User's Guide

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ΩEOMEGA® CN78000 TEMPERATURE CONTROL

Specifications - Installation and Operating Instructions

48
(1.880)

48 (1.880)

11.4
(0.45)

133 (5.24)

MEETS NEMA 4X

44.7
(1.76)

6.35 (0.25)
MAX. PANEL
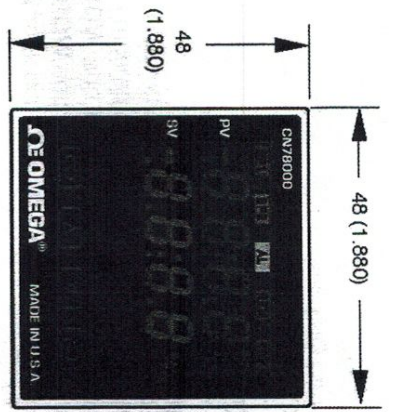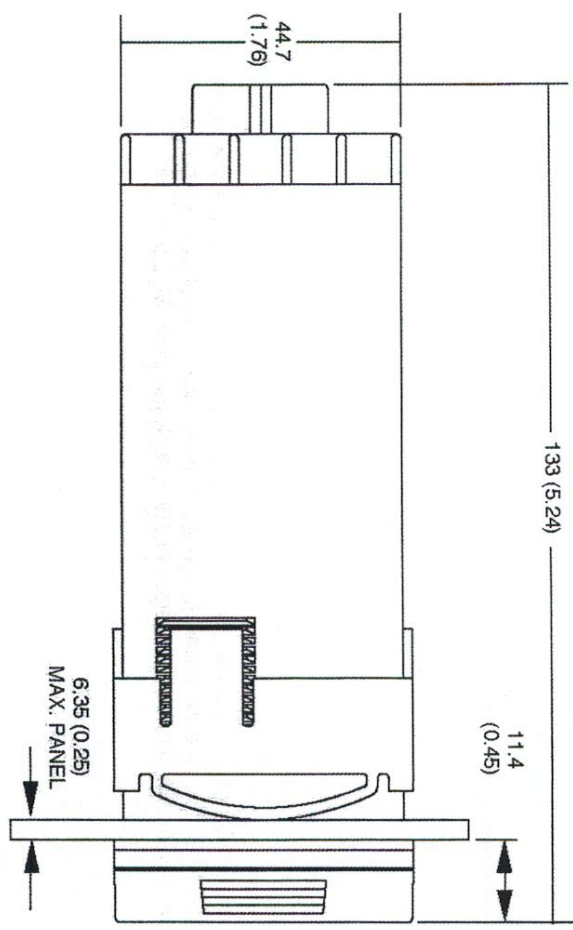
PANEL CUTOUT FOR ALL MODELS 45 MM X 45 MM (1.77" X 1.77")
ALLOW FOR 13 MM (0.5") CLEARANCE AT THE REAR OF INSTRUMENT.

ALL DIMENSIONS IN MILLIMETERS (INCHES IN PARENTHESES)

OMEGA Engineering
One Omega Drive, Stamford, Connecticut 08907-0047
P.O. Box 4047

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| 800/848-4286 or 203/359-1660 | 203/359-7700 |

CONTENTS

GETTING STARTED

1. Install the control as described on page 4.

2. Wire your control following the instructions on page 5. If you are using a two-wire transmitter as an input, see the drawing and instructions on page 6. Option wiring instructions are on Page 7. Option descriptions and specific instructions start on page 13.

3. Most controls do not need many (if any) program changes to work on your process. For best results when changing the programming, make all the necessary changes in the Secure Menu (page 16). If error messages occur, check the Error Messages on page 31-33 for help.

Take the example of a Series CN78000 that comes from the factory programmed for type J thermocouples. Suppose for this example you wish to change the input to a 100 ohm Platinum RTD and limit the set point range between 0° and 300°C.

First enter the Secure menu by pressing and holding the **UP ARROW** & **ENTER** keys

---

for 5 Seconds (see Page 22.) Press the **INDEX** key until the display shows *inP* and press the **DOWN ARROW** until the display shows *P385*. Don't forget to press the **ENTER** key to retain your setting.

Next, press the **INDEX** key to display *Un it*. Press the **DOWN ARROW** until the display shows *t*. Press **ENTER**.
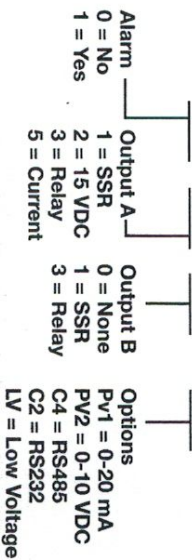
Next, press the **INDEX** key until *SPL* is displayed (pass the *dPt* and *inPt* selections). Press the **UP ARROW** until the display shows *0*. Press **ENTER**.

Finally, press **INDEX** key to display *SPH*. Press the **DOWN ARROW** until the display shows *300*. Press **ENTER**.

The necessary program changes are now complete. After 30 seconds the display will switch back to the temperature reading. If you want to return faster, press the **UP ARROW** and **ENTER** keys (at the same time) and then press the **DOWN ARROW** and **INDEX** keys (again at the same time). This will 'back out' of the menu and immediately display the temperature reading.

If you want to use Self Tune or Auto/Manual features, see the special sections on these items. Page numbers for these are in the Contents section on the previous page.

CN78

	Output A		Output B		Options
Alarm	0 = No	1 = 5mA	0 = None	Pv1 = 0-20 mA	Pv1 = 0-20 mA
0 = No	1 = Yes	2 = 15 VDC	1 = SSR	PV2 = 0-10 VDC	PV2 = 0-10 VDC
1 = Yes		3 = Relay	3 = Relay	C4 = RS485	C4 = RS485
		5 = Current		C2 = RS232	C2 = RS232
				LV = Low Voltage	LV = Low Voltage

Option Description

PV1*   Analog Retransmission of Process Variable or Set Variable, 0 to 20 mAdc, scalable (may be programmed for 1 to 5mA, 4 to 20 mA, etc).

PV2*   Analog Retransmission of Process Variable or Set Variable, 0 to 10 Vdc, scalable.

C4*   RS-485 Serial Communications, Lovelink™ protocol.

C2*   RS-232 Serial Communications, Lovelink™ protocol.

LV*   12-24 Vdc/Vac 50-400 Hz power supply (control operates on low voltage equipment).

* These options may not be combined with each other.
Option LV may be combined with other options.

INSTALLATION

Mount the instrument in a location that will not be subject to excessive temperature, shock, or vibration. All models are designed for mounting in an enclosed panel.

Select the position desired for the instrument on the panel. If more than one instrument is required, maintain the minimum of spacing requirements as shown on the drawing below. Closer spacing will structurally weaken the panel, and invalidate the IP66, UL type 4X rating of the panel.
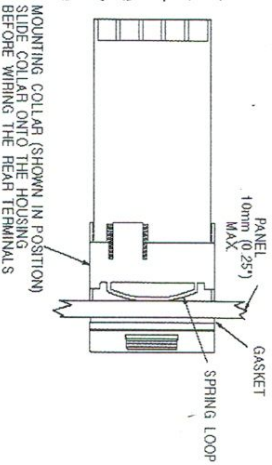
Prepare the panel by cutting and deburring the required opening.
All Tolerances are -0.00 +0.60mm (-0.000 + 0.020 in.)

45mm (1.77in)					
Cut Out		19mm (0.75in)		45mm (1.77in)	
		Cut Out			45mm (1.77in)

45mm (1.77in)
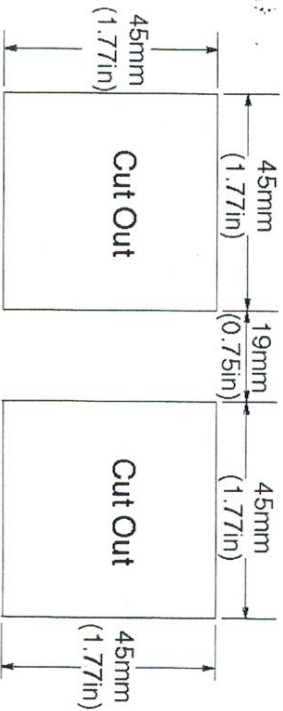
From the front of the panel, slide the housing through the cut out. The housing gasket should be against the housing flange before installing.

