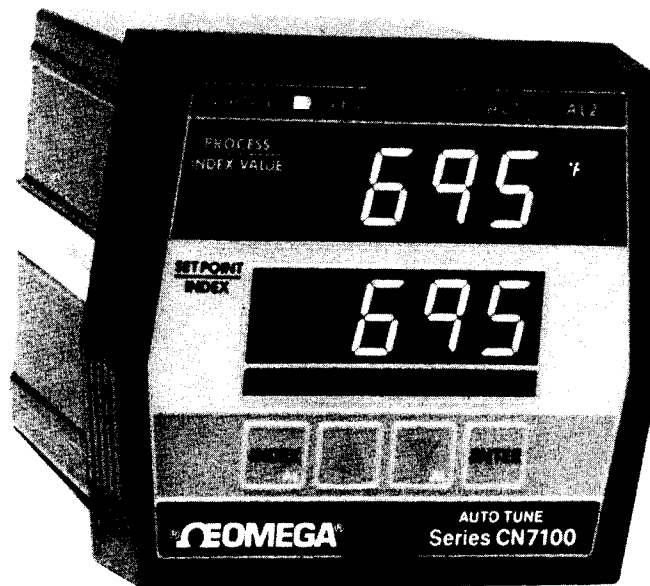


**CN 7100 Series
Auto-Tuning/Manual Tuning
Controllers**



OMEGA
ENGINEERING, INC.

One Omega Drive, Box 4047
Stamford, CT 06907-0047
(203) 359-1660 Telex: 996404
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ADDENDUM TO CN7100 SERIES
AUTO-TUNING/MANUAL TUNING CONTROLLERS
OPERATOR'S MANUAL M966/0989

FACTORY DEFAULT FEATURE for MODEL CN7100 SERIES
SINGLE OUTPUT CONTROLLERS

At times it may be necessary to reprogram the Controller back to the Factory Default Settings. The following procedure allows the operator to perform this with minimal effort.

To reset to Factory Default Values: (See the following tables)

1. Put the controller in the Set-up Mode (Switch 1 UP).
2. "INDEX" through the Menu until **InP** or **dP** appears in the Lower Display.
3. Press **▼** or **▲** until the Upper Display shows **----**, then press "ENTER". **CAL0** will appear in the Lower Display.
4. Press **▼** until **FACT** **dFLt** appears in the Displays. Press "ENTER" first and hold, then press **▼**. The Display will blank and perform the Power Up sequence to the Home Position.
5. Perform the programming for the Set-up Menu as required for the Process to be Controlled.

NOTE: Should the Controller display **FAIL** **tEst**, pressing the "INDEX" will cause one of the following messages to appear.

FACT = Memory has been corrupted. Refer to steps 4 & 5 above.
dFLt In some cases the Controller may require Calibration.
Contact the Factory for the proper Instructions.

bAd = All of the Security Switches are Open. Check the Switch
SECr and if it appears OK, move it OFF and ON. If this does not correct the problem, return to the Factory.

bAd = The A/D board is Bad. Replace the A/D board or return to the
A-d the Factory for service.

rEt = Not Recoverable, return to the Factory for service.

FACT

FACTORY DEFAULT VALUES FOR CONTROLLERS

CON- DITION	LOWER DISPLAY	THERMOCOUPLE INPUTS EJK TRS		RTD INPUTS 1°	CURRENT or VOLTAGE
A.	SP1	175 °F		175 °F	175
B.	AL1	150 °F		150 °F	150
C.	AL2	200 °F		200 °F	200
PD1.	tunE	SELF			
PD6.	LERn	Strt			
PD7.	dFAC	3			
D1.	CY1	10			
E.	F-C	F			N.A.
G.	SPL	-100 °F	0 °F	-328 °F	0
H.	SPH	1600 °F	3200 °F	1607 °F	400
I.	S10L	0			
J.	S10H	100			
K.	SP1A	rE			
L.	SP1L	0 on			
M.	ALt	Abs			
N.	AL1A	rE			
O1.	AL1L	0 on			
O2.	AL1F	On			
P1.	AL1r	OnOF			
Q.	AL2A	dir			
R1.	AL2L	0 on			
R2.	AL2F	On			
S1.	AL2r	OnOF			
T1,2, 2A,3.	InP	J-IC	S-10	106	N.A.
T4.	SCAL	N.A.			0
T5.	SCAH	N.A.			400
T6.	dP	N.A.			none
T7.	OSUP	N.A.			OFF
T8.	Unit	N.A.			0
T9.	InPt	N.A.			OFF
U.	tCS	OFF	OFF	N.A.	
V.	InPC	0			

N.A. = Not Applicable

FACTORY DEFAULT VALUES FOR OPTIONS

OPTION No. and DESCRIPTION	LOWER DISPLAY	THERMOCOUPLES EJK, TRS	RTD 1°	CURRENT VOLTAGE
-RSP LOCAL/REMOTE SET Pt 0 to 10 VDC	LorE	LOC		
	rSCL	0		
	rSCH	200		
	rSUP	1		
-AM MENU AUTO/MAN	Auto	On		
-PV SCALEABLE RECORDER OUTPUT, 0 to 10 VDC	POL	0		
	POH	200		

WARRANTY

OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of 61 months from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal five (5) year product warranty to cover handling and shipping time. This ensures that our customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. Our 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. However, this WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive current, heat, moisture, vibration, or misuse. Components which wear or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

THERE ARE NO WARRANTIES EXCEPT AS STATED HEREIN. THERE ARE NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND OF FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL OMEGA ENGINEERING, INC. BE LIABLE FOR CONSEQUENTIAL, INCIDENTAL OR SPECIAL DAMAGES. THE BUYER'S SOLE REMEDY FOR ANY BREACH OF THIS AGREEMENT BY OMEGA ENGINEERING, INC. OR ANY BREACH OF ANY WARRANTY BY OMEGA ENGINEERING, INC. SHALL NOT EXCEED THE PURCHASE PRICE PAID BY THE PURCHASER TO OMEGA ENGINEERING, INC. FOR THE UNIT OR UNITS OR EQUIPMENT DIRECTLY AFFECTED BY SUCH BREACH.



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Return Requests/Inquiries

Direct all warranty and repair requests/inquiries to OMEGA Customer Service Department, telephone number (203) 359-1660. BEFORE RETURNING ANY INSTRUMENT, PLEASE CONTACT THE OMEGA CUSTOMER SERVICE DEPARTMENT TO OBTAIN AN AUTHORIZED RETURN (AR) NUMBER. The designated AR number should then be marked on the outside of the return package.

To avoid processing delays, also please be sure to include:

1. Returnee's name, address, and phone number.
2. Model and Serial numbers.
3. Repair instructions.

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

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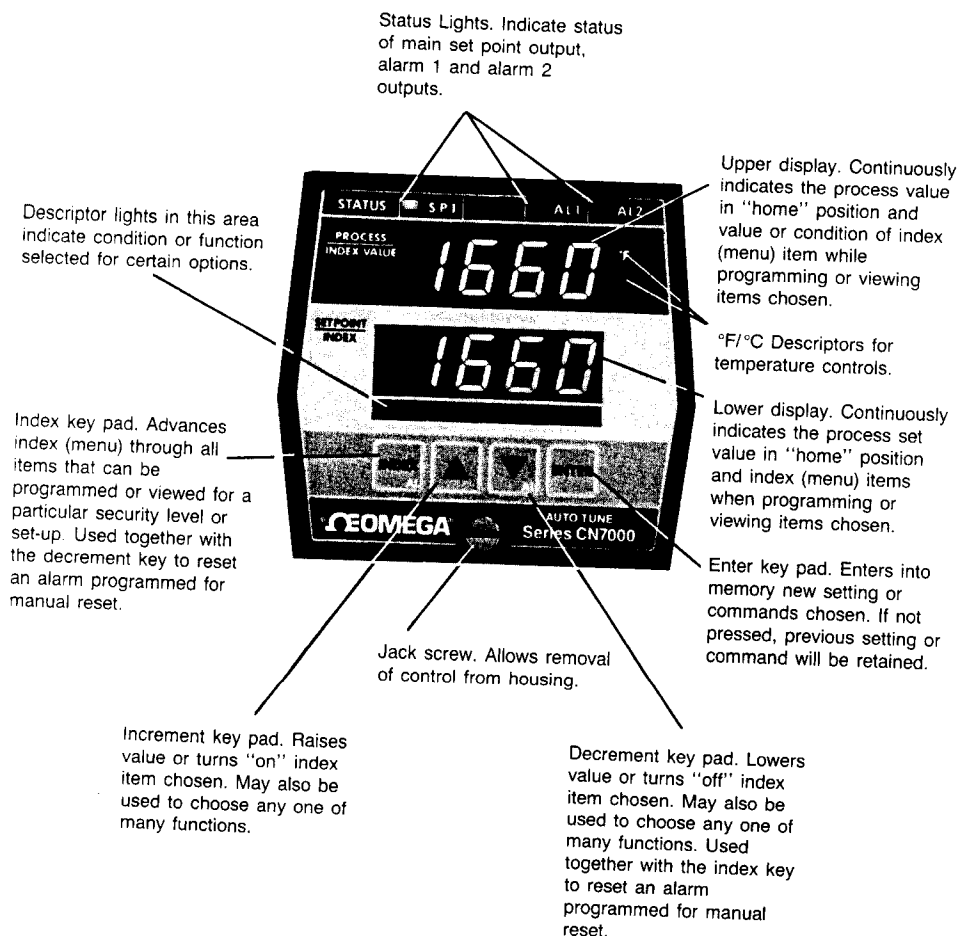
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M966/0489

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Front Panel Presentation



Temperature Ranges

Thermocouple	
Sensor Type	Range
J	-100 to +1600 °F/-73 to +871 °C
K	-200 to +2500 °F/-129 to +1371 °C
E	-100 to +1800 °F/-73 to +982 °C
T	-350 to +750 °F/-212 to +398 °C
R	0 to 3200 °F/-17 to +1760 °C
S	0 to 3200 °F/-17 to +1760 °C

RTD	
Sensor Type	Range
100 ohm Plat. .00385, Cal. 106	-328 to +1607 °F/-200 to +875 °C
100 ohm Plat. .00392, Cal. 104	-328 to +1607 °F/-200 to +875 °C
120 ohm Nickel, Cal. 105	-112 to +608 °F/-80 to +320 °C
100 ohm Plat. .00385, Cal. 106	-200.0 to +990.0 °F/-128.9 to +532.2 °C
100 ohm Plat. .00392, Cal. 104	-200.0 to +990.0 °F/-128.9 to +532.2 °C
120 ohm Nickel, Cal. 105	-112.0 to +385.0 °F/-80.0 to +196.1 °C

Description

The Omega[®] CN-7100 Series controllers are microprocessor based and include auto-tuning or manual tuning of the P.I.D. functions: gain (band width), reset (integral) and rate (derivative).

