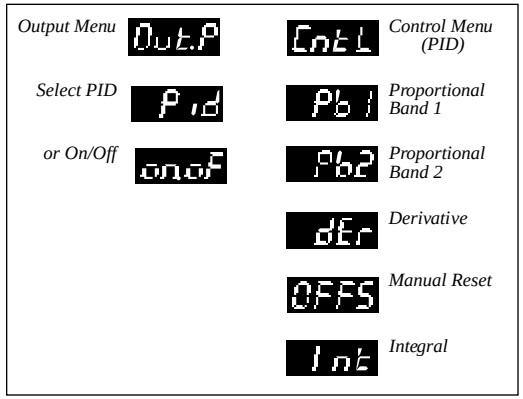
When a latching alarm has been activated and the alarm condition has been removed, the Mode/Enter key must be pressed to unlatch the alarm.

Latching Alarms

The CN8590's alarms may also be configured as latching alarms by selecting LAT in the Output 1 or Output 2 Alarm Action A1AC or A2AC parameter selection.

Available Control Methods

The user-selectable control method options provided by the CN8590 controller are On/Off, PID (including subsets P, PI, PD, P/Manual Reset, PD/Manual Reset), or Manual. Use the Output menu to select On/Off or PID output action and the Control menu to enable or disable the derivative, integral, and manual reset selections as desired. Use the FOP (Fixed Output Percentage) operating mode to enable Manual operation (see page 29).



Autotuning

In order for the controller to autotune properly, the setpoint value must be at least 1% of span above or below the initial process value. Ex. sensor span = 1548 (Type J thermocouple); acceptable setpoint value = ±16 (15.4) units from the initial process value.

Tuning accuracy increases as the spread between ambient and setpoint value increases.

While some processes other than heat or cool applications may respond successfully to autotuning procedures, the controller must be manually tuned for most non-temperature processes.

To place the CN8590 in Autotune mode:

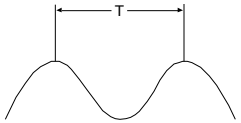
1) Configure the controller by following the directions for Initial Setup Sequence through Step 5 on page 20. Set damping to normal dL. (See page 24.)
2) If the controller is not already in Standby mode, place it in Standby now as follows. Press and hold the Mode/Enter key for 3 seconds. Display will indicate FOP. Press the Raise key to select Standby. Press Mode key again and the display will alternate between StbY and the process value.
3) If Setpoint Value has not been entered, adjust setpoint now by pressing the Menu Access key once. The Setpoint menu SP, alternating with the Setpoint Value, will flash. (If not, press the Menu Access key for three seconds to return to the Standby/Process Value display, then press it once again.) Use the Raise or Lower key to set the desired setpoint. Press the Mode/Enter key to return to the Standby/Process Value display. Wait for process to stabilize before proceeding, e.g., in the case of a heating process, return to ambient temperature.
4) Initiate Autotuning. Press and hold the Mode/Enter key for 3 seconds, then press the Lower key once AtUn. Finally, press the Mode/Enter key again. The display will alternately indicate AtUn and process value as the controller "learns" the proper gain, derivative, and integral values for the process.

If unacceptable overshoot occurs on restart, shut down the process and re-tune at the high Hi damping setting. If sluggish response is observed, shut down the process and re-tune using low Lo damping.

Manual Tuning Procedure - Heating Process (Zeigler-Nichols PID Method)

This tuning method may be used if the spread between ambient and operating temperature is small, and the autotuner is, therefore, disabled. It may also be used on non-temperature reverse-acting processes.

1) Disable cooling device.
2) Turn off the Direct-Acting output.
3) Under the Control menu, set derivative dEr and integral Int to zero, and the proportional band Pb1 or Pb2 to its maximum setting.
4) Adjust the setpoint to the desired value.
5) While monitoring the recording device, decrease the proportional band value by repeatedly halving the value until a small, sustained temperature oscillation is observed. Measure the period of one cycle of oscillation ("T" on the diagram on the next page).



6) Divide the period of oscillation (T) by eight. The resulting number is the correct Derivative dEr time in seconds. Multiply this number by four. This is the correct Integral time Int in seconds.
7) Multiply the bandwidth value obtained in Step 7 by 1.66 and enter this as the new proportional band value.