From the rear of the panel slide the mounting collar over the housing. Hold the housing with one hand and using the other hand, push the collar evenly against the panel until the spring loops are slightly compressed. The ratchets will hold the mounting collar and housing in place.

MOUNTING COLLAR (SHOWN IN POSITION)
SLIDE COLLAR ONTO THE HOUSING
BEFORE WIRING THE REAR TERMINALS

PANEL
10mm (0.25")
MAX.

GASKET

SPRING LOOP

CAUTION: It is not necessary to remove the instrument chassis from the housing for installation. If the instrument chassis is removed from the housing, you must follow industry standard practice for control and protection against Electro-Static Discharge (ESD). Failure to exercise good ESD practices may cause damage to the instrument.

WIRING
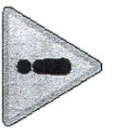
Do not run RTD, thermocouple, or other class 2 wiring in the same conduit as power leads. Use only the type of thermocouple or RTD probe for which the control has been programmed. Maintain separation between wiring of sensor, optional inputs and outputs and other wiring. See the "Secure Menu" for input selection.

For thermocouple inputs always use extension leads of the same type designated for your thermocouple.

For supply connections use No. 16 AWG or larger wires rated for at least 75°C. Use copper conductors only. All line voltage output circuits must hvave a common disconnect and be connected to the same pole of the connect.

Input wiring for thermocouple, current, and RTD; and output wiring for current and 15 VDC is rated CLASS 2.

Control wiring is as shown (view is from the rear of instrument showing wiring terminals).

INPUTS

Current
RTD*
Voltage
Thermocouple

ALARM OUTPUT

Terminals 9 & 10 are Normally Open relay contacts.
See Rating Label.

F1
3/8 A @250 VAC
Medium Lag

AL1

Line Input See Rating
Label for details
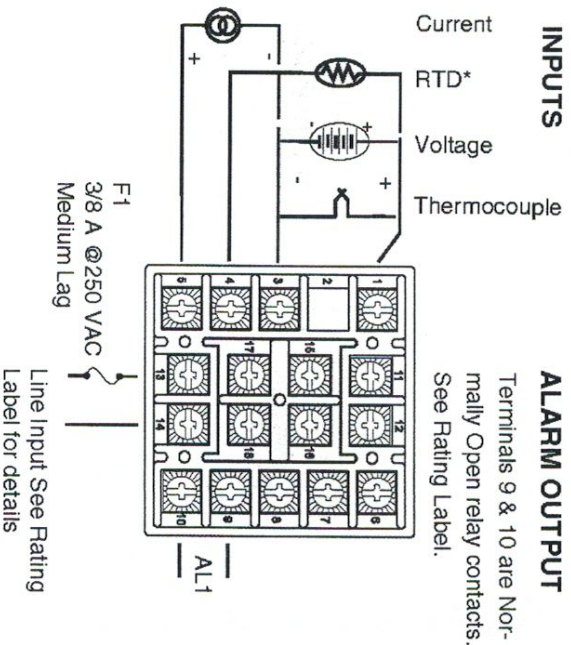
*For 2 wire 100 Ohm and 1K Ohm RTD use terminal 1 & 3, and place a jumper wire between terminals 3 & 4.

OUTPUTS
(Rear View showing center)
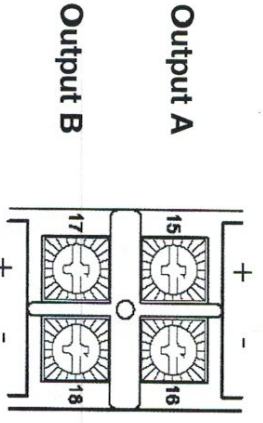
Output A

Output B

For AC SSR or relay type outputs (Output Codes 1 or 3), 15 & 16, and 17 & 18 are normally open. See Rating Label for details.

For Pulsed DC, Current, or DC SSR ouputs (Output codes 2, 4, or 8), 15 & 17 are positive, 16 & 18 are negative.

Note: Factory default assigns Output A to Set Point 1 and Output B to Set Point 2. If necessary, these realtionships may be reversed. See **SP 10** in the Secure Menu.

Wiring for 4 to 20mA Transmitter Inputs

Wiring power and ouputs as shown above. Two-wire transmitters wire as shown below. View is of instrument as seen from the rear to show wiring terminals. For three or four-wire transmitters, follow the wiring instructions provided with your transmitter.
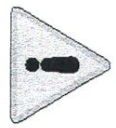
CAUTION: DO NOT WIRE THE 24 VOLT POWER SUPPLY ACROSS THE INPUT OF THE CONTROL. DAMAGE TO THE CONTROL INPUT CIRCUITRY WILL OCCUR.
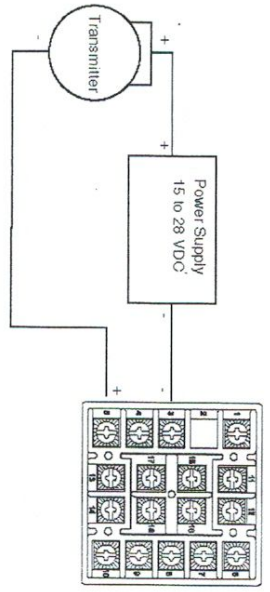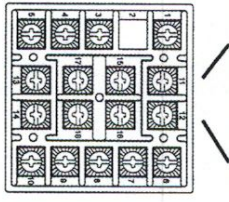

Wiring for Optional Inputs and Outputs

Options are described on Page 3. Detailed option programming and operation starts on Page 13. Wire power and outputs as shown on Pages 5 and 6. Wiring for options is shown opposite. All wiring shown above is CLASS 2. Shielded twisted pair is required for Option C4. Shielded cable is required for Option C2.

CAUTION: DO NOT RUN SIGNAL WIRING IN THE SAME CONDUIT OR CHASE AS THE POWER WIRING. ERRATIC OPERATION OR DAMAGE TO THE CONTROL CIRCUITRY WILL OCCUR.

OPTION/TERMINALS	11	12	6	7	8
PV1 PV/SV Retransmission, Current (e.g. 4-20 mA)	+	-	na	na	na
PV2 PV/SV Retransmission, Voltage (e.g. 0-10V)	+	-	na	na	na
C4 RS-485 Serial Communications	B	A	na	na	na
C2 RS-232 Serial Communications	Data In	Data Out	Signal Ground	na	na

View of rear of instrument showing wiring terminals.

RS-485 Daisy Chain Wiring Example

Line A
Line B
Ground

Shielded Twisted Pair Wire

120 ohm terminator resistor

Note: Industry standard designation for RS-485 lines is A and B. Some equipment manufacturers use a non-standard designation of plus and minus. The association of A to minus and B to plus is based on a sample of devices marked as plus and minus and is not intended to represent ALL such labelled devices. Final responsibility for correct identification of leads and terminals rests with the user/installer and the manufacturer of the other device(s) installed in the system.