Two large LED displays indicate all controller parameters as well as process temperature (or other input variable) and set point value.

A wide selection of inputs are offered with multiple choice thermocouple or RTD selection in the same control. Input scaling may be field programmed for voltage or current inputs.

Output plug-in modules, that can be changed in the field, provide complete output versatility.

Status lights indicate output conditions at all times.

Every parameter of the control may be field adjusted, if desired. Two levels of security are also provided. Four front panel membrane key pads are used to view or change all selected index (menu) items.

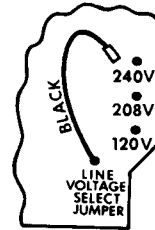
Complete non-volatile memory eliminates the need for battery back-up and attendant battery problems.

Many options are available, including two alarm outputs.

Voltage Selection. FAILURE TO SELECT PROPER VOLTAGE CAN RESULT IN TRANSFORMER BURN-OUT.

Check the label affixed to the top of the controller housing to determine the line voltage for which the unit will operate as shipped. This is usually 240 V.A.C. 50/60 HZ.

To change this input voltage, remove the controller from its housing as described under "Removal from the Housing". There is a black jumper located along the right edge of the circuit board as you are facing the rear of the control. This jumper is soldered to one terminal and plugged on to one of the voltage select terminals. These terminals are marked 120V, 208V, or 240V. If you wish to change the voltage input, unplug the jumper from the terminal that it is on, using a long-nosed plier and pulling straight up. Plug it on to the desired voltage terminal. Replace controller into its housing.



Removal from the Housing

The controller does not have to be removed from its housing for mounting. However, if security switch or alarm jumper changes are required, it will have to be removed.

To remove the controller from its housing, turn the jack screw, located in the center of the bottom edge of the controller face, in a counter-clockwise direction until loose. Pull the control forward to slide out of the housing.

To replace, slide the control chassis into the housing in its proper slots until the jack screw is engaged. Turn the jack screw clockwise, while at the same time pushing gently on the top edge of the controller, until tight. **Do not** over tighten.

Mounting

Select a location for mounting where the control will not be subject to excessive temperature, shock, vibration, dust, moisture, oil or other liquids.

All models are designed for mounting in an enclosed panel through a 3 $\frac{5}{8}$ in. x 3 $\frac{5}{8}$ in. (92 mm x 92 mm) cutout. No other holes are required.

Remove the U bracket from the housing by removing the two mounting screws from the rear of the controller housing. Slip the control through the cutout from the front of the panel and replace the U bracket. Tighten bracket screws until the controller is secure in its cutout. **Do not** over tighten these screws.

Mount the Omega SSR240A10 or SSR240A25 (solid state relays), used with triac driver output module, to a large metal surface within the control panel. The fins must be oriented perpendicular to ground for best heat radiation.

Power Wiring

Wire in accordance with the wiring diagrams shown for your specific output module.

Make all wiring connections in accordance with the National Electrical Code and local regulations. Use N.E.C. Class 1 wiring for all power terminals. Use No. 14 AWG copper conductors only.

Grounding of the control is not required.

It is advisable to fuse the incoming power line to terminal 8 with a type 3AG or MDL, $\frac{1}{8}$ A SLO-BLO fuse. Be sure that it fuses the instrument power input only and not the load also.

For all output modules, other than relay, output terminals may be wired with No. 20 AWG copper conductors only. Use No. 14 AWG for relay output terminals.

Input Wiring

Do not run thermocouple or other input wiring in the same conduit as power leads. Use only the type of thermocouple or RTD probe for which the control has been programmed. The type may be viewed by stepping through the menu using the Index key pad. Voltage or current input values are shown on the serial number label inside the instrument.

For thermocouple input, always use extension leads of the type designated for your thermocouple. Generally, the red wire from the thermocouple is *negative*.

On thermocouple input units, do not remove reference junction compensator assembly connected under terminals 15 and 16 by a tab terminal and red wire.

Input Selection

Where displays are shown in these instructions, a heavy line at the top indicates the upper display, while a heavy line at the bottom indicates the lower display.

Inputs appear as follows:

Temperature:

Upper display —

100 = Iron/Constantan

101 = Copper/Constantan

102 = Chromel/Alumel

103 = Plat. 13% R.H./Plat.

104 = Chromel/Constantan

105 = Plat. 10% R.H. /Plat.

106 = PLT. 100 OHM .00392 N.B.S. Curve RTD

107 = NICKEL 120 OHM RTD

108 = PLT. 100 OHM .00385 DIN curve RTD

Lower display—

4 109 = Input

Voltage and Current:

Almost any Linear Scale may be programmed by the user (including decimal point positioning).

The scale range must fall within a 4000 or less count range. The term "count" in this case means the amount of numbers that can be displayed regardless of the position of the decimal point.

For example; 0 to 4000, -2000 to +2000, -10.0 to 390.0,

1.000 to 5.000 and 30.00 to 70.00 are all at the 4000 count maximum.

The minimum value for any range must be 100 counts or more.

For example; -50 to +50, 0 to 100, 2.5 to 12.5, .50 to 1.50 and -.010 to .090 are all at the 100 count minimum.

If the scale low value \boxed{SCALE} and the scale high value \boxed{SCRR} are greater than 4000 counts or less than 100 counts, then, either \boxed{CHFC} \boxed{SCRR} or \boxed{CHFC} \boxed{SCALE} will show up on the display, depending on which one is presently being programmed (opposite one shows the error).

Examples of typical programming for \boxed{SCALE} & \boxed{SCRR} for various scale ranges are;

SCALE RANGE	\boxed{SCALE} VALUE	\boxed{SCRR} VALUE
-350 +999	-350	999
-67 +113	-67	113
	or -67.0	113.0
-2 +0	-2.00	0
	or -2.000	0.000
-0.1 +0.4	-.100	.400
0 +15,000	0	150 ($\times 100$)
	or 0	1500 ($\times 10$)

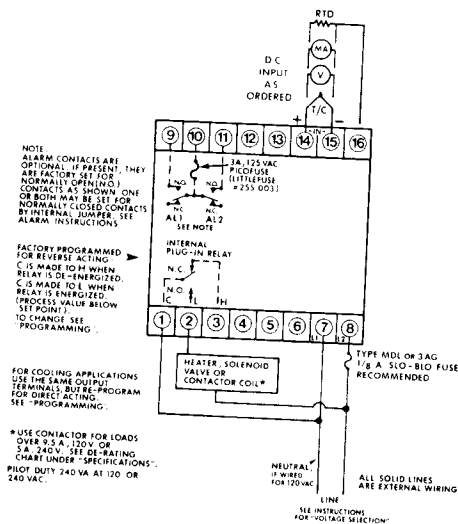
All standard ranges may be programmed for 0 suppression (\boxed{OSUP}) (20% range elevation) by the user for Process Signals.

INPUT FOR STANDARD RANGES	INPUT FOR 0 SUPPRESSION \boxed{OSUP} PROGRAMMED \boxed{ON}	INPUT IMPEDANCE
0 to 1 MA	0.2 to 1 MA	100 ohms
0 to 5 MA	1 to 5 MA	20 ohms
0 to 20 MA	4 to 20 MA	5 ohms
0 to 50 MA	10 to 50 MA	2 ohms
0 to 10 MV	2 to 10 MV	10K ohms
0 to 20 MV	4 to 20 MV	10K ohms
0 to 50 MV	10 to 50 MV	10K ohms
0 to 100 MV	20 to 100 MV	10K ohms
0 to 250 MV	50 to 250 MV	10K ohms
0 to 500 MV	100 to 500 MV	10K ohms
0 to 1 V	0.2 to 1 V	20K ohms
0 to 5 V	1 to 5 V	100K ohms
0 to 10 V	2 to 10 V	200K ohms
> 10	USE 10 V RANGE & EXTERNAL VOLTAGE DIVIDER	

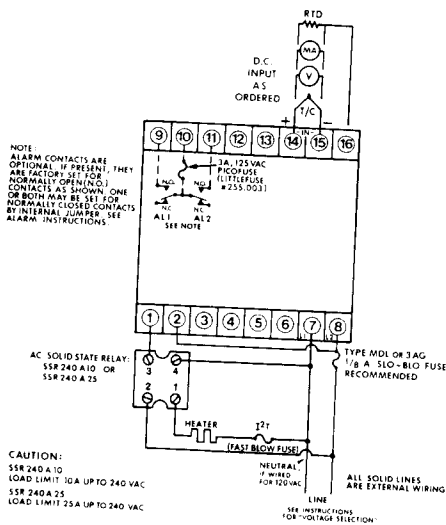
$^{\circ}\text{F}$ and $^{\circ}\text{C}$ descriptors as well as no descriptors at all may be programmed by the user. A multiple Engineering Units Label Card is provided with each instrument. The card has labels of the most common Engineering Units on it as well as blanks to create your own. The appropriate label is applied to the upper R.H. corner of the silver area opposite "SET POINT/INDEX" on the front of the instrument.

Overflow and Underflow protection may be manipulated by the user to protect from 1.) A shorted input line, 2.) Suppressed range inputs which require some time before entering the instrument scale range and 3.) Potential runaway input conditions (like overrange) and other time related input fault conditions (See "Diagnostic Error Messages").