Error Codes

If an error code Er01 through Er05 cannot be cleared by using the actions provided, contact factory.

Display	Problem	Actions
Er01	RAM Diagnostic Test Failure	Press any key to perform a soft reset and reinitialize controller.
Er02	ROM Diagnostic Test Failure	
Er03	EEPROM Range Test Failure or EEPROM Update Failure	
Er04	SPI/EEPROM Interface Failure	
Er05	Default EEPROM Load Warning	
ErrH	Open Sensor	Check sensor, wiring, and Input Type selection in the Input menu.
ErrL	Reversed Sensor	

Technical Specifications

Operating Limits	
Ambient Temperature	32°F to 131°F (0°C to 55°C)
Relative Humidity Tolerance	90%, Non-Condensing
Power	85 to 250 Vac 50/60 Hz (Single-Phase)
Power Consumption	Less than 6 VA
Performance	
Accuracy	±0.20% of Full Scale (±0.10% Typical), ±1 Digit
Setpoint Resolution	1 Count / 0.1 Count
Repeatability	±1 Count
Temperature Stability	5 µV /°C (Maximum)
TC Cold-End Tracking	0.05°C /°C Ambient
Noise Rejection	>100 dB Common Mode, >70 dB Series Mode
Process Sampling	3.7 Hz (270ms)
Control Characteristics	
Setpoint Limits	Automatically Adjust to Selected TC / RTD
Alarms	Adjustable for High / Low; Selectable Process or Deviation
Proportional Band	1 to Span of Sensor
Integral	0 to 9600 Seconds
Derivative	0 to 2400 Seconds

Technical Specifications

Cycle Time	0 = 300 ms; 1 to 120 sec
Control Hysteresis	1 to Span of Sensor
Autotune	Operator Initiated from Front Panel
Manual Control	Operator Initiated from Front Panel

Mechanical Characteristics

Display	7-segment LED, alphanumeric
Numeric Range	-1999 to 9999
Display Height	0.400"
Color	Green
Front-Panel Cutout	0.874" x 1.772" (22.19 mm x 45 mm)
Bezel Outside Dimensions	0.944" x 1.890" (24 mm x 48 mm)
Bezel Height	0.328" (8.33 mm)
Case Depth	3.937" (100 mm)
Weight	3.04 oz (86.18 g)
Connections	Input and output via removable barrier strip.

Technical Specifications

Inputs

Thermocouple	J, K, T Maximum lead resistance 100 ohms for rated accuracy
RTD	Platinum 2-wire, 100 ohms at 0°C, DIN curve standard (0.00385)
Linear	0-50 mV/10-50 mV, 0-20 mA/4-20 mA with external 2.5 ohm shunt resistor
Input Impedances	0-50 mV/10-50 mV: 1 K ohm ±1% 0-20 mA/4-20 mA: 2.5 ohm ±1%

Outputs

Type R	Electromechanical relay, 5 A @ 120 Vac, 5 A @ 240 Vac
Type T	Solid-state relay, 120/250 Vac, zero voltage-switched, 1 A continuous / 10 A surge @ 25°C.
Type DC	5 Vdc pulsed (open collector)

Ordering Information

*To Order (Specify Model Number)**

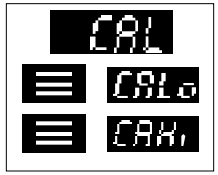
Model Number	Price	Output 1/Output 2
CN8592-R1-DC2	$190	Relay/DC SSR Driver
CN8592-R1-T2	$190	Relay/SSR
CN8592-DC1-DC2	$190	DC Pulse/DC Pulse
CN8592-DC1-T2	$190	DC Pulse/DC Pulse
CN8592-T1-DC2	$190	SSR/DC Pulse
CN8592-T1-T2	$190	SSR/SSR

Note: Both outputs must be configured in the field to be either direct-acting or reverse-acting.

*Single-output models are no longer available.

Recalibration Procedures

The CN8590 controller is precalibrated at the factory. Under normal circumstances, the factory calibration should be valid for the life of the instrument. If recalibration should be required, allow the controller to warm up for 15 minutes and follow these steps carefully.