RS-232 DB-25 WIRING (VIEWED FROM WIRE SIDE)

PIN	DESC	PIN	DESC	PIN	DESC
1	SHIELD	4	RTS	7	GROUND
2	TRANSMIT	5	CTS	8	DCD
3	RECEIVE	6	DSR	20	DTR

DATA IN 11
DATA OUT 12
DATA GROUND 6

RS-232 DB-9 WIRING (VIEWED FROM WIRE SIDE)

PIN	DESCRIPTION
1	DCD
2	RECEIVE
3	TRANSMIT
4	DTR
5	GROUND
6	DSR
7	RTS
8	CTS

DATA OUT 12
DATA IN 11
DATA GROUND 6

FRONT PANEL KEY FUNCTIONS

Alarm Lamp
Set Point 1 Lamp
Set Point 2 Lamp
Process Display
Set Point Display

Remote Set Lamp
Heater Fail Lamp
°F Indicator
°C Indicator
Percent Lamp
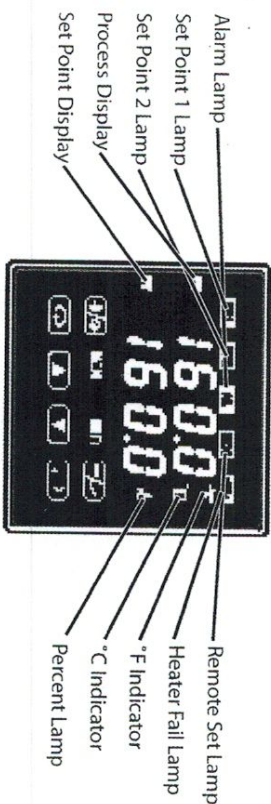
The decimal point flashes when Self Tune is operating. Keys are illuminated when pressed. Key functions are as follows:

INDEX: Menu Navigation. Pressing the INDEX key advances the display to the next menu item. May also be used in conjunction with other keys as noted below.

UP ARROW: Increments a value, changes a menu item, or selects the item to ON. The maximum value obtainable is 9999 regardless of decimal point placement.

DOWN ARROW: Decrements a value, changes a menu item, or selects the item to OFF. The minimum value obtainable is -1999 regardless of decimal point placement.

ENTER: Pressing ENTER stores the value or the item changed. If not pressed, the previously stored value or item will be retained. The display will flash once when ENTER is pressed.

UP ARROW & ENTER: Menu Access. Pressing these keys simultaneously brings up the secondary menu starting at the alarm, tune, or cycle item (depending on programming). Pressing these keys for 5 seconds will bring up the secure menu.

INDEX & DOWN ARROW: Menu navigation. Pressing these keys simultaneously will allow backing up one menu item, or if at the first menu item they will cause the display to return to the primary menu.

INDEX & DOWN ARROW: Alarm Reset. If an alarm condition has occurred, press and hold these keys for three seconds to reset the alarm. Note that the alarm condition will not reset if the alarm condition still exists.

INDEX & ENTER: 'Global Reset'. Pressing these keys simultaneously and holding them for 5 seconds forces a 'warm boot', restarting the

control (similar to turning power off and on). 'Global Reset' will allow recovery from errors and reset the following menu items:

AL   H: Alarm inhibit   OPEn   inP: Input error
bA   nP: Input err   CHEC CAL: Check calibration

Correct the problems associated with the above conditions before using the reset keys. More than one error could present. Caution is advised since several items are reset at one time.

While in the **Primary** or **Secondary Menu**, if no key is pressed for a period of 30 seconds, the display will return to the HOME position displaying the temperature value. While in the **Secure Menu**, if no key is pressed for a period of 60 seconds, the display will return to HOME position displaying the temperature value. Outputs are disabled (turned off) when the **Secure Menu is active**.

NOTE: To move the **Primary** or **Secondary Menu** quickly from any other menu, press the UP ARROW & ENTER keys followed by pressing the INDEX & DOWN ARROW keys.

SECURITY LEVEL SELECTION

Four levels of security are provided. The display shows the current security level. To change security levels, change the password value using the UP ARROW and DOWN ARROW keys and press the ENTER key. Refer to the password table for the correct value to enter for the security level desired. The SECr menu item security level may be viewed or changed at any time regardless of the present security level.

Example: To set security access level to 2, at the SECr menu item, press the UP ARROW key until the upper display shows the password for level 2 access, 1101. Press the ENTER key. The display will blink and return with the level value, 2, in the upper display.

The password values shown in the table cannot be altered, so retain a copy of these pages for reference. This is the only reference made to password values in this instruction book.

PASSWORD TABLE

Security Level	Status	Displaying Value When Viewed	Password Value To Enter
Menu	Status		
Primary	Locked		
Secondary	Locked	1	1110
Secure	Locked		
Primary	Unlocked		
Secondary	Locked	2	1101
Secure	Locked		
Primary	Unlocked		
Secondary	Unlocked	3	1011
Secure	Locked		
Primary	Unlocked		
Secondary	Unlocked	4	111
Secure	Unlocked		

NOTATION CONVENTIONS FOR THE MENUS

Because of the number of features available in this control, information is included that may not apply to your specific control. All usable features are included in this book, but may not be used in your process. To increase clarity, the following conventions are used:

1. Certain features, menu items, and functions shown in this book may or may not appear on your control, depending on other menu item selections. At various places in the menu there are notes identifying menu items that "control" or "direct" other menu items. If you are looking for a particular menu item and can't find it, check the menu item that is it's "control" for proper setting

2. The "#" symbol is used in two ways. It is used inside group of characters to indicate which set point function (SP1 or SP2) is being affected. It is also used before a group of characters of a menu item to indicate that there may be more than one selection or value for that menu item. This is used for certain repeated items such as in the Ramp/Soak Program section.

3. Features that apply only to Options will be printed in Italics.

THE HOME DISPLAY

The home display is the normal display while the control is operating. If no errors or functions are active, the HOME display will indicate the Process Variable (the temperature, pressure, flow, RH, etc., that is being measured) on the top display and the Set Variable (Set Point 1) on the bottom.

Items that can change the HOME display are the Auto/Manual function, the Run/Hold function, the $Pro9$ function, the $Pct0$ function, and any error message. Description of these special displays follows.

If the [A/M] Auto/Manual key is pressed, the Manual indicator lights, and the home display is changed. The upper display continues to show the Process Variable (PV), but the lower display changes to show the percentage of output in tenths of a percent to 99.9% (0.0 to 99.9) or 100 if 100%. The display digit to the right of the number shows a flashing letter o to indicate that the value displayed is no longer the SV, but percent output. The $SP2$ percent output is indicated by the use of an overline on the o. Access to the $SP2$ value is made by the [INDEX] INDEX key. See Auto/Manual Operation on Page 14 for further information.

If $Pro9$ is turned $0n$, the HOME display changes the SV display from SP1 to the Present Set Variable as calculated by the Ramp/Soak Programmer function. See Programming and Operation for Ramp/Soak Feature below for more information.

If $Pct0$ (Secondary Menu) is turned $0n$, the lower display changes to show the active percentage of output as required to maintain $SP1$. The display is similar to the Auto/Manual display above, except that the percent indicators (o, ō) do not flash, and the output is displayed in whole percentages of output, not in tenths of a percent. If the control has both $SP1$ and $SP2$, the lower display will alternate between the $SP1$ percent output and the $SP2$ percent output.

Error messages are listed on Pages 37-39.

Option PV1, PV2, Isolated Analog Retransmission

The analog retransmission option allows the process variable or the Set Variable to be sent as an analog signal to an external device. The signal may be either 0 to 10 VDC (Option PV2) or o (or 4) to 20 mADC (option PV1). THe output may be changed in the field from one to the other by the toggle switch located on the top printed circuit board.

Wire the output as shown on page 7.

To set up the analog retransmission, first determine the scale range that the analog signal will represent. The maximum scale is 9999°F, 5530°C, or 9999 counts. In the Secondary Menu set PO_L for the scale value that will be represented by the high end of the analog signal (10 Volts or 20 mA).

If you require a suppressed scale or output, use the following equations to determine the proper setting for PO_L and PO_H.

K = (Highest desired scale reading - Lowest desired scale reading) / (Maximum desired analog signal - Minimum desired analog signal).

PO_H = ((Maximum possible analog output - Maximum desired analog signal) * K) / + Highest desired analog reading.

PO_L = Lowest desired scale reading - ((Minimum desired analog output) * K).

Next select whether you want the retransmission signal to follow the Process Variable or the Set Variable. Usually the Process Variable is sent to recorders or other data acquisition devices. Usually the Set Variable is sent to other controls to be used as an analog remote set point. If you want the analog retransmission signal to follow the PV, in the Secondary Menu set PO_5- to inP. If you want the analog retransmission signal to follow the SV, set PO_5- to SPt.