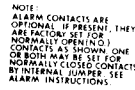
RELAY OUTPUT MODULE (STANDARD) EXTERNAL WIRING



TRIAC DRIVER MODULE (OPTION T)
EXTERNAL WIRING



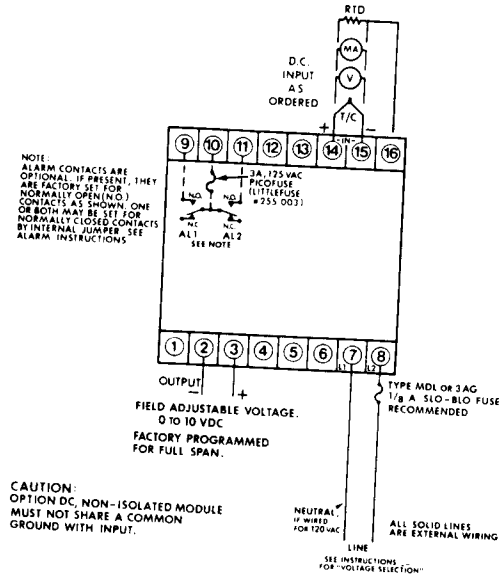
24 VDC VOLTAGE SWITCH MODULE (OPTION P)
EXTERNAL WIRING



PROPORTIONAL CURRENT OUTPUT MODULE
(OPTION F, NON-ISOLATED)
EXTERNAL WIRING

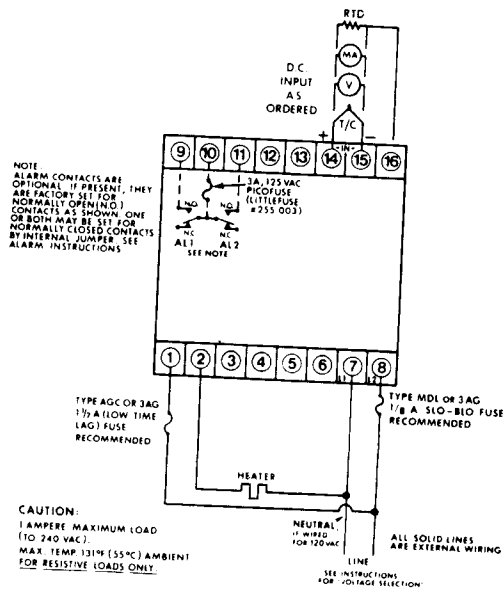


PROPORTIONAL VOLTAGE OUTPUT MODULE
(OPTION DC, NON-ISOLATED)
EXTERNAL WIRING



CAUTION:
OPTION DC, NON-ISOLATED MODULE
MUST NOT SHARE A COMMON
GROUND WITH INPUT.

1.0 A TRIAC SOLID STATE SWITCH MODULE (OPTION T1A)
EXTERNAL WIRING



CAUTION:
1 AMPERE MAXIMUM LOAD
(TO 240 VAC)
MAX. TEMP. 131°F (55°C) AMBIENT
FOR RESISTIVE LOADS ONLY

The Security Switch

The security switch allows the user to limit the changes that may be made while the control is in operation. This will help prevent unauthorized personnel from changing important settings.

The security switch allows three conditions to be selected.

1. Set-up: Allows all programmable functions to be viewed and changed.
2. Level 1: Allows changes to control set points, alarm set points and cycle rate (if time proportioning). The following may be viewed, but *not* changed: output type, lowest set point value, highest set point value, lowest output available (in percent), highest output available (in percent) and T/C or RTD type.
3. Level 2: No changes may be made. The following may be viewed: all control and alarm set points, cycle rate (if time proportioning), output type, lowest and highest set point value, lowest and highest output available (in percent) and T/C or RTD type.

The security switch is located inside the controller. It is set for security level 1 as shipped from the factory. To change the setting, remove the control from its housing as described under "Removal from the Housing". The switch is mounted on the right hand side of the processor printed circuit board near the front of the instrument.

Looking from the rear of the control, look between the upper and lower PCBs to the right of the transformer. The switch has three slide actuators as shown below:



Select the slide actuator for the security condition desired. With a small screw driver move the selected slide actuator to the ON (up) position. Move the other slide actuators to the OFF (down) position. If two or more slide actuators are left in the ON position, security will be set for the lowest position. If all slide actuators are left in the OFF position, will appear on the displays upon power up.

See the section "Programming in the Set-up Mode" for further instructions for the Set-up Mode.

Operation Common to All Models

In showing what the displays may indicate in these instructions, a heavy line at the top of the displayed item means that it appears on the upper display ; heavy line at the bottom, the lower display .



After mounting and wiring, power the system. All lamps and display segments come on for 2 seconds for a lamp test for visual test to determine if they are all operative. Turn off, then on, if more time is needed. Then is displayed, indicating that an internal diagnostic test is taking place. If is then displayed, service and/or recalibration is required. Outputs remain off during this time. When the control passes the diagnostic test, the displays will then indicate both the process value and the set value. If the security switch is in the level 1 condition (as shipped from the factory) or in the level 2 condition, the outputs will be active. If left in the set-up condition, the outputs will remain off.



For all instructions following, other than under "Programming in the Set-up Mode", it is assumed that the security switch is in the level 1 condition.


When the displays indicate the process and set point values respectively, that is considered to be "home" position.

Press the "Index" key pad each time to advance through the various programmable or viewable parameters for a particular security condition.

When stepping through the various "Index" positions, if no keys are pressed for 4 to 5 seconds, the displays will revert to "Home" position. This can be defeated by keeping either the "Index" or "Enter" key pad depressed.

The "Increment"  key pad is used to raise a setting. The "Decrement"  key pad is used to lower a setting. They both operate at a variable speed to allow rapid setting. Settings change faster as the key is depressed longer. These keys are also used to turn certain functions on or off or to choose any one of many conditions for certain functions. This would be done while programming.

The "Index"  and "Decrement"  key pads are also used to manually reset an alarm. See "Alarm Operation".

No settings will be entered into memory without depressing the "Enter"  key pad. The previous setting will be retained if not entered. The outputs are not disturbed unless a new setting is entered. Pressing the "Enter" key will cause the displays to momentarily blank, indicating that the new data has been entered into memory.

Before adjusting for the PID control functions, refer to "PID Tuning Procedure (Quick Method)" and/or "PID Tuning Procedure (Exact Method)". If reset (integral) is to be turned off, see PD4 of "Programming in the Set-up Mode".

If thermocouple short protection is desired, see "Set-up for T/C Short Protection."

Using Auto-Tuning

The user has the choice of selecting either Self-Tune or manual PID tune.

If manual PID is selected, follow the tuning procedures on page 11 or 12.

Omega's Auto-Tune is a continuously active function that changes the P, I and D parameters as the control sees the process change. The system's performance is monitored through the process input and changes made as necessary to keep the system running smoothly. If the information received is incorrect, the control output can be seriously affected. It is therefore necessary to avoid certain conditions that would detract from the performance of the control if the Self-Tune mode has been selected.

- 1.) Never turn off power to the heaters without turning off the power to the control as this will cause the control to tune to a condition that does not exist.

- 2.) The set point must be at least 50° F above ambient for start up with no loss of power or turn-off while approaching the set point on the first time rise to set point.
- 3.) In multi-zone applications for first time warm up, all zones should warm up simultaneously because of the influence of adjoining zones.
- 4.) If items 2 or 3 above are not possible, then select suitable values of P, I and D and switch to Self-Tune after selection.

Any of the above conditions can cause the control to learn (and try to control) a process using the wrong PID values so that in normal operation the control will take a long time to return to the correct values.

There are other types of processes that may require special handling. If you have questions about your particular application, consult the Factory.

The control must be in the Start Learn mode during the initial heat up of the process. If you bench test the control before installation, or if you are moving the control to a new process, be sure to put the control in Start Learn (see Condition PD 6 under "Programming in the Set-up Mode").

If Self-Tune is initially selected, the PID settings may be read out by selecting the manual PID mode. Any of the parameters may then be changed. If Self-Tune is later initiated, it will start with the manually selected settings.

PID Tuning Procedure (Quick Method)

Index	Initial Settings		
	Slow Response System	Medium Response System	Fast Response System
Prop Band	12	8	6
Reset	20.0	7.0	3.0
Rate	1.67	0.58	0.25
Output	= 15	= 10	= 6

Fine tuning the initial settings:

- 1) Increase and/or decrease if temperature excursions are greater than desired.
- 2) Decrease reset time (in steps) for best (quickest) response when returning to the set point. If temperature excursions begin to show up at the set point, then, reset time is too fast (increase reset time).
- 3) Rate time should be approximately 1/2 of the reset time. If the process hesitates when returning to the set point, then, decrease the rate time slightly (in steps) until little or no hesitation is discernable.

PID Tuning Procedure (Exact Method)

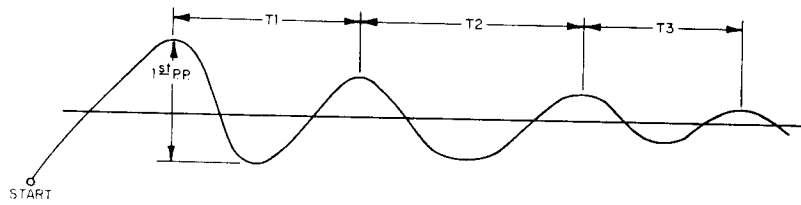


Fig. 1-Use 3 or more excursions in step 2.

- 1.) In Set-up Mode:
 - A.) Set Reset & Rate functions to Off.
 - B.) Set Control Output to On/Off. Set SP1d to -2.
- 2.) Obtain Heating Data (in Lev 1). Refer to Fig. 1:
 - A.) Start at least 20 degrees below the Set Point. Record Excursions & Time.
 - B.) Measure the 1st P.P. cycle excursion = Nom. Pb. =
 - C.) Measure T1, T2, T3, etc.;

T1 =	T2 =	T3 =
Rt min. = Lowest of T1 or T2 or T3 =		
Rt max. = Highest of T1 or T2 or T3 =		
- 3.) Calculate P I D Settings:
 - A.) $Pb = \text{Nom. Pb} \times 1.1 =$
 - B.) Start with Reset = $Rt \text{ max.} \times 2 =$
 - C.) Rate = $Rt \text{ max.}/8 =$
 - D.) Enter the Pb, Reset & Rate values previously calculated into the Controller & start the process.

Fine Tuning The PID Values

- 4.) Increase Pb if Temperature Excursions are greater than desired.
- 5.) Decrease Reset time (changing Rate = New Reset Time/8 each time) for best response when returning to the Set Point. Reset should not be less than Rt min. calculated in Step 2. If the Process Value hesitates when returning to the Set Point, then, decrease the Rate time slightly until little or no hesitation is discernable.

Programmable Functions

The programmable functions in your control are as outlined in the following chart. Normal factory programming for a particular output module is as shown in the chart. If it is satisfactory, no programming change is necessary. If programming must be changed or if a different output module is installed, see "Programming".

All instructions following, for each type of output module, assumes factory programming.

Programmable Functions Chart

Inputs		Input Type Ordered									
		Thermocouple J, K and E		Thermocouple T, R and S		RTD		Voltage or Current			
		Can Be Programmed For	Normal Factory Program	Can be Programmed For	Normal Factory Program	Can Be Programmed For	Normal Factory Program	Can Be Programmed For	Normal Factory Program		
Programmable Items		Type J Thermocouple	✓	As Ordered						These Inputs Not Programmable	As Ordered
Type K Thermocouple	✓										
Type E Thermocouple	✓										
Type T Thermocouple			✓	As Ordered							
Type R Thermocouple			✓								
Type S Thermocouple			✓								
RTD 100 Ω Plat 00385					✓	As Ordered					
RTD 100 Ω Plat 00392					✓						
RTD 120 Ω Nickel					✓						
T/C Short Protection	On	✓		✓							
	Off	✓		✓							
Display	°F		✓		✓						
	°C	✓	As Ordered		✓	As Ordered	✓		As Ordered	✓*	As Ordered
										✓*	

*For voltage or current input. *F/C display only for temperature scaling. Other engineering units may be used for various scaling

*For voltage or current input. *F/°C display only for temperature scaling. Other engineering units may be used for various scaling.