1) Remove power from the controller, then all wires from terminals 1 through 6. Attach an appropriate sensor emulator to input terminals 1 and 2.
2) Power on the sensor emulator, making sure that the current emulated value is not outside the range of the CN8590. Then, power on the CN8590.
3) Index to the Calibration Low CALo menu item in the Calibration Menu. (You must have the Security Level set to "Factory" to access this menu.)
4) For thermocouples and RTDs, dial the low calibration values into the sensor emulator using the table below. For linear inputs, calibrate from low scale.

Sensor Type	Calibration Low	Calibration High
J	0° C/32° F	760° C/1400° F
K	0° C/32° F	1350° C/2462° F
T	0° C/32° F	400° C/ 752° F
RTD	0° C/32° F	850° C/1562° F
RT.D (decimal)	0° C/32° F	200.0° C/392.0°F

5) Use the Raise or Lower Keys to match the values shown on the display to the extracted table value.
6) Push the Mode/Enter Key to index to the Calibration High CAHi menu item.
7) Repeat Steps 4 and 5 for the Calibration High CAHi setting.
8) Press the Menu Access key for three seconds to return to the Process Value display.

1. To return the unit to last operating mode (Normal, Standby, FOP, or Tune):

	Action	Display
From Menu System:	Press and hold for 3 sec.	PV/Mode
From Security Level Menu:	Press	PV/Mode

2. To enter Standby operating mode:

	Action	Display
From Normal operating mode:	Press and hold for 3 sec.	FOP
	Press	StBy
	Press	StBy + PV
From FOP (Manual) operating mode	Press and hold for 3 sec.	StBy
	Press	StBy + PV
From Menu System:	Press and hold for 3 sec.	
	Press and hold for 3 sec.	FOP
	Press	StBy
	Press	StBy + PV
From Security Level Menu:	Press and hold for 3 sec.	PV
	Press	FOP
	Press	StBy
	Press	StBy + PV

3. To escape from Standby operating mode:

Action	Display
Press and hold for 3 sec.	FOP
Press	StBy
Press	nor
Press	PV

4. To initiate Autotuning:

Action	Display
Enter Standby operating mode (See Quick-Help #2)	
Press and hold for 3 sec.	FOP
Press	AtUn
Press	AtUn + PV

5. To abort Autotuning:

Action	Display
Press and hold for 3 sec.	FOP
Press	FOP + PV
Press and hold for 3 sec.	StBy
Press	nor
Press	PV

Quick-Helps

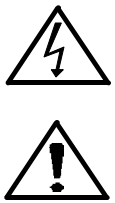
6. To enter FOP (Manual) operating mode:

Action	Display
Press and hold	
☰ for 3 sec.	FOP
Press ☰	FOP + PV
Press ↻	Pct + % of Power Value or
	Pct1
	Pct2 + % of Power Value
Press ▲ ▼ to set new % of Power Value	
Press ☰	FOP + PV

7. To escape from FOP (Manual) operating mode:

Action	Display
Press and hold	
☰ for 3 sec.	StBy
Press ▲	nor
Press ☰	PV

IEC Requirements



USE OF THIS EQUIPMENT IN A MANNER NOT SPECIFIED BY THE MANUFACTURER MAY IMPAIR PROTECTION PROVIDED BY THE EQUIPMENT!

The maximum supply current is line voltage dependent:

230 mA for a 24 Vac input fuse rating=700 mA
60 mA for an 85-265 Vac input fuse rating=100 mA

Output Specifications

Output Type	Max current	Voltage	Leakage
R	5 A	380 Vac	1000M Ohms
T	1 A	400 Vpk	1 mA
DC	20 mA	5 V	NA

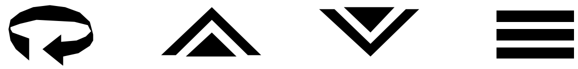
CLEANING INSTRUCTIONS

1. Remove power from the unit prior to any cleaning operation.
2. Use a cotton cloth to gently and sparingly apply isopropyl alcohol only. Do not use cleaners or other solvents as they may damage the unit.
3. Allow the unit to dry completely prior to reapplying power.

Quick Setup Instructions - CN8590 Temperature Controller

Experienced users, already familiar with the CN8590, and using the controller with PID outputs, may follow these condensed instructions to autotune the controller and get started quickly once the instrument is properly mounted and wired, and the Security Level is set to CnFG. Once setup is complete, we recommend changing the Security Level back to the most restrictive level suitable for your application.