Operation is automatic. There are no further programming steps required.

Option C2, C4, Serial Communication

The serial communications options allow the control to be written to and read from a remote computer or other similar digital device. Communication is allowed either through a RS-485 (Option C4) port, or a RS-232 (Option C2) port.

Wire the communication lines as shown on Page 7. Wiring for the RS-485 is run from control to control in a daisy chain fashion with a termination resistor (120 ohms) across the transmit and receive terminals of the last control in the chain.

Select the control address and communication baud rate with the $Addr$ and $bAud$ menu items in the Secure Menu.

NOTE: THE BAUD RATE AND ADDRESS MENU ITEM SETTINGS WILL TAKE EFFECT ON THE NEXT POWER UP OF THE CONTROL. BE SURE TO TURN THE POWER TO THE CONTROL OFF AND ON BEFORE USING THE NEW BAUD RATE AND ADDRESS VALUES.

In operation, you have the option of preventing a write command from the host computer. To prevent the host from writing to the control change the $LO-E$ menu item in the Secondary Menu to LOC. To allow the host to write commands to the control set $LO-E$ to rE. (The host does have the ability to change the $LO-E$ state, but it is not automatic.)

If your system depends on constant reading or writing to and from the host, you may wish to set the No Activity Timer (nAt) to monitor the addressing of the control. When the $LO-E$ is set to rE and the nAt is set to any value other than Off, the control will expect to be addressed on a regular basis. If the control is not addressed in the time set by the value of nAt, then the control will display the error message $CHEC LO-E$. To clear the message set $LO-E$ to LOC.

Serial Communications
Options and Non-volitile Memory

There are many different types of memory used in computer driven devices. The terms RAM (random access memory) and ROM (read only memory) are a couple with which you may be familiar.

RAM is used in computers to run programs and hold data for a short period of time. This is the memory that is used primarily in PCs. RAM is very fast and can be read and written to over and over again.

ROM is used in computers to hold the 'permanent' programming that allows a PC to start. This memory is 'burned in' to the chip itself and can not be changed. Unlike RAM, however, this memory is permanent. While it can not be changed, it can not lose its programming when power is turned off.

There is a third type of memory that is now currently used to combine the characteristics of both RAM and ROM. This is known as EEPROM (electrically erasable programmable read only memory). While the name may be long and somewhat cryptic, the EEPROM can be erased and re-written many times, and yet hold the programmed data even over long periods of time when the power is off. This is the type of memory that all Omega products use to save the settings your program in your control. The reliability and longevity of the data retention is what allows us to guarantee a 10 year data retention without power.

In normal operation, the control uses RAM, just as any other computerized device. Whenever you make a change to one of the parameters in the control, the set point for example, the new value is written into the EEPROM. This way, if power goes off for whatever reason, when power resumes, the latest settings are preserved. When

power is turned on, the data is copied from the EEPROM to the RAM to begin operation.

If EEPROM is such a wonderful thing, you might ask, why bother with RAM? One reason is that RAM is much faster than EEPROM. Faster speed gives you better performance in critical control functions.

Perhaps the most important reason is that EEPROM has a limit to the number of times it can be erased and re-written. Current technology now sets that limit at about one million erase/write cycles. In a dynamic control situation, it may be necessary to update RAM every few milliseconds. EEPROM can not keep up to that pace, and, even if it could, it would be 'used up' in a matter of days.

If you think about how long it would take a million changes to the control programming through the front key pad, you will see that it would take a very long time to get to use up the life of the EEPROM.

Adding one of the computer communications options (e.g. 992, 993) changes the picture. The speed of computer communications is such that hundreds of instructions can be made in less than a minute. In such a situation, the million erase/write cycles could be used up in a couple of months causing the control to fail.

Usually in such a situation, the control is under close observation by the host computer. It may not be necessary, then to the data written to the EEPROM, as it is 'transitory' in nature (changing set points for a ramp/soak sequence for example).

All CNT8000 Series controls with communications options made before April 2001 are only able to write to the EEPROM. Controls manufactured after this date have a menu item in the Secure menu (*Stor*) that allows the serial communications to write to RAM (*Stor = no*) with a special write command that allows to EEPROM to be updated or written directly to EEPROM (protocol command 0442).

The factory default is 'write to EEPROM (*Stor = YES*).

If your computer system will be making frequent changes to the control we strongly recommend that you select the 'write to RAM' parameters (*Stor = no*). If you are primarily reading from the control, there is no need to change the setting.

Any instruments equipped with any Serial Communications are limited to one million WRITE cycles to the EEPROM through the Serial Communications Port. Exceeding this limit will generate a *FAIL tESt* error. There is no limit to the number of times you can READ from this instrument EEPROM.

Make sure that the software you use does not write too often to the instrument.

If you have any questions regarding how your software works with the instrument(s), contact your System Administrator, Programmer, or Software Supplier.

MENU SELECTIONS

PRIMARY MENU
Press **INDEX** to advance to the next menu item. Press **UP ARROW** or **DOWN ARROW** to change the value in the display. Press **ENTER** to retain the value. If StAt, (Secondary Menu [16A3]), is *On*, the three program status menu items shown on Page 14 will precede the following.

SP1   Set Point 1 Adjust, Control Point 1.

SP2   Set Point 2 Adjust (if equipped), Control Point 2.

SECONDARY MENU
Hold **UP ARROW & ENTER**. Press **INDEX** to advance to the next menu item. Press **UP ARROW** or **DOWN ARROW** to change the value in the display. Press **ENTER** to retain the value.

ALo   Alarm 1 Low: The Low Alarm point is usually set below the Set Point. May not appear depending on *ALi* setting in Secure Menu.

AHi   Alarm 1 High: The High Alarm Point is usually set above the Set Point. May not appear depending on *ALi* setting in Secure Menu.

Out 1 Output selection: Select OnOF, ##tP, #Put, or ProP.

OnOF A setting of OnOF allows the control to operate in simple on/off mode. This setting forces the control to turn off at set point, and on at the set point plus the differential (SP id). When selected, the Out 1 OnOF menu items is followed by #### SP Od, and the tunE, Pb, rES, S IDL and S IDH selections in the Secure menu are suppressed.

SP id Set Point On-Off Differential (hysteresis). Set for the amount of difference between the turn off point and the turn on point. Select I to 9999 (direct acting), or - I to -9999 (reverse acting). This value will be negative for reverse acting set points, and positive for direct acting outputs. The following drawings shows output behavior for reverse and direct action. For reverse action note how the output decreases as the input process variable increases, e.g. heat power goes to zero as the temperature increases to set point.

DIRECT ACTING (S#St = d ir) (UPSCALE DIFFERENTIAL)

REVERSE ACTING (S#St = rE) (DOWNSCALE DIFFERENTIAL)
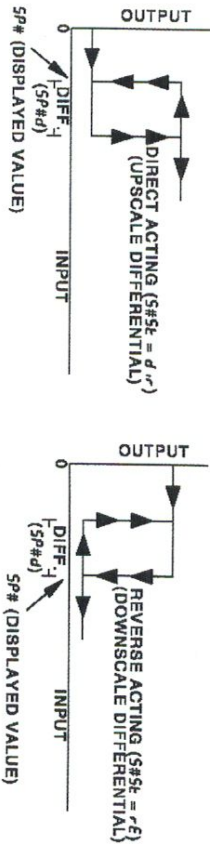
##tP Time Proportioning Cycle Time. Select itP to 80tP. A setting of 1tP is recommended for solid state outputs (SSR or 15VDC).

itP to 80tP Time Proportioning Control is adjustable in 1 second steps. Recommended for mechanical outputs (relays, solenoids, etc.). For best contact life, a time should be selected as long as possible without causing the process to wander.

#Put Pulsed Time Proportioning Output: Select iPut to ?Put. iPut = Linear and ?Put = most nonlinear. Changes output linearity for use in cooling applications or for extremely fast response processes. At the center of the proportional band, a pulse value of 1 provides an output of one second on and one second off (50% output). A pulse value of 2 provides an output of one second on and two seconds off (33% output). Output at center of band equals one second on, 2(pulse value-1) seconds off.