Outputs	Output Module Ordered											
	Relay		Triac or Triac Driver		24 V.D.C.		Proportional Current		Proportional Voltage			
	Can Be Programmed For	Normal Factory Program	Can Be Programmed For	Normal Factory Program	Can Be Programmed For	Normal Factory Program	Can Be Programmed For	Normal Factory Program	Can Be Programmed For	Normal Factory Program		
Programmable Items												
On-Off	✓		✓		✓							
On-Off Differential (if On-Off)	✓		✓		✓							
Time Proportioning (Slow)	✓		✓		✓							
Cycle Rate Adjustable 2 to 80 sec.	✓	10 sec.	✓		✓	10 sec.						
Pulse	✓		✓		✓							
Pulse Rate (if Pulse) Adjustable 1 to 7	✓		✓		✓							
Fast Triac			✓	✓	✓							
Current Proportional												
Voltage Proportional											✓	✓
Set Point Minimum Setting	✓	Min.	✓	Min.	✓	Min.						
Set Point Maximum Setting	✓	Max.	✓	Max.	✓	Max.	✓	Min.	✓	Min.		
Output ***	Reverse Acting	✓	✓	✓	✓	Max.	✓	Max.	✓	Max.		
	Direct Acting	✓	✓	✓	✓		✓	✓	✓	✓		
Output Adjustment Minimum 0 to 90%	✓	0%	✓	0%	✓	0%	✓		✓	0%		
Output Adjustment Maximum 10 to 100%	✓	100%	✓	100%	✓	100%	✓	20% (4 mA)	✓	0 V D C		
Set Point Status Light	Lit When Output Is "On"	✓	✓	✓	✓		✓	100%	✓	100%		
	Lit When Output Is "Off"	✓		✓	✓	✓	✓	(20 mA)	✓	**		
							✓		✓			

*For non-isolated proportional voltage output modules, "output adjustment maximum" is 100%.

**For non-isolated proportional voltage output modules, "output adjustment maximum" is factory set for 100% (10 V.D.C.), for isolated, 100% (5 V.D.C.)
***SP2 (cooling) output is factory programmed as direct acting (except for the triac driver module).

Operational Suggestions and Hints

1. If thermocouple short protection is desired, see "Set-up for T/C Short Protection".
2. For Relay or 24 V.D.C. output modules, start with a cycle rate $\boxed{5.0}$ at $\boxed{10}$ seconds. Vary the cycle rate faster $\boxed{10} \rightarrow \boxed{2}$ seconds if control excursion is greater than 4° around the set value. Cycle rate can be slower $\boxed{10} \rightarrow \boxed{80}$ seconds if control excursion is less than 2° around the set value.
3. For Current or Voltage output modules, "Set point 1 Output Low" end $\boxed{5.10L}$ and "Set point 1 Output High" end $\boxed{5.10H}$ may be changed as required, but, when changed, will not go over the complete range which may be desired. For example: controller initially "Set up" for $\boxed{5.10L} = \boxed{20}$ percent, $\boxed{5.10H} = \boxed{100}$ percent for a 4 to 20 mA output range. $\boxed{5.10L}$ is later changed to $\boxed{25}$ and $\boxed{5.10H}$ changed to $\boxed{80}$ now represents a 5 to 18 mA range. See " $\boxed{5.10L}$ and $\boxed{5.10H}$ Selection".
4. For Relay, 24 V.D.C. or Triac Driver output modules, leave $\boxed{5.10L}$ at $\boxed{0}$ and $\boxed{5.10H}$ at $\boxed{100} \rightarrow \boxed{100}$ until sure that changing these values is necessary.

Operation With Relay or 24 V.D.C. Voltage Switch Module

Read instructions given under "Operation Common to All Models".

Depress "Index" key pad. $\boxed{###} \boxed{SP.1}$ appears on displays. The control set point may now be changed using the "Increment" $\boxed{\blacktriangle}$ or "Decrement" $\boxed{\blacktriangledown}$ key pads. When the desired set point is reached, depress "Enter" to retain.

Depress "Index" key pad. If alarms are in your model, $\boxed{###} \boxed{AL.1}$ will be indicated and the alarm 1 set point may be set in the same manner as for the control set point. Be sure to depress "Enter" after the set point has been selected.

Depress "Index" key pad. $\boxed{###} \boxed{AL.2}$ indication allows selection of alarm 2 set point.

Be sure to read the instructions given under "Alarm Operation".

Depress "Index". Select $\boxed{SELE} \boxed{LUNL}$ or $\boxed{P.d} \boxed{LUNL}$ by depressing $\boxed{\blacktriangle}$ or $\boxed{\blacktriangledown}$ respectively. Depress "Enter" to retain. If $\boxed{P.d} \boxed{LUNL}$ is selected, set \boxed{Pb} , \boxed{rES} and \boxed{rLE} to desired settings.

Depress "Index". $\boxed{\#} \boxed{Pb}$ proportional band adjustable from 6 to 1000 deg. F (or equivalent deg. C) for temp inputs or 6 to 4000 counts for current or voltage inputs. Depress "Enter" to retain.

Depress "Index" $\boxed{###} \boxed{rES}$ reset (integral) adjustable 0.1 to 99.9 minutes in 6 second (0.1 minute) increments or \boxed{OFF} turns off the reset function and $\boxed{###} \boxed{OFF}$ appears and can be adjusted from 0.1 to 99.9% of proportional band at the set point. If $\boxed{OFF} \boxed{OFF}$ is selected, then displays return to $\boxed{###} \boxed{rES}$ and a reset value must be selected. Depress "Enter" to retain.

Depress "Index" $\boxed{###} \boxed{rLE}$ rate (derivative) adjustable 0.01 to 99.99 minutes in 0.6 second (0.01 minute) increments or \boxed{OFF} turns off the rate function. Press "Enter" to retain.

Depress "Index". $\boxed{.00} \boxed{CY.1}$ indicates time proportioning cycle rate in seconds. This is adjustable from 2 to 80 seconds in 2 second intervals. The time set is total time of on time plus off time at 50% duty cycle (equal on-off times). Setting too short a time will wear out mechanical contactors, while too long a time may cause process cycling around the set point. A setting of 10 seconds or more is good for contactors. Where operating directly into heating loads a shorter time can be considered but may reduce the life of the relay module. The 24 V.D.C. module can be cycled as fast as can be set.

Depress "Index". **####** **SP1** is displayed. This indicates the lowest set value that may be set for any setable function like control set point or alarm settings. This cannot be set in level 1. It may only be viewed.

Depress "Index". **####** **SPH** is displayed. The highest set value that may be set. Viewed only.

Depress "Index". **00** **100** is shown, indicating the lowest output (in percent) available. This cannot be set in level 1. It may be viewed only.

Depress "Index". **100** **100** is displayed. The highest output (in percent) available. Viewed only.

Depress "Index". **W-10** **INP** indicates input calibration. See "Input Wiring" for designations of various input calibrations. This cannot be changed in level 1. It may be viewed only.

For temperature ranges, the °F/°C descriptor alongside the upper display will indicate which temperature scale that the control is programmed for. This may be changed in the set-up condition only.

When the set point is set above the process value, the red status light will be lit, indicating that the output is energized. The heating system is now active. As the temperature rises towards the set point, the process value indicator will continue to indicate the changes taking place in the process. When the edge of the proportional band is reached, the red status light will start to alternate from on to off. This is the time proportioning action. This action continues at the set point to maintain a stable control temperature.

If your control is equipped with alarms, see "Alarm Operation".

Operation With Triac Driver Module or Triac Module

Read instructions given under "Operation Common to All Models".

Depress "Index" key pad. **####** **SP1** appears on displays. The control set point may now be changed using the "Increment" **▲** or "Decrement" **▼** key pads. When the desired set point is reached, depress "Enter" to retain.

Depress "Index" key pad. If alarms are in your model, **####** **AL1** will be indicated and the alarm 1 set point may be set in the same manner as for the control set point. Be sure to depress "Enter" after the set point has been selected.

Depress "Index" key pad. **####** **AL2** indication allows selection of alarm 2 set point. Be sure to read the instructions given under "Alarm Operation".

Depress "Index". Select **SELE** **UNF** or **P.D** **UNF** by depressing **▲** or **▼** respectively. Depress "Enter" to retain. If **P.D** **UNF** is selected, set **PE** **SE** and **RE** **SE** to desired setting.

Depress "Index". **#** **PB** proportional band adjustable from 6 to 1000 deg. F (or equivalent deg. C) for temp inputs or 6 to 4000 counts for current or voltage inputs. Depress "Enter" to retain.

Depress "Index". **####** **RES** reset (integral) adjustable 0.1 to 99.9 minutes in 6 seconds (0.1 minute) increments or **OFF** turns off the reset function and **####** **OFF** appears and can be adjusted from 0.1 to 99.9% of proportional band at the set point. If **OFF** **OFF** is selected, then displays return to **####** **RES** and a reset value must be selected. Depress "Enter" to retain.

Depress "Index". **####** **RTE** rate (derivative) adjustable 0.01 to 99.99 minutes in 0.6 second (0.01 minute) increments or **OFF** turns off the rate function. Press "Enter" to retain.

Depress "Index". **FAST** **OUT** appears on the display, indicating the controller has been programmed for fast triac output (time proportioning rate as fast as 1/20 second on and 1/20 second off).

Depress "Index". **####** **SP1** is displayed. This indicates the lowest set value that may be set for any settable function like control set point or alarm settings. This cannot be set in level 1. It may only be viewed.

Depress "Index". **####** **SPH** is displayed. The highest set value that may be set. Viewed only.

Depress "Index". **0** **LO%** is shown, indicating the lowest output (in percent) available. This cannot be set in level 1. It may be viewed only.

Depress "Index". **100** **H%O** is displayed. The highest output (in percent) available. Viewed only.

Depress "Index". **U-I** **INP** indicates input calibration. See "Input Wiring" for designations of various input calibrations. This cannot be changed in level 1. It may be viewed only.

For temperature ranges, the °F/°C descriptor alongside the upper display will indicate which temperature scale that the control is programmed for. This may be changed in the set-up condition only.

With the set point set above the process value, the red status light will be lit, indicating that power is being supplied to the heaters.

As the temperature rises towards the set point, the process indicator will continue to indicate the change taking place in the process. When the edge of the proportional band is reached, the red status light will start to alternate from on to off. This is the time proportioning action. This action continues at the set point to maintain a stable control temperature.