These quick setup instructions are not meant as a substitute for reading the full instruction manual supplied with the controller. Please be sure to read through the manual for specific details of operation and, most importantly, for safety precautions. If you have any questions, or experience problems with setting up your controller, consult the full instruction manual first and, if you still need assistance, contact your Omega representative or call 1-800-872-9436.



Menu Access   Raise   Lower   Mode/Enter

1. Apply power. After self-check display stops, place controller in Standby mode by pressing and holding the ≡ key for 3 seconds, the ▲ key once, and then the ≡ key again. Stby will flash, alternating with the Process Value.

2. Press ↻ repeatedly until InP is displayed. Then press the ≡ key repeatedly until tYPE appears. Use ▲ or ▼ to select sensor input type.

3. Press ↻ to display Out.P. Then press ≡ once to display O1.tY. Use ▲ or ▼ to select Pid.

4. Press the ≡ key until Output 1 Action O1.Ac is displayed. Select the desired output action using the ▲ or ▼ keys. rE = Heating dir = Cooling

5. Press ≡ again to display the Output 1 Cycle Time O1.cY parameter. Select the desired cycle time according to the output device used. If unsure, refer to the ordering code on page 40 of the instruction manual and compare it to the number on the label.
   Recommended cycle times are:

For Control Output Device —	Select Cycle Time (in seconds)
R (Output 1 only)	15
DC	0
T	15

IMPORTANT: IF ONLY ONE OUTPUT IS ***PID***, SET THE OTHER OUTPUT TO EITHER ***ON/OFF, ALARM***, OR ***OFF***.

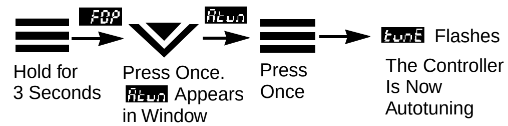
6. Press the ≡ key to display the next output parameter, Output 1 High Limit O1.HL, and select the desired value using the ▲ or ▼ keys.

7. Repeat Steps 3 through 6 for Output 2 if required; otherwise, repeat Step 3 to select other Output Type.

8. Press the ↻ repeatedly until tunE is displayed, then press ≡ and make sure autotune damping parameter is set to normal nL. If not, use ▲ or ▼ to change it to the normal setting.

9. Press and hold the Menu Access key ↻ for 3 seconds until Stby flashes.

10. Initiate autotuning per chart below.



11. If unacceptable overshoot occurs, shut down the process and allow it to stabilize. Re-tune at the high damping setting. If response is sluggish, use the low damping setting.

Notes

Notes

Notes

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of 25 months from date of purchase. OMEGA's Warranty adds an additional one (1) month grace period to the normal two (2) year product warranty to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR WARRANTY RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR NON-WARRANTY REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchse Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

OMEGA is a registered trademark of OMEGA ENGINEERING, INC.

Where Do I Find Everything I Need for Process Measurement and Control? OMEGA...Of Course!

TEMPERATURE

- Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- Wire: Thermocouple, RTD & Thermistor
- Calibrators & Ice Point References
- Recorders, Controllers & Process Monitors
- Infrared Pyrometers

PRESSURE, STRAIN AND FORCE

- Transducers & Strain Gages
- Load Cells & Pressure Gages
- Displacement Transducers
- Instrumentation & Accessories

FLOW/LEVEL

- Rotameters, Gas Mass Flowmeters & Flow Computers
- Air Velocity Indicators
- Turbine/Paddlewheel Systems
- Totalizers & Batch Controllers

pH/CONDUCTIVITY

- pH Electrodes, Testers & Accessories
- Benchtop/Laboratory Meters
- Controllers, Calibrators, Simulators & Pumps
- Industrial pH & Conductivity Equipment

DATA ACQUISITION

- Data Acquisition & Engineering Software
- Communications-Based Acquisition Systems
- Plug-in Cards for Apple, IBM & Compatibles
- Datalogging Systems
- Recorders, Printers & Plotters

HEATERS

- Heating Cable
- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

- Metering & Control Instrumentation
- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments

M2386/0699