ProP For Current (Code 5) outputs only.

The following menu items apply only if your control is equipped with a second set point (last digit of model number is not zero). If your control does not have a second set point, jump to the tunE menu on the next page.

Out2 Output selection: Select OnOF, ##tP, #Put, or ProP.

OnOF A setting of OnOF allows the control to operate in simple on/off mode. This setting forces the control to turn off at set point, and on at the set point plus the differential (SP2d). When selected, the Out2/OnOF menu item is followed by #### SP2d, and the Pb2 selection in the Secondary menu and the S2DL and S2DH selections in the Secure menu are suppressed.

SP2d Set Point On-Off Differential (hysteresis). Select I to 9999 (direct acting), or - I to -9999 (reverse acting). See SP id on the previous page.

##tP Time Proportioning Cycle Time. Select itP to 80tP. A setting of itP is recommended for solid state outputs (SSR or 15VDC).

itP to 80tP Time Proportioning Control is adjustable in 1 second steps. Recommended for mechanical outputs (relays, solenoids, etc.). For best contact, life, a time should be selected as long as possible without causing the process to wander.

#Put Pulsed Time Poportioning Output: Select iPut to ?Put. iPut = Linear and ?Put = most nonlinear. Changes output linearity for use in cooling applications or for extremely fast response processes. At the center of the proportional band, a pulse value of 1 provides an output of one second on and one second off (50% output). A pulse value of 2 provides an output of one second on and two seconds off (33% output). Output at center of band equals one second on, 2(pulse value -1) seconds off.

ProP For Current (Code 5) outputs only.

tunE Tuning Choice: Select *SELF*, *P id*, *SLO*, *nor*, or *FASt*. The Controller will evaluate the Process and select the PID values to maintain good control. Active for SP1 only.

SELF Select *YES* or *no*.

YES Start Learning the Process. After the process has been learned the menu item will revert to *no*. Learning will stay in present mode.

no

dFAC Damping factor, select *OFF*, *1* to *7*. Sets the ratio of Rate to Rate for the *SELtunE* mode. *7* = most Rate. Factory set to *3*. For a fast response process the value should be lowered (less Rate). For a slower process the value should be increased (more Rate).

P id Manually adjust the PID values. PID control consists of three basic parameters, Proportional Band (Gain), Reset Time (Integral), and Rate Time (Derivative).

Pb 1 Proportional Band (Bandwidth). Select *1* to *9999*°F, °C, or counts.

Pb2 Proportional Band (Bandwidth). Select *1* to *9999*°F, °C, or counts. Appears only if control is equipped with second set point and *Out2* is NOT selected as *OnOf*.

rES Automatic Reset Time. Select *OFF*, *0.1* to *99.9* minutes. Select *OFF* to switch to *OFS*.

OFS Manual Offset correction Select. Select *OFF*, *0.1* to *99.9* percent. Select *OFF* to switch to *rES*.

rtE Rate Time. Select *OFF*, *0.1* to *99.9* minutes. Derivative.

P id2 Linkage of PID parameters between SP1 and SP2: Select *On* or *OFF*.

On Applies SP1 *rES*, *rtE*, *Fbnd*, and *FrtE* terms to SP2 for heat/cool applications

OFF SP2 functions without *rES*, *rtE*, *Fbnd*, and *FrtE*.

SLO PID values are preset for a slow response process.

nor PID values are preset for a normal response process.

FASt PID values are preset for a fast response process.

Ar-UP Anti- Reset Windup Feature: Select *On* or *OFF*.

On When *Ar-UP* is *On* the accumulated Reset Offset value will be cleared to 0% when the process input is not within the Proportional Band.

OFF When *Ar-UP* is *OFF*, the accumulated Reset Offset value is retained in memory when the process input is not within the Proportional Band.

Ar-tE Approach Rate Time: Select *OFF*, *0.0* to *99.99* minutes. The function defines the amount of Rate applied when the input is outside of the Proportional Band. The *Ar-tE* time and the *rtE* time are independent and have no effect on each other. To increase damping effect and reduce overshoot set the approach rate time for a value greater than the natural rise time of the process (natural rise time = process value time to set point).

F int Fuzzy Logic Intensity: Select *0* to *100%*. *0%* is OFF (disables Fuzzy Logic). The function defines the amount of impact Fuzzy Logic will have on the output.

Fbnd Fuzzy Logic Error Band: Select *0* to *4000* °F, °C, or counts. Sets the band width of the Fuzzy Logic. Set *Fbnd* equal to PID proportional band (*Pb 1*) for best results.

Fr-tE Fuzzy Logic Rate of Change: Select 0.00 to 99.99 counts/second. For best initial setting, find the counts/second change of process value near Set Point 1 with output ON 100%. Multiply this value by 3. Set *Fr-tE* to this calculated value.

PEA The Peak feature stores the highest input the control has measured since the last reset or Power On. At Power On *PEA* is reset to the present input. To manually reset the value *PEA* must be in the lower display. Press the **ENTER** key to reset. *PEA* will be reset and display the present input value.

UAL The Valley feature stores the lowest input the Instrument has measured since the last reset or Power On. At Power On *UAL* is reset to the present input. To manually reset the value *UAL* must be in the lower display. Press the **ENTER** key, *UAL* will be reset and display the present input value.

PctO Percent Output Feature: Select *On* or *OFF*.

    On When selected *On*, the HOME lower display will indicate the output of the controller in percent. An "*o*" will appear in the right hand side of the lower display to indicate percent output for SP1. An "*o̅*" will appear on the right hand corner of the lower display to represent percent output for SP2, if the control is so equipped. The display will alternate between these values.

    OFF Percent Output display is disabled.

InPC Input Correction: Select *-500* to *0* to *500* °F, °C, or counts. This feature allows the input value to be changed to agree with an external reference or to compensate for sensor error. **Note:** *InPC* is reset to zero when the input type is changed, or when decimal position is changed. Factory default is *0*.

F.lt Digital Filter: Select *OFF*, *1* to *99*. In some cases the time constant of the sensor, or noise, could cause the display to jump enough to be unreadable. A setting of 2 is usually sufficient filtering (2 represents approximately a 1 second time constant). When the 0.1 degree resolution is selected this should be increased to 4. If this value is set too high, controllability will suffer.

InPt Input Fault Timer: Select OFF, 0.1 to 540.0 minutes. Whenever an Input is out of range (UFL or OFL displayed), shorted, or open, the timer will start. When the time has elapsed, the controller will revert to the output condition selected by InPt below. If OFF is selected, the Input Fault Timer will not be recognized (time = infinite).

SEnc Sensor Rate of Change: Select OFF, 1 to 4000 °F, °C, or counts per 1 second period. This value is usually set to be slightly greater than the fastest process response expected during a 1 second period, but measured for at least 2 seconds. If the process is faster than this setting, the SEnc bad error message will appear. The outputs will then be turned off. This function can be used to detect a runaway condition, or speed up detection of an open thermocouple. Use the [INDEX] [ENTER] **INDEX & ENTER** keys to reset.

SCRL Scale Low: Select 100 to 11998 counts below SCRH. The total span between SCRL and SCRH must be within 11998 counts. Maximum setting range is -1999 to +9999 counts. For Current and Voltage inputs, this will set the low range end. Value not adjustable for Thermocouple and RTD ranges.

SCRH Scale High: Select 100 to 11998 counts above SCRL. The total span between SCRL and SCRH must be within 11998 counts. Maximum setting range is -1999 to +9999 counts. For Current and Voltage inputs, this will set the high range end. Value not adjustable for Thermocouple and RTD ranges.

SPL Set Point Low: Select from the lowest input range value to SPH value. This will set the minimum SP1 or SP2 value that can be entered. The values for SP1 or SP2 will stop moving when this value is reached.

SPH Set Point High: Select from the highest input range value to SPL value. This will set the maximum SP1 or SP2 value that can be entered. The values for SP1 or SP2 will stop moving when this value is reached.