If your control is equipped with alarms, see "Alarm Operation".

Operation With Proportional Current Output Module

Read instructions given under "Operation Common to All Models".

Depress "Index" key pad. **####** **SP1** appears on displays. The control set point may now be changed using the "Increment" **▲** or "Decrement" **▼AL** key pads. When the desired set point is reached, depress "Enter" to retain.

Depress "Index" key pad. If alarms are in your model, **####** **RL1** will be indicated and the alarm 1 set point may be set in the same manner as for the control set point. Be sure to depress "Enter" after the set point has been selected.

Depress "Index" key pad. **####** **RL2** indication allows selection of alarm 2 set point. Be sure to read the instructions given under "Alarm Operation."

Depress "Index". Select **SET P** **UNL** or **P.d** **UNL** by depressing **▲** or **▼AL** respectively. Depress "Enter" to retain. If **P.d** **UNL** is selected, set **Pb**, **RES** and **RES** to desired settings.

Depress "Index". **#** **Pb** proportional band adjustable from 6 to 1000 deg. F (or equivalent deg. C) for temp inputs or 6 to 4000 counts for current or voltage inputs. Depress "Enter" to retain.

Depress "Index". **####** **RES** reset (integral) adjustable 0.1 to 99.9 minutes in 6 second (0.1 minute) increments or **OFF** turns off the reset function and **####** **OFF** appears and can be adjusted from 0.1 to 99.9% of proportional band at the set point.

If **0.00** **0.00** is selected, then displays return to **###** **0.00** and a reset value must be selected. Depress "Enter" to retain.

Depress "Index". **###** **0.01** rate (derivative) adjustable 0.01 to 99.99 minutes in 0.6 second (0.01 minute) increments or **0.00** turns off the rate function. Press "Enter" to retain.

Depress "Index". **0.0** **0.00** appears on the display, indicating the controller has been programmed for proportional current output.

Depress "Index". **####** **50.0** is displayed. This indicates the lowest set value that may be set for any setable function like control set point or alarm settings. This cannot be set in level 1. It may only be viewed.

Depress "Index". **####** **50.0** is displayed. The highest set value that may be set. Viewed only.

Depress "Index". **0.0** **5.00** is shown, indicating the lowest output (in percent) available. This cannot be set in level 1. It may be viewed only.

Depress "Index". **0.00** **5.00** is displayed. This highest output (in percent) available. Viewed only.

Depress "Index". **0.0** **1.00** indicates input calibration. See "Input Wiring" for designations of various input calibrations. This cannot be changed in level 1. It may be viewed only.

For temperature ranges, the °F/°C descriptor alongside the upper display will indicate which temperature scale that the control is programmed for. This may be changed in the set-up condition only.

With the set point set above the process value, the red status light will be lit, indicating that there is a current output signal. This light stays on as long as there is any current output at all. Since the control is programmed at the factory for 4 to 20 mA output, the red status light will always be on. If the output is re-programmed for 0 to 20 mA or any other current output starting at zero, the light would go out upon the current output signal becoming zero. If light is desired to be off with 4 to 20mA output, re-program **50.0** to **0.00** in "Set-up" mode. See "Programming in the Set-up Mode."

The current output will vary from 20mA to 4mA within the proportional band to maintain stable control. No tuning adjustments need be made in this control, as they are automatically made through the Self-Tune feature of the instrument.

If your control is equipped with alarms, see "Alarm Operation".

Operation With Proportional Voltage Output Module

Read instructions given under "Operation Common to All Models."

Depress "Index" key pad. **####** **50.0** appears on displays. The control set point may now be changed using the "Increment" **▲** or "Decrement" **▼** key pads. When the desired set point is reached, depress "Enter" to retain.

Depress "Index" key pad. If alarms are in your model, **####** **81.0** will be indicated and the alarm 1 set point may be set in the same manner as for the control set point. Be sure to depress "Enter" after the set point has been selected.

Depress "Index" key pad. **####** **81.2** indication allows selection of alarm 2 set point. Be sure to read the instructions given under "Alarm Operation".

Depress "Index". Select **50.0** **0.00** or **0.0** **0.00** by depressing **▲** or **▼** respectively. Depress "Enter" to retain. If **0.0** **0.00** is selected, set **0.0** **0.00** and **0.00** to desired settings.

Depress "Index". $\boxed{\#}$ $\boxed{P\%}$ proportional band adjustable from 6 to 1000 deg. F (or equivalent deg. C) for temp inputs or 6 to 4000 counts for current or voltage inputs. Depress "Enter" to retain.

Depress "Index". $\boxed{###}$ $\boxed{r\int\int}$ reset (integral) adjustable 0.1 to 99.9 minutes in 6 second (0.1 minute) increments or \boxed{OFF} turns off the reset function and $\boxed{###}$ \boxed{OFF} appears and can be adjusted from 0.1 to 99.9% of proportional band at the set point. If \boxed{OFF} \boxed{OFF} is selected, then displays return to $\boxed{###}$ $\boxed{r\int\int}$ and a reset value must be selected. Depress "Enter" to retain.

Depress "Index". $\boxed{###}$ $\boxed{r\frac{d}{dt}}$ rate (derivative) adjustable 0.01 to 99.99 minutes in 0.6 second (0.01 minute) increments or \boxed{OFF} turns off the rate function. Press "Enter" to retain.

Depress "Index". \boxed{SP} \boxed{OUT} appears on the display, indicating the controller has been programmed for proportional voltage output.

Depress "Index". $\boxed{####}$ $\boxed{SP\downarrow}$ is displayed. This indicates the lowest set value that may be set for any settable function like control set point or alarm settings. This cannot be set in level 1. It may only be viewed.

Depress "Index". $\boxed{####}$ $\boxed{SP\uparrow}$ is displayed. The highest set value that may be set. Viewed only.

Depress "Index". $\boxed{0}$ $\boxed{5\%}$ is shown, indicating the lowest output (in percent) available. This cannot be set in level 1. It may be viewed only.

Depress "Index". $\boxed{100}$ $\boxed{5\%}$ is displayed. The highest output (in percent) available. Viewed only.

Depress "Index". $\boxed{U\cdot I}$ \boxed{INP} indicates input calibration. See "Input Wiring" for designations of various input calibrations. This cannot be changed in level 1. It may be viewed only.

For temperature ranges, the °F/°C descriptor alongside the upper display will indicate which temperature scale that the control is programmed for. This may be changed in the set-up condition only.

With the set point set above the process value, the red status light will be lit, indicating that there is a voltage output signal. This light stays on as long as there is any voltage output at all. The voltage output control is programmed at the factory for 0 to 10 V.D.C. for non-isolated modules and 0 to 5 V.D.C. for isolated modules. Therefore the red status light will go out when the output voltage is zero. If re-programmed to an output range starting above zero, such as, 1 to 5 V.D.C., the light will never go out. If light is desired to be off with output ranges starting above zero, re-program $\boxed{SP\downarrow}$ to \boxed{OFF} in "Set-up" mode. See "Programming in the Set-up Mode".

The voltage output will vary over its range within the proportional band to maintain stable control.

If your control is equipped with alarms, see "Alarm Operation".

Alarm Operation and Alarm Programmable Functions



If your control is equipped with alarms, they may be programmed for various types of operation as described in the following chart. Normal factory programming is as shown in the chart. If it is satisfactory, no programming change is necessary. If programming must be changed, see "Programming in the Set-up Mode".

CAUTION: In any critical application where failure could cause expensive product loss or endanger personal safety, a second redundant limit controller is recommended.

Programmable Functions for Alarms

Alarms (Optional)

Programmable Items		Alarm 1		Alarm 2	
		Can Be Programmed For	Normal Factory Program	Can Be Programmed For	Normal Factory Program
Alarm Type (Both Alarms Must Be Same Type)	Absolute (Non-Tracking)	✓	✓	✓	✓
	Deviation (Tracking)	✓	✓	✓	✓
Alarm Reset	Automatic	✓	✓	✓	✓
	Manual	✓	✓	✓	✓
Alarm Action	Reverse Acting (Low Alarm)	✓	✓	✓	✓
	Direct Acting (High Alarm)	✓	✓	✓	✓
Alarm Power Interrupt Circuit	Off	✓	✓	✓	✓
	On	✓	✓	✓	✓
Alarm Status Lights	Lit When Alarm Output Is "On"	✓	✓	✓	✓
	Lit When Alarm Output Is "Off"	✓	✓	✓	✓
Alarm Light Behavior	Flashing	✓	✓	✓	✓
	Steady	✓	✓	✓	✓
Alarm Output Contacts (Selected by Internal Jumper)	Normally Open with No Power	✓	✓	✓	✓
	Normally Closed With No Power	✓	✓	✓	✓

When programmed for manual alarm reset, the "Index"  and "Decrement"  key pads act as a manual reset switch when both are depressed at the same time.

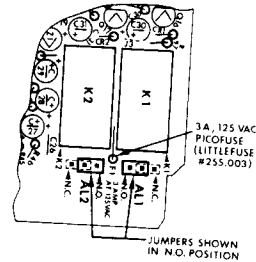
Reset will occur only if there is no alarm condition.

Alarm output contacts may be re-programmed for normally closed operation (one or both) by internal jumper.

To change the jumper position, remove the control from its housing as described under "Removal from the Housing". On the left side of the upper PCB, as viewed from the rear, near the rear terminals, the AL1 and AL2 jumpers can be seen. See sketch below. There are three posts in the PCB for each jumper. The center post is common. The outer posts are marked N.O. (normally open) and N.C. (normally closed). Change the jumper position by pulling it straight up from the PCB and off the posts. Replace it in the desired position by pushing it over the posts.

As received from the factory, the control is programmed for absolute (non-tracking) alarms. When setting the alarm set point, set for the process value where an alarm must be initiated.

If programmed for deviation (tracking) alarms, set the alarm set points for the deviation from set value. Example: high alarm point, +5, +10, +15, or other value; low alarm, -5, -10, -15, or other value; 0 represents the same set value as SPI (main set point). If SPI is changed, the alarms will continue to hold the same relationship as originally set.



Options

Option 520. Factory Programming. Set-up menu pre-programmed to customer specifications instead of the standard factory programs as outlined in the "Programmable Functions Chart". Program may be checked by placing the security switch in the set-up condition and stepping through each "Index" position.

Option 617. Rear Terminal Enclosure. The enclosure may be used to simply cover the rear terminals or to surface mount the controller. To mount the enclosure to the controller, follow the instructions packaged with the enclosure.

Option 6156. Splash and Dust Resistant Construction. Consists of a gasketed splash resistant cover which snaps over the bezel, a gasket between the bezel and housing and a gasket between the housing and customer panel. Follow the instructions packaged with the cover.

Option 6162. Tamper Resistant Cover. Similar to Option 6156, except screws are provided (top and bottom) that lock into two blind holes in the instrument bezel. The instrument must be supplied with these holes. See Option 6166 below. Gasketed cover only. No extra gaskets provided. Follow the instructions packaged with the cover.

Option 6166. Blind Holes for Option 6162. Blind holes are provided in the instrument bezel to accept the tamper resistant cover.

Other Options

For other options, see separate instruction sheet furnished if that option was ordered.

Specifications

Input: Thermocouple, RTD, current or voltage.

Input Impedance: 15 megohms minimum.

Accuracy: $\pm 0.25\%$ of span ± 1 least significant digit.

Resolution: 1 or 0.1 degree.

Line Voltage Stability: $+10\%$, -15% change in line voltage from nominal will not shift the control point by more than 0.05% of span.

Temperature Stability: $3 \mu\text{V}/^\circ\text{C}$ typical, $6 \mu\text{V}/^\circ\text{C}$ maximum.

Maximum Thermocouple Resistance: 1000 ohms. 200 ohms equals less than $\pm 0.1\%$ of span error.

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

Common Mode Rejection: 140 DB minimum at 60 Hz.

Normal Mode Rejection: 65 DB typical, 60 DB minimum at 60 Hz.

Supply Voltage: 120/208/240/V.A.C., 50/60 Hz by jumper selection.

Power Consumption: 10 V.A. nominal.

Ambient Temperature Range: 0 to 55°C (32 to 130°F).

Storage Temperature: -40 to $+80^\circ\text{C}$ (-40 to $+175^\circ\text{F}$).

Displays: 0.56" high LED displays indicate Process Value/Set Point or Index Value/Index.

Display Update: Greater than 3 times per second.

Status Lights: All output, descriptor and alarm conditions are indicated. Output and descriptors by red LED's, alarm conditions by yellow LED's.

Backup: Non-volatile memory. No batteries required.

Input Protection: Outputs turn off and error message appears on the display for either open or shorted sensor input and for either over or under range current or voltage inputs.

Other Protection: Error messages are displayed also for the following reasons: self diagnostic test has failed, internal reference is out of specification, pre-set set point limits have been exceeded, ambient temperature at the control is out of the specification range (T/C input only) or process heater is inoperative (T/C input only).

Diagnostics: Self-check, display and lamp test and full array of error messages.

Programmability: See programmable functions chart.

Control Functions:

P.I.D.: Proportional, integral (reset) and derivative (rate).

Cycle Rate: Adjustable, 2 to 80 seconds full time of on time plus off time at 50% duty cycle (equal on and off times). In the time proportioning mode only.

On-Off Differential: Adjustable, from 2° to full scale in 1° steps or 0.5° to 999.0° in 0.1° steps. In the on-off mode only.

Pulse Rate: Adjustable pulse rate in 7 steps. In the pulse mode only.

Output Modules:

Relay (Standard): Plug-in, 9.5A (120 V.A.C.) up to 30 °C ambient, de-rated to 8.0A at 55 °C. Also 5.0 A (240 V.A.C.) up to 55°C. Ratings are for resistive loads. Pilot duty, 240 V.A. at 120 or 240 V.A.C. Relay output contacts are single pole, double throw.

Relay de-rating chart for 120 V.A.C. loads is shown below. For 240 V.A.C. loads, current rating is 5A to 55°C (131 °F).

Ambient °C	Ambient °F	Current Rating Amperes
Up to 30	Up to 86	9.5
35	95	9.2
40	104	8.9
45	113	8.6
50	122	8.3
55 max.	131 max.	8.0

Triac Driver: Solid state switch rated at 0.1 A to drive solid state relays SSR240A10 and SSR240A25.

24 V.D.C. Voltage Switch: Supplies 24 V.D.C. @ 35 mA max. to drive solid state contactors.

Proportional Current, Non-Isolated: 0 to 20.4 mA into 0 to 1000 ohms max. Span programmable through front panel key pads, such as 4 to 20 mA. 1 to 5 mA, 2 to 12 mA, etc. Control input must not share common grounds with the output.

Proportional Voltage, Non-Isolated: 0 to 10.2 V.D.C. at 20 mA max. (500 ohms min.). Span programmable through front panel key pads, such as 0 to 1 V.D.C., 1 to 5 V.D.C., 4 to 7 V.D.C., 0 to 5 V.D.C., etc. Control input must not share common grounds with the output.

Triac Solid State Switch: Rated at 1.0 A, 240 VAC max. (resistive). Not used to drive contactors or SSR's.

Alarms: Two optional. Full selection of alarm actions.

Alarm Relays: 1.0 A at 120 V.A.C. only. For resistive loads. Normally open or normally closed output contacts selected by internal jumper. Alarm relays are fused.





























Security: Three conditions selected by internal switch.

Housing: Flame retardant U.L. rated plastic. Sealed membrane switch front panel is moisture and oil resistant. Wiring terminals are located on the rear. Full plug-in construction.

Weight: Approx. 2.5 lbs.

Diagnostic Error Messages

The CN-7100 Series Controller will display several error messages in accordance with its diagnostics to give appropriate warning when necessary. When the chart below shows Outputs "Turned off", this means that relays are de-energized, 24 V.D.C. or triac driver modules turn off and current or voltage modules go to zero as if power was turned off.

Display	Meaning	Outputs	Action Required
 	Both displays blank (unlit). Control is not getting any power or voltage supply is too low.	Turned off.	Check to make sure power supply is turned on. Check voltage selection jumper inside control (see "Voltage Selection"). Check fuses external to the control. Failure to select proper voltage to the controller can result in transformer burn-out.
 	Fail test. Appears upon power up if internal diagnostics detects a failure. Failure may be circuit related or if one of the security switches is not in the "on" position. This is also displayed if, during the course of normal operation, a catastrophic event occurs. Displays flash.	Turned off.	First check to see if the security switch of your choice is "on". If it isn't, turn it on. Replacing the control back into its housing and turning the power on will reset the control. If one of the security switches is on and this message occurs, remove the controller from service.
 or   or  or  or   or  or  or 	One or more of these messages will appear upon power up, if any of these set points or differentials are set either below or above the  or  programmed values or beyond the input range ends.  = Set point one.  = Off/On differential.  = Alarm one set point.  = Alarm two set point.	Turned off.	In the "Set-up" mode, correct  or  or  or  to be within the  or  limits or re-program  or  to be at or beyond the selected set points, but not beyond the input range. See "Programming in the Set-up Mode."

Display	Meaning	Outputs	Action Required
$\overline{\text{SPH}}$ or $\overline{\text{SPH}}$ $\overline{\text{SPH}}$ or $\overline{\text{SPH}}$	Check 'Set Point Low' value or check 'Set Point High' value appears upon power-up, if $\overline{\text{SPH}}$ or $\overline{\text{SPH}}$ is programmed either below or above the input range ends. See "Temperature Ranges".	Turned off.	Correct $\overline{\text{SPH}}$ or $\overline{\text{SPH}}$ by re-programming in the "Set-up" mode to within the input range. See "Programming in the Set-up Mode".
$\overline{\text{SPH}}$ $\overline{\text{SPH}}$	Check 'Set Point High' value. Appears when, in the "Set-up" mode, one or more of the set points, differentials or alarm points is set above the maximum value entered for $\overline{\text{SPH}}$. It will also appear if any set point, control or alarm, is set above $\overline{\text{SPH}}$ while in security Level 1. The set point will not be accepted and the previously entered set point will be retained. The displays return to home position.	Turned off during "Set-up". Remain active in security Level 1.	In "Set-up", select a set point, differential or alarm point below the 'Set Point High' value or re-program $\overline{\text{SPH}}$ to a new value above the highest set point, differential or alarm point, but not beyond the input range. In security Level 1, select a set point or alarm point below the 'Set Point High' value or re-program $\overline{\text{SPH}}$ to a new value. See "Programming in the Set-up Mode".
$\overline{\text{SPH}}$ $\overline{\text{SPH}}$	Check 'Set Point Low' value. Appears when in the "Set-up" mode, one or more of the set points, differentials or alarm points is set below the minimum value entered for $\overline{\text{SPH}}$. It will also appear if any set point, control or alarm, is set below $\overline{\text{SPH}}$ while in security Level 1. The set point will not be accepted and the previously entered set point will be retained. The displays return to home position.	Turned off during "Set-up". Remain active in security Level 1.	In "Set-up", select a set point, differential or alarm point above the 'Set Point Low' value or re-program $\overline{\text{SPH}}$ to a new value below the lowest set point, differential or alarm point, but not below the input range. In security Level 1, select a set point or alarm point above the 'Set Point Low' value or re-program $\overline{\text{SPH}}$ to a new value. See "Programming in the Set-up Mode".

Display	Meaning	Outputs	Action Required
<p> $\frac{0.00}{0.00}$ or $\frac{0.00}{0.00}$ $\frac{###}{###}$ or $\frac{###}{###}$ sequencing to </p> <p> $\frac{0.00}{0.00}$ $\frac{0.00}{0.00}$ </p>	<p>Underflow or overflow of current or voltage input. $\frac{0.00}{0.00}$ flashes under low end of zero suppressed range. $\frac{0.00}{0.00}$ or under the first 0.1% of zero start range. $\frac{0.00}{0.00}$ flashes at 0.5% above the top of the range. $\frac{0.00}{0.00}$ flashes at 0.5% above the top of the range. Lower display continues to indicate the set value.</p> <p>When $\frac{0.00}{0.00}$ (input fault time) has been programmed for $\frac{0.00}{0.00}$ min. (6 sec.) to $\frac{0.00}{0.00}$ min. (9 hrs.), then outputs will remain active until the end of this time, when, $\frac{0.00}{0.00}$ $\frac{0.00}{0.00}$ will flash and outputs are turned off.</p> <p>When $\frac{0.00}{0.00}$ (input fault time) has been programmed for $\frac{0.00}{0.00}$, then outputs remain active indefinitely.</p> <p>$\frac{0.00}{0.00}$ $\frac{0.00}{0.00}$ is displayed on input polarity reversal or beyond the underflow or overflow minimal limits when $\frac{0.00}{0.00}$ has been programmed as described above. Displays flash.</p>	<p>Remain active</p> <p>Remain active to Turned off.</p> <p>Remain active</p> <p>Turned off.</p>	<p>Input signal may normally go above or below range ends. If not, check input and correct. If the condition is corrected before sequencing to bad input, the displays will go back to normal indication (home position) without further attention.</p> <p>Correct input. Turn power to the control off, then on, to reset.</p> <p>Underflow and/or overflow is normal. No action required.</p> <p>Correct input. Turn power to the control off, then on, to reset.</p>
<p> $\frac{0.00}{0.00}$ $\frac{0.00}{0.00}$ </p>	<p>Bad input. RTD sensor open or shorted, T/C shorted or heater is not working. For thermocouple input $\frac{0.00}{0.00}$ (T/C short protection) must be turned "on" to warn of shorted T/C or heater not working. Displays flash.</p>	<p>Turned off.</p>	<p>Correct sensor or heater condition. Turn power to the control off, then on, to reset.</p>