SP1O Set Point 1 Output Select: Select OutA or Outb.
OutA Set Point 1 is routed through Output A. Set Point 2 (if equipped) is routed through Output B.
Outb Set Point 1 is routed through Output B, Set Point 2 (if equipped) is routed through Output A.

SSt Set Point 1 state : Select d ir or rE.
d ir Direct Action. As the input increases the output will increase. Most commonly used in cooling processes.
rE Reverse Action. As the input increases the output will decrease. Most commonly used in heating processes.

If Out1 (Page 21) is set for ##tP, #PUL, or ProP, then S1OL and S1OH appear. If Out1 is set for OnOF, then skip S1rE.

S1OH Set Point 1 Output High Limit. Select 0 to 100% but not less than S1OL for output codes 1, 2, 3, 4, or 8. Select 0 to 102% but not less than S1OL for output code 5. This item allows setting the maximum output limit. This is useful with processes that are over powered. Adjustment to 102% allows seeing current output to force a full on condition for output devices which do not have bias adjustments. Factory set to 100 for all output codes.

S1OL Set Point Output Low Limit. Select 0 to 100% but not greater than S1OH. This item limits the lowest output value. This is useful for adding a bias to the process when needed. Factory set to 0 for output codes 1, 2, 3, 4, and 8. Factory set to 20 for output code 5 (20% output equals 4 mA output).

If Out1 is set for ##tP, #PUL, or ProP, then skip to S1iP below.

If Out1 is set to OnOF (in Secondary Menu), then the next three menu items can make the SP1 and SP1d settings act like a high or low alarm set point. See the information on alarm settings and the cautions and warnings that apply to them on Pages 30-31.

Note that when Set Point 1 Power Interrupt, S1iP, is On, and Set Point 1 Reset, S1rE, is programmed to Hold, the SP1 output will automatically reset upon a power failure and subsequent restoration, if the process is below SP1.

S1rE Set Point 1 Reset. Select OnOF or Hold.
OnOF Output will automatically reset when process passes back through SP1d.
Hold Manual Reset. Reset by simultaneously pressing the [INDEX] [DOWN ARROW] **INDEX & DOWN ARROW** keys for 3 seconds.

S IP i Set-Point 1 Power Interrupt. Select On or OFF.

- On Alarm Power Interrupt is On. Output will automatically reset on power-up if no alarm condition exists.
- OFF Alarm Power Interrupt is OFF. Output will be in the alarm condition on power-up regardless of condition of process.

S I IH Set Point 1 Inhibit: Select On or OFF.

- On Alarm Inhibit is On. Alarm action is suspended until the process value first enters a non-alarm condition.
- OFF Alarm Inhibit is OFF.

S I ILP Set Point Lamp: Select O on or OoFF.

- O on Lamp ON when Output is ON.
- OoFF Lamp OFF when Output is ON.

If your control is not equipped with Set Point 2, then proceed to the alarm section (next page).

S2t Set Point 2 type: Select Ab or dE.

- AbS Absolute. SP2 is independent of SP1, and may be set anywhere between the limits of SPL and SPH.
- dE Deviation SP2. SP2 is set as a deviation from SP1, and allows SP2 to retain its relationship with SP1 when SP1 is changed (SP2 tracks SP1).

S2St Set Point 2 State: Select d ir or rE.

- d ir Direct Action. As the input increases the output will increase. Most commonly used in cooling processes.
- rE Reverse Action. As the input increases the output will decrease. Most commonly used in heating processes.

If Out2 is set for ##tP, #PUL, or ProP, then S2OL and S2OH appear. If Out2 is set for OnOF, then skip S2OL and S2OH.

S2OL Set Point Output Low Limit: Select 0 to 100% but not greater than S2OH. This item limits the lowest output value. This is useful for adding a bias to the process when needed. Factory set to 0 for output codes 1,2, 3, 4, and 8. Factory set to 20 for output code 5 (20% output equals 4 mA output).

S2OH Set Point 2 Output High Limit: Select 0 to 100% but not less than S2OL for output codes 1, 2, 3, 4, or 8. Select 0 to 102% but not less than S2OL for output code 5. This item allows setting the maximum output limit. This is useful with processes that are over powered. Adjustment to 102% allows setting current output to

force a full on condition for output devices which do not have bias adjustments. Factory set to 100 for all output codes.

If Out2 is set to OnOF (in the Secondary Menu), then the next three menu items can make the SP2 and SP2d settings act like a high or low alarm set point. See the information on alarm settings and the cautions and warnings that apply to them on the next pages.

Note that when Set Point 2 Power Interrupt, S2Pi, is On, and Set Point 2 Reset, S2rE, is programmed to Hold, the SP2 output will automatically reset upon a power failure and subsequent restoration, if the process is below SP2.

S2rE Set Point 2 Reset. Select OnOF or Hold.

- OnOF Output will automatically reset when process passes back through SP2d.
- Hold Manual Reset, Reset (acknowledge) by simultaneously pressing the ⊃ ▼ INDEX & DOWN ARROW keys for 3 seconds.

S2Pi Set Point 2 Power Interrupt. Select On or OFF.

- On Alarm Power Interrupt is On. Output will automatically reset on power-up if no alarm condition exists.
- OFF Alarm Power Interrupt is OFF. Output will be in the alarm condition on power-up regardless of condition of process.

S2IH Set Point 2 Inhibit: Select On or OFF.

- On Alarm Inhibit is On. Alarm action is suspended until the process value first enters a non-alarm condition.
- OFF Alarm Inhibit is OFF.

S2LP Set Point 2 Lamp: Select O on or OoFF.

- O on Lamp ON when Output is ON.
- OoFF Lamp OFF when Output is ON.

ALARM TYPE AND ACTION (if alarm function is present)

Caution: In any critical application where failure could cause expensive product loss or endanger personal safety, a redundant limit controller is required.
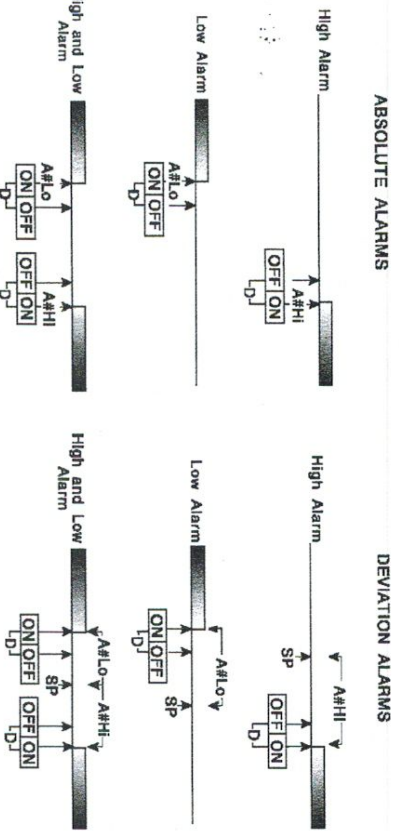
When setting an alarm value for an absolute alarm (A1t = AbS), simply set the value at which the alarm is to occur. When setting the alarm value for a deviation alarm (A1t = dE), set the difference in value from the Set Point desired. For example if a low alarm is

required to be 5 degrees below the Set Point, then set A1Lo to -5. If a high alarm is required 20 degrees above the Set Point, then set A1Hi to +20. If the Set Point is changed, the alarm will continue to hold the same relationship as originally set.

The diagram below shows the action and reset functions for both absolute and deviation alarms.

D = 1 degree F, 1 degree C, or 1 count.

ABSOLUTE ALARMS   **DEVIATION ALARMS**

High Alarm — A#Hi | ON|OFF | OFF|ON — D

Low Alarm — A#Lo | ON|OFF | OFF|ON — D

High and Low Alarm — A#Lo | A#Hi | ON|OFF | OFF|ON — D

High Alarm — A#Hi | SP | OFF|ON — D

Low Alarm — A#Lo | SP | ON|OFF — D

High and Low Alarm — A#Lo | A#Hi | SP | ON|OFF | OFF|ON — D

Note that when Alarm Power Interrupt, A1Pi, is programmed ON and Alarm Reset, A1rE, is programmed for Hold, the alarm will automatically reset upon a power failure and subsequent restoration if no alarm condition is present.