Display	Meaning	Outputs	Action Required
$\overline{0000}$ $\overline{1000}$	Open input. T/C circuit open. For T/C input only. Displays flash.	Turned off	Correct T/C or T/C leads. Turn power to the control off, then on, to reset.
#### $\overline{0000}$	Area appears if the controller ambient temperature nears either extreme of its specification of 0°C (32°F) or 55°C (131°F). Upper display continues to indicate the process value. Both displays flash.	Remain active	Correct ambient temperature conditions by eliminating cause (too near heated area, cabinet filters clogged, poor location, etc.). Will reset to home position when condition is corrected.
$\overline{0000}$ $\overline{0000}$	Area appears with blank upper display if the controller ambient temperature reaches 5°C (9°F) beyond the extreme of its specification. This occurs at -5°C (23°F) or +60°C (140°F). Lower display remains steady.	Turned off.	Correct ambient temperature conditions by eliminating cause (too near heated area, cabinet filters clogged, poor location, etc.). Turn power to the control off, then on, to reset.
$\overline{0000}$ $\overline{0000}$	Check calibration. Appears during normal operation if internal reference or associated circuitry is out of tolerance. Intermittent flashing occurs at edge of specification, alternating with home position. When over specification, display flashes continuously without alternating.	Remain active at edge of specification. Turned off when over specification.	Remove controller for service and/or recalibration.
$\overline{0000}$ or $\overline{0000}$ $\overline{0000}$ $\overline{0000}$	The difference between "Scale Low Value" $\overline{0000}$ and "Scale High Value" $\overline{0000}$ is programmed for greater than 4000 or less than 100 counts during programming of voltage or current input scale range.	Turned off	Program within the allowable count range.

Programming in the Set-up Mode

As an aid to programming, a blank "Programming Selection Table" is located in the back of this instruction booklet. It may be used to pre-select your program choices.



During programming, in the "Set-up" condition, all outputs will be off.



Remove the controller from its housing as described under "Removal From the Housing".



Set the security switch to "Set-up". Switch #1 "ON", switches #2 and #3 off (down) as described under "The Security Switch".

Replace the controller into its housing and power the instrument.

All lamps and display segments come on for 2 seconds for a lamp test for user examination to determine if they are all operative. Turn power off, then on, if more time is needed.



In showing what the displays may indicate in these instructions, a heavy line at the top of the displayed item means that it appears on the upper display ; heavy line at the bottom, the lower display .

  is then displayed, indicating that an internal diagnostic test is taking place.

If   is then displayed, service and/or recalibration is required.

When the control passes the diagnostic test, the displays will then indicate both the process value and the set value. This is considered "home" position. The controller will return to the "home" position if no keys are pressed for 8-10 seconds. This can be defeated by holding in either the "Index" or "Enter" key pads.

Repeated actuation of the "Index" key pad advances the various programmable functions onto the displays for either viewing or changing. At each function display, if nothing is done, the controller will return to the "home" position unless the "Index" or "Enter" key pads are continually depressed as described above.

The "Increment"  key pad is used to raise a setting, turn certain functions "on" or to choose any one of many conditions for certain functions. The "Decrement" key pad  is used to lower a setting, turn certain functions "off" or to choose any of many conditions for certain functions. They both operate at a variable speed to allow rapid setting. Settings change faster as the key is depressed longer.

Index items may be presented in reverse order by depressing the "Decrement" key pad and then depressing the "Index" key pad.

No settings can be entered into memory without depressing the "Enter" key pad. The previous setting will be retained if not "Entered". When depressing the "Enter" key pad the displays will momentarily go blank, indicating that the new data has been "Entered" into memory.

Programmable data will be presented as shown in the following chart. At each step press "Enter" if you wish to retain that particular data choice that is being newly entered. If no change is desired, press "Index" to proceed to next programmable function. If the displays automatically return to the "home" position before being able to make changes, simply repeatedly depress the "Index" key until back to the function of interest.

Set Point Changes

	Display Reads	Change Value in Upper Display by Pressing	Comments
A.	#### SP.1 Set Point #1	▲ or ▼ Variable Speed	Press "Enter" to retain. Press "Index" to proceed to next programmable function. This function may also be changed in "level 1 security."
B.	#### SP.2 Alarm #1 Set Point (if equipped)	▲ or ▼ Variable Speed	Press "Enter" to retain. Press "Index" to proceed to next programmable function. This function may also be changed in "level 1 security".
C.	#### SP.2 Alarm #2 Set Point (if equipped)	▲ or ▼ Variable Speed	Press "Enter" to retain. Press "Index" to proceed to next programmable function. This function may also be changed in "level 1 security."

Programming For Auto-Tune or PID Control

CON- DITION	Display Reads	Change Value in Upper Display by Pressing	Comments
PD1.	SP.1 or PD.5 Select Self-Tune or manual tune PID	▲ to select SP.1 turns Auto-Tune function "on". ▼ to select PD.5 turns manual PID tune "on".	If SP.1 (Auto-Tune feature) is desired, press "Enter" and "Index" to condition PD6. If PD.5 manual adjustment is desired, press "Enter". Condition PD2, PD3 or PD4, and PD5 can now be indexed to and changed directly without having to "Enter" PD.5 again. This function may also be changed in "level 1 security".

Programming For Auto-Tune or P.I.D. Control (Cont.)

CON- DITION	Display Reads	Change Value in Upper Display by Pressing	Comments
PD2.	<input type="text" value="#"/> <input type="text" value="P%"/> to <input type="text" value="###"/> Set proportional band (in degrees or counts).	<input type="text" value="▲"/> or <input type="text" value="▼"/> Variable Speed	Proportional band can be selected from 6 (2 on 0.1° ranges) to 1000 Deg. F (or equivalent Deg. C) for temperature inputs or 6 to 4000 counts for current or voltage inputs. Press "Enter" to retain. Press "Index" to proceed to next programmable function (PD3).
PD3.	<input type="text" value="###"/> <input type="text" value="r:0"/> to <input type="text" value="###"/> <input type="text" value="r:0"/> Automatic Reset. Set reset time (minutes).	<input type="text" value="▲"/> or <input type="text" value="▼"/> Variable Speed	Automatic Reset can be selected from 0.1 to 99.9 minutes in 6 second increments. If Automatic Reset is desired, press "Enter" and proceed to condition PD5. If <input type="text" value="###"/> <input type="text" value="r:0"/> is "Entered", then Automatic Reset is turned "Off". Condition PD4
PD4.	<input type="text" value="###"/> <input type="text" value="r:0"/> to <input type="text" value="###"/> <input type="text" value="r:0"/> Manual Offset Correct	<input type="text" value="▲"/> or <input type="text" value="▼"/> Variable Speed	Manual Offset can be selected from 0.1 to 99.9% output at the set point. To correct offset, start at 50%. If the Process Value (PV) settles out below the set point increase the Manual Offset value above 50% and wait each time. Repeat until the PV settles out at the set point. If the PV settles out above the set point decrease the Manual Offset value below 50% and repeat if necessary. If <input type="text" value="###"/> <input type="text" value="r:0"/> is "Entered", then proceed back to condition PD3 (Automatic Reset).

Programming For Auto-Tune or P.I.D. Control (Cont.)

CON- DITION	Display Reads	Change Value in Upper Display by Pressing	Comments
PD5.	<p> 0.00 to 99.99 Automatic Rate. Set Rate time (minutes) </p>	<p> ▲ or ▼ Variable Speed </p>	<p>Automatic Rate can be selected from 0.01 to 99.99 minutes in 0.6 second increments. If 0.00 is selected, Rate is turned "Off". Press "Enter" and proceed to condition D1.</p>
PD6.	<p> 0.00 or 0.01 Re-start Self-Tune function when changing control process and indicates when initial PID values have been calculated. </p>	<p> Set-up mode only: ▲ to select 0.00 </p>	<p>In Set-up Mode: When this menu item is selected, 0.00 will automatically appear in the upper display if the Auto-Tune function has learned the process and has set the proper PID parameters. If not, 0.00 will appear. Once a process has been learned (maybe during bench testing) and the control instrument is subsequently moved to a new process, always select 0.00 to avoid a long delay in learning the new process. This selection removes the old PID parameters from memory and the Auto-Tune is free to immediately learn the new ones for the new process. Press "Enter" to retain. In Level 1 or 2 Mode: Displays 0.00 until initial values have been calculated, then displays 0.01 as it continues to tune the process. This function can only be changed in Set-up as above.</p>
PD7.	<p> 0.00 to 99.99 Damping Factor. For selecting the ratio of Rate to Reset in the Self-Tune mode. </p>	<p> Set-up mode only: ▲ or ▼ Single step OFF thru 7. </p>	<p>Use 0.00 for PI control only (no Rate term). Factory set at 3. For fast response (underdamped) decrease this number. For slow response (overdamped) increase this number. Press "Enter" to retain. Press "Index" to proceed to the next function. Condition PD7 is not equipped in some controls.</p>

Control Output Functions

	Display Reads	Change Value in Upper Display by Pressing	Comments
D1.	<p> to Set Point #1 cycle time in seconds For relay, 24 V.D.C. and triac output modules only </p>	<p> or Single step by 2 </p>	<p> If time proportioning is not desired, depress "Decrement" key one step below 2 on the upper display. The next programmable function (D2) will be displayed. If this output is desired, press "Enter" to retain and proceed to condition E. </p>
D2.	<p> Fast triac for triac and 24 V.D.C. output modules only. or for current proportional output modules only. or for voltage proportional output modules only. </p>	<p> or Single step. </p>	<p> If these output functions are not desired, depress "Decrement" key one step below on the upper display. The next programmable function (D3) will be displayed. If one of these outputs is desired, press "Enter" to retain the one selected and proceed to condition E. </p>
D3.	<p> Pulse proportioning for water or oil cooling applications on- ly. For relay, triac and 24 V.D.C. output modules only. </p>	<p>—</p>	<p> If this output function is not desired, depress the "Decrement" key one step below on the upper display. The next programmable function (D4) will be displayed. If this output is desired, depress the "Enter" key, D4 will be displayed. </p>

Control Output Functions (Cont.)