If Alarm Inhibit, A1IH, is selected ON, an alarm condition is suspended upon power up until the process value passes through the alarm set point once. Alarm inhibit can be restored as if a power up took place by pressing both the **[INDEX] [ENTER]** INDEX and ENTER keys for 3 seconds.

WARNING: IF INHIBIT IS ON AND A POWER FAILURE OCCURS DURING A HIGH ALARM, RESTORATION OF POWER WILL NOT CAUSE THE ALARM TO OCCUR IF THE PROCESS VALUE DOES NOT FIRST DROP BELOW THE HIGH ALARM SETTING. DO NOT USE THE ALARM INHIBIT FEATURE IF A HAZARD IS CREATED BY THIS ACTION. BE SURE TO TEST ALL COMBINATIONS OF HIGH AND LOW ALARM INHIBIT ACTIONS BEFORE PLACING CONTROL INTO OPERATION.

The following menu items apply only to the alarm.

AL1   Alarm 1 function: Select *OFF*, *Lo*, *Hi*, or *Hi.Lo*.
  OFF   Alarm 1 is disabled. No Alarm 1 menu items appear in the Secondary or Secure menus.
  Lo   Low Alarm Only. *A i.o* appears in the Secondary Menu.
  Hi   High Alarm Only. *A iH,* appears in the Secondary Menu.
  Hi.Lo   High and Low Alarms. Both *A i.o* and *A iH,* appear in the Secondary Menu, and share the same Alarm 1 Relay output.

If *AL1* is set to *OFF* and the control is not equipped with options, the Secure Menu ends here. If *AL1* is set to *OFF* and the control is equipped with options, proceed to *Addr* below.

A1t   Alarm 1 Type: Select *Abs* or *dE*
  Abs   Absolute Alarm that may be set anywhere within the values of *SCRL* and *SCRH* and is independent of *SP1*.
  dE   Deviation Alarm that may be set as an offset from *SP1*. As *SP1* is changed the Alarm Point will track with *SP1*.

[INDEX & DOWN ARROW] INDEX & DOWN ARROW keys for 3 seconds.

A1rE   Alarm 1 Reset: Select *OnOF* or *Hold*.
  OnOF   Automatic Reset.
  Hold   Manual Reset. Reset (acknowledge) by simultaneously pressing the

A1Pi   Alarm 1 Power Interrupt: Select *On* or *OFF*.
  On   Alarm Power Interrupt is *On*.
  OFF   Alarm Power Interrupt is *OFF*.

A1IH   Alarm 1 Inhibit: Select *On* or *OFF*.
  On   Alarm Inhibit is *On*. Alarm action is suspended until the process value first enters a non-alarm condition.
  OFF   Alarm Inhibit is *OFF*.

A1St   Alarm 1 Output State: Select *CLOS* or *OPEn*.
  CLOS   Closes Contacts at Alarm Set Point.
  OPEn   Opens Contacts at Alarm Set Point.

A !!P   Alarm 1 Lamp: Select *Con* or *CoFF*.

     Con   Alarm Lamp is ON when alarm contact is closed.

     CoFF   Alarm Lamp is OFF when alarm contact is closed.

A !Lb   Alarm 1 Loop Break. Select *On* or *OFF*.

     On   Loop Break Condition will cause an Alarm Condition.

     OFF   Loop Break will not affect the Alarm Condition.

Addr   (Option C2, C4, Serial Communications) Control Address: Set from *!* to *3FF* for Options C4 and C2. This number (hexadecimal, base 16) must match the address number used by the host computer. Power to instrument must be turned off and on before change takes effect (see Page 14).

bRud   (Option C2, C4, Serial Communications) Communication Baud Rate: Select *300*, *1200*, *2400*, *4800*, *9600* (baud), *19.2* or *28.8* (kbaud). This number must match the baud rate used by the host computer. Power to instrument must be turned off and on before change takes effect (see Page 14).

nRt   (Option C2, C4, Serial Communications) No Activity Timer: Select *OFF* or *!* to *99* minutes.

     !-99   Maximum time between host computer accesses. If timer counts to *0*, *CHEC torE* will be displayed.

     OFF   No Activity Timer function is disabled.

Stor   (Option C2, C4, Serial Communications) Store to EEPROM: Select *YES* or *no*. (See additional information on page 18).

     YES   Menu Item changes made through the Serial Communications are stored directly to the EEPROM.

     no   Menu Item changes made through the Serial Communications are stored in RAM.

NOTES

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ERROR MESSAGES

Any error message may be cleared by using the 'Global Reset' by pressing and holding the [INDEX] [ENTER] INDEX & ENTER keys for five seconds.

DISPLAY	MEANING	SP OUTPUTS	ACTION REQUIRED
ArER (Alternates with PV)	This message appears if the ambient temperature of the control approaches the ends of tolerance.	Set point outputs active. Alarm active.	Correct the ambient temperature conditions. Ventilate the area of the cabinet or check for clogged filters. If internal temperature sensor is broken (RJC located in terminal 2), return to service.
ArEA	This message appears if the ambient temperature of the control is out of range or RJC sensor is broken.	Set point outputs active. Alarm active.	Correct the ambient temperature conditions. Ventilate the area of the cabinet or check for clogged filters. If internal temperature sensor is broken, return for service.

ERROR MESSAGES

Any error message may be cleared by using the 'Global Reset' by pressing and holding the ⊡ ⊡ INDEX & ENTER keys for five seconds.

DISPLAY	MEANING	SP OUTPUTS	ACTION REQUIRED
UFL or OFL	Underflow or Overflow: Process value has exceeded input range ends.	Set point outputs active. Alarm active.	May be normal if input signals go above or below range ends. If not the case, check sensor, input wiring and correct.
bAd inP	...one of these messages if the InPt is set for a time value. UFL or OFL will sequence to display	Set point outputs inactive. Alarm active.	When inPt (input fault timer) has been set for a time, the outputs will be turned off after the set time. Setting the time to OFF causes the outputs to remain active, however UFL or OFL will still be displayed.
OPEn inP	For RTD inputs RTD is open or shorted. For THERMOCOUPLE inputs thermocouple is open.		Correct or replace sensor. Clear with 'Global Reset'.
LOOP bAd	The sensor may be defective, heater fuse open, heater open, or the final power output device is bad.	Set point outputs inactive. Alarm active.	Correct or replace sensor, or any element in the control loop that may have failed. Correct the problem.
SEnt bAd	Sensor Rate of Change exceeded the programmed limits set for SEnr.	Set point outputs inactive. Alarm active.	Check for the cause of the error. The value setting may be too slow for the process, or the sensor is intermittent. Correct the problem.
CHEC CAL	Check calibration appears as an alternating message if the instrument calibration nears tolerance edges.	Set point outputs inactive. Alarm active.	Remove the instrument for service and / or recalibration.
	Check calibration appears as a flashing message if the instrument calibration exceeds specification.	Set point outputs inactive. Alarm active.	Remove the instrument for service and / or recalibration.

ERROR MESSAGES

Any error message may be cleared by using the 'Global Reset' by pressing and holding the ⊡ ⊡ INDEX & ENTER keys for five seconds.

DISPLAY	MEANING	SP OUTPUTS	ACTION REQUIRED
No display lighted	Display is blank. Instrument is not getting power, or the supply voltage is too low.	Set point outputs inactive. Alarm inactive.	Check that the power supply is on, measure supply voltage, check that the external fuses are good.
FAIL tESt	Fail test appears upon power up if the internal diagnostics detect a failure. This message may occur during operation if a failure is detected. Displays flash.	Set point outputs inactive. Alarm inactive	The display alternates between FAIL tESt and one of the following messages: FACt dFLt: Memory may be corrupted. Restore to the factory default settings. Recheck controller programming. rEt FACt: Unrecoverable error. Return to service.
CHEC SP1, CHEC SP2, CHEC iSP...	This message will appear upon power up if SP1, SP2, #SP1, or ##SP is set outside of the SPL or SPH values.	Set point outputs inactive. Alarm active	Correct the SP1, etc. or adjust the SPL or SPH values by programming new values.
CHEC SP1 or CHEC SPH	This message appears at power up if SP1 or SPH values are programmed outside the input range ends.	Set point outputs inactive. Alarm active	Correct the SP1 or SPH values by programming new values.
CHEC SPH	This message appears if the analog remote set point signal is out of range.	Set point outputs inactive. Alarm active	The control will revert to SP1. Correction of the analog signal or turning off the rSPt clears the error message.
CHEC LorE	This message appears if the Serial Communications has timed out.	Set point outputs inactive. Alarm active	Change the LorE to LOC. Restore the communications line and switch LorE back to rE.

SPECIFICATIONS

Selectable Inputs: Thermocouple, RTD, DC Voltage, or DC Current selectable.

Input Impedance:

Thermocouple = 3 megohms minimum. RTD current = 200 µA.

Current = 10 ohms. Voltage = 5000 ohms.

Sensor Break Protection: De-energizes control output to protect system after customer set time. (See InPt in Secure Menu.)

Set Point Range: Selectable (See Input Ranges Page 43).

Display: Two 4 digit, 7 segment 0.3" high LEDs.

Control Action: Reverse (usually heating), Direct (usually cooling) selectable.

Proportional Band: 1 to 9999 °F, °C, or counts.

Reset Time (Integral): Off or 0.1 to 99.9 minutes.

Rate Time (Derivative): Off or 0.01 to 99.99 minutes.

Cycle Rate: 1 to 80 seconds.

On - Off Differential: Adjustable 1° F, 1° C, or 1 count to full scale in 1° F, 1° C, or 1 count steps.

Alarm On - Off Differential: 1° F, 1° C, or 1 count.

Fuzzy Percent: 0 to 100%.

Fuzzy Rate: Off or 0.01 to 99.99 counts per second.

Fuzzy Band: Off or 1 to 4000 °F, °C, or counts.

Accuracy: ±0.25% of span, ±1 least signifi cant digit.

Resolution: 1 degree or 0.1 degree, selectable.

Line Voltage Stability: ±0.05% over the supply voltage range.

Temperature Stability: 4µV/°C (2.3 µV/°F) typical, 8 µV/°C (4.5 µV/°F) maximum (100 ppm / °C typical, 200 ppm / °C maximum).

Common Mode Rejection: 140 db minimum at 60 Hz.

Normal Mode Rejection: 65 db typical, 60 db at 60 Hz.

Isolation:

Relay and SSR outputs: 1500 Vac to all other inputs and outputs.

SP1 and SP2 Current output: 500 Vac to all other inputs and outputs but not isolated from each other.

SP1 and SP2 Switched Voltage output: 500 Vac to all other inputs and outputs, but not isolated from each other.

Process Output (934, 936): 500 Vac to all other inputs and outputs.

Supply Voltage: 100 to 240 Vac, nominal, +10 -15%, 50 to 400 Hz, single phase; 132 to 240 Vdc, nominal, +10 -20%.

Supply Voltage (Option 9502): 12 to 24 Vdc, Vac 40-400 Hz, ±20%.

Power Consumption: 5VA maximum.

Operating Temperature: -10 to +55 °C (+14 to 131 °F).

Storage Temperature: -40 to +80 °C (-40 to 176 °F).

Humidity Conditions: 0 to 90% up to 40°C non-condensing, 10 to 50% at 55°C non-condensing.

Memory Backup: Nonvolatile memory. No batteries required.

Control Output Ratings:

SSR: 2.0 A combined outputs A & B @ 240 VAC at 25°C (77°F).

Derates to 1.0 A @ 55°C (130°F).

Relay: SPST, 3 A @ 240 VAC resistive; 1.5A @ 240 VAC inductive; Pilot duty rating 240 VA, 2 A @ 120 VAC or 1 A 240 VAC.

Alarm Relay: SPST, 3 A @ 240 VAC resistive; 1/10 HP @ 120 VAC.

Current (isolated): 0 to 20 mA across 600 ohms maximum.

Switched Voltage (isolated): 15 VDC @ 20 mA.

DC SSR: 1.75 A @ 32 Vdc maximum.

Panel Cutout: 45 mm x 45 mm (1.775" x 1.775").

Depth Behind Mounting Surface: 121.6 mm (4.79") maximum.

Weight: 220 g (8 oz).

Agency Approvals: UL, C-UL E83725; CE.

Front Panel Rating: IP66, (UL Type 4X).

-PV1

Analog Retransmission of PV/SV (Programmable)

Output: 0 to 20 mADC into 600 Ohms, maximum.

Isolation: 500 VAC.

Scale: Programmable from 100 to 11998 counts, depending on PV range selected.

-PV2

Analog Retransmission of PV/SV (Programmable)

Output: 0 to 10 VDC @ 20 mA maximum.

Isolation: 500 VAC.

Scale: Programmable from 100 to 11998 counts, depending on PV range selected.

-C2

RS-485 Series Communications

Port Compliance: EIA-485.

Isolation: 500 VAC.

Protocol: Lovelinks™ II.

Address Range: 001H or 3FFH.

Baud Rates: 300, 1200, 2400, 4800, 9600, 19.2k, 28.8k, 57.6k,

Mode: Half duplex.

Character: 8 bits, 1 start, 1 stop, no parity.

Number of units on line/ports1: 32.

Cable Lengths1: 6,000 ft (1,828 m).

-C4

RS-232 Series Communications

Port Compliance: RS-232C.

Isolation: 500 VAC.

Protocol: Lovelinks™ II.

Address Range: 001H or 3FFH.

Baud Rates: 300, 1200, 2400, 4800, 9600, 19.2k, 28.8k, 57.6k.

Mode: Half duplex.

Character: 8 bits, 1 start, 1 stop, no parity.

Number of units on line/ports: 1.

Cable Lengths1: 25 ft (7.6 m).

Termination: 120 Ohms, balanced.

1. Number can be increased through use of a repeater such as the Mother Node™. Consult factory for details.

INPUT RANGES

INPUT TYPE

INPUT TYPE	RANGE °F	RANGE °C
Type J or L¹ Thermocouple	-100 to +1607	-73 to +871
Type K¹ Thermocouple	-200 to +2500	-129 to +1371
Type T¹ Thermocouple	-350 to +750	-212 to +398
Type E¹ Thermocouple	-100 to +1800	-73 to +982
Type R Thermocouple	0 to 3200	-17 to +1760
Type S Thermocouple	0 to 3200	-17 to +1760
Type B Thermocouple	+75 to +3308	+24 to +1820
Type C Thermocouple	0 to 4208	-17 to +2320
Type N¹ Thermocouple	-100 to +2372	-73 to +1300
100 Ω Pt. 0.00385 DIN¹ RTD	-328 to 1607	-200 to +875
100 Ω Pt. 0.00392 NIST¹ RTD	-328 to 1607	-200 to +875
120 Ω Nickel 0.00628 US¹ RTD	-112 to +608	-80 to +320
1000 Ω Pt. 0.00385 DIN¹ RTD	-328 to +1607	-200 to +875
Current/Voltage/ΔVoltage²	Scalable Units from -1999 to +9999	

1. These Input Types can be set for 0.1°display. If temperature goes above 999.9°or less than -199.9°the display will return to whole degree resolution.

2. The 0 to 20 mADC, 4 to 20 mADC, 0 to 10 VDC, 2 to 10 VDC, and -10 to +10 mVDC inputs are fully scalable from a minimum of 100 counts span placed any where within the within the range of -1999 to +9999. Decimal point position is adjustable from the zero place (9999), tenths (999.9), hundredths (99.99), thousandths (9.999), or ten thousandths (.9999).

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) 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 in which wear is not warranted, include but are 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 the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED 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. Purchase 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.

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