CON- DITION	Display Reads	Change Value in Upper Display by Pressing	Comments
D4.	<div> <div> <div></div> <div>0.00</div> </div> <div>To</div> <div> <div></div> <div></div> </div> </div> Pulse rate for pulse output. Arbitrary setting. Set for best control results.	<div> <div>▲</div> or <div>▼</div> </div> Single step 1 thru 7.	For "Oil" cooling, use 1 thru 4. For "Water" cooling, use 3 thru 7. Press "Enter" to retain and proceed to condition E.
D5.	<div> <div>0.00</div> <div>0.00</div> </div> On/Off control for relay, triac and 24 V.D.C. output modules only.	—	If on-off control is not desired, depress "Index" key and proceed to condition E. If on/off control is desired, depress the "Enter" key, D6 will be displayed.
D6.	<div> <div>###</div> <div>5.0</div> </div> On/Off Differential for Set Point #1 if set for D5 condition. 2 degrees to full scale in one degree increments or 0.5 to 999.0 degrees in 0.1 degree increments, limited by condition G.	<div> <div>▲</div> or <div>▼</div> </div> variable speed.	Number of degrees displayed remain the same regardless of F or C selection. Press "Enter" to retain and proceed to condition E. See Figure D6 for modes of operation.

Other Control Functions

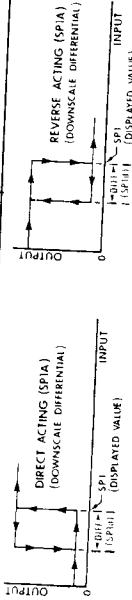
	Display Reads	Change Value in Upper Display by Pressing	Comments
E.	\boxed{F} $\boxed{5}$ $\boxed{2}$ or $\boxed{5}$ $\boxed{2}$ temperature scale selection.	$\boxed{\blacktriangle}$ Selects °F. $\boxed{\blacktriangledown}$ Selects °C.	All temperature values converted and displayed in chosen scale (except $\boxed{5}$ $\boxed{2}$ differential and certain options). Press "Enter" to retain and proceed to condition F. Descriptor \boxed{F} or $\boxed{5}$ to the right of the upper display will light. This condition not present on current or voltage inputs. See condition T8.
G.	$\boxed{####}$ $\boxed{5}$ $\boxed{2}$ Lowest set point desired for Set Point #1, Alarm #1, Alarm #2 or on/off differential.	$\boxed{\blacktriangle}$ or $\boxed{\blacktriangledown}$ variable speed.	This function sets the low end of the desired set point span of the control.
H.	$\boxed{####}$ $\boxed{5}$ $\boxed{2}$ Highest set point desired for Set Point #1, Alarm #1, Alarm #2 or on/off differential.	$\boxed{\blacktriangle}$ or $\boxed{\blacktriangledown}$ variable speed	This function sets the high end of the desired set point span of the control.
I.	$\boxed{0}$ $\boxed{5}$ $\boxed{2}$ to $\boxed{30}$ in percent Low end output restriction	$\boxed{\blacktriangle}$ or $\boxed{\blacktriangledown}$ variable speed	Usually used to select Current or Voltage output ranges desired when Current or Voltage output modules are used. Also used for time proportioning output with relay, 24 V.D.C. or triac driver output modules to restrict duty cycle so that the lowest power output may be increased for under powered heating systems. Adjustable from 0 to 90% of output or $\boxed{5}$ $\boxed{2}$ value, whichever is lowest. See " $\boxed{5}$ $\boxed{2}$ and $\boxed{5}$ $\boxed{2}$ Selection".

Other Control Functions (Cont.)

	Display Reads	Change Value in Upper Display by Pressing	Comments
J.	$\boxed{100}$ to $\boxed{100}$ in percent High end output restriction	\blacktriangle or \blacktriangledown variable speed	Same as $\boxed{100}$ except adjusts high end of output. Also restricts duty cycle so that the highest power output may be decreased for over powered heating systems. Adjustable from 102 to 10% of output or $\boxed{100}$ value, whichever is highest. See " $\boxed{100}$ " and " $\boxed{100}$ Selection".
K.	$\boxed{0.0}$ or $\boxed{0.0}$ Set Point #1 action-direct or reverse	\blacktriangle to select $\boxed{0.0}$ \blacktriangledown to select $\boxed{0.0}$	Direct acting: Relay, 24 V.D.C. or triac output energized above the set point. Current or Voltage output highest above the set point. Reverse acting is normally used for "heating" and direct acting for cooling. When controller reverts to "safe" conditions due to certain diagnostic information, all outputs turn off. See explanation under "Diagnostic Error Messages".
L.	$\boxed{0.0}$ or $\boxed{0.0}$ Set Point #1 status light "lit".	\blacktriangle lit when S.P. #1 output is "on". \blacktriangledown lit when S.P. #1 output is "off".	If your controller is not equipped with alarms, proceed to Condition T.

FIG. D6 $\boxed{0.0}$ Modes of Operation:

Note: For upscale differential — SPI (displayed value) = Desired set point + differential (SP1d).



Alarm Functions (If Equipped)

CAUTION: In any critical application where failure could cause expensive product loss or endanger personal safety, a second redundant limit controller is recommended.

	Display Reads	Change Value in Upper Display by Pressing	Comments
M.	<div> <div> <div>0.0</div> <div>5</div> </div> <div>or</div> <div> <div>0.0</div> <div>0</div> </div> </div> <div>Alarm Type: Absolute or deviation</div>	<div> <div>▲</div> to select <div>0.0</div> <div>▼</div> to select <div>0.0</div> </div> <div>Affects both alarms</div>	<div> If absolute is selected, alarms stay at whatever set value is entered and do not follow the control set point if it is changed (non-tracking). If deviation is selected, the alarms, once set, will hold the same relationship to the control set point and will follow if the control set point is changed (tracking). </div>
N.	<div> <div>0.0</div> <div>0</div> </div> <div>or</div> <div> <div>0.0</div> <div>0</div> </div>	<div> <div>▲</div> to select <div>0.0</div> </div> <div>Direct Acting</div> <div> <div>▼</div> to select <div>0.0</div> </div> <div>Reverse Acting</div>	<div> Direct acting: relay coil energized when the process value is above the alarm set point. Usually used for high alarm. Reverse acting: relay coil energized when the process value is below the alarm set point. Usually used for low alarm. </div>
O1.	<div> <div>0.0</div> <div>0</div> </div> <div>or</div> <div> <div>0.0</div> <div>0</div> </div>	<div> <div>▲</div> lit when alarm #1 output is "ON". </div> <div> <div>▼</div> lit when alarm #1 output is "OFF". </div>	
O2.	<div> <div>0.0</div> <div>0</div> </div> <div>or</div> <div> <div>0.0</div> <div>0</div> </div>	<div> <div>▲</div> to select <div>0.0</div> </div> <div>▼</div> to select <div>0.0</div>	<div> When "ON" is selected, the alarm status light will flash when it is lit. When "OFF" is selected, the alarm status light will stay on steadily when lit. </div>
P1.	<div> <div>0.0</div> <div>0</div> </div> <div>or</div> <div> <div>0.0</div> <div>0</div> </div>	<div> <div>▲</div> to select <div>0.0</div> </div> <div>automatic reset.</div> <div> <div>▼</div> to select <div>0.0</div> </div> <div>manual reset</div>	<div> If automatic reset is selected, press "Enter" to retain and "Index" to condition Q. If manual reset is selected, press "Index" to condition P2. With manual reset, once the alarm has been initiated, the condition must return to normal and the <div>INDEX</div> and <div>▼</div> keys must be depressed at the same time to reset. </div>

Alarm Functions (If Equipped) (Cont.)

	Display Reads	Change Value in Upper Display by Pressing	Comments
P2.	<div> <div>ON</div> <div>or</div> <div>OFF</div> </div> <div>Alarm #1 power interrupt function</div>	<div> <div>▲</div> to select <div>ON</div> turns function "ON". <div>▼</div> to select <div>OFF</div> turns function "OFF". </div>	Used only with manual alarm reset. If "ON" is selected, will automatically reset an alarm after a power failure and subsequent restoration if no alarm condition exists. Press "Enter" and proceed to condition Q.
Q.	<div> <div>dir</div> <div>or</div> <div>rev</div> </div> <div>Alarm #2 action direct or reverse</div>	<div> <div>▲</div> to select <div>dir</div> Direct Acting <div>▼</div> to select <div>rev</div> Reverse Acting </div>	Direct Acting: relay coil energized when the process value is above the alarm set point. Usually used for high alarm. Reverse Acting: relay coil energized when the process value is below the alarm set point. Usually used for low alarm.
R1.	<div> <div>ON</div> <div>or</div> <div>OFF</div> </div> <div>Alarm #2 status light "lit"</div>	<div> <div>▲</div> lit when alarm #2 output is "ON". <div>▼</div> lit when alarm #2 output is "OFF". </div>	
R2.	<div> <div>ON</div> <div>or</div> <div>OFF</div> </div> <div>Alarm #2 status light flasher</div>	<div> <div>▲</div> to select <div>ON</div> <div>▼</div> to select <div>OFF</div> </div>	When "ON" is selected, the alarm status light will flash when lit. When "OFF" is selected, the alarm status light will stay on steadily when lit.

Alarm Functions (If Equipped) (Cont.)

CON- DITION	Display Reads	Change Value in Upper Display by Pressing	Comments
S1.	$\overline{0.00}$ $\overline{0.20}$ or $\overline{0.00}$ Alarm #2 reset choice automatic or manual	\blacktriangle to select $\overline{0.00}$ automatic reset. \blacktriangledown to select $\overline{0.20}$ manual reset	If automatic reset is selected, press "Enter" to retain and "Index" to condition T. If manual reset is selected, press "Enter" to condition S2. With manual reset, once the alarm has been initiated, the condition must return to normal and the \overline{INDEX} and $\overline{0.00}$ keys must be depressed at the same time to reset.
S2.	$\overline{0.00}$ $\overline{0.20}$ or $\overline{0.00}$ $\overline{0.20}$ Alarm #2 power interrupt function	\blacktriangle to select $\overline{0.00}$ Turns function "ON". \blacktriangledown to select $\overline{0.20}$ Turns function "OFF".	Used only with manual alarm reset. If "ON" is selected, will automatically reset an alarm after a power failure and subsequent restoration if no alarm condition exists. Press "Enter" and proceed to Condition T.

Input Selection (Thermocouple and RTD only)

CON- DITION	Display Reads	Change Value in Upper Display by Pressing	Comments
T1.	Thermocouple E, J or K $\overline{E.00}$ $\overline{J.00}$ $\overline{K.00}$ or $\overline{0.00}$ $\overline{1.00}$ $\overline{2.00}$ or $\overline{0.00}$ $\overline{1.00}$ $\overline{2.00}$ or $\overline{0.00}$ $\overline{1.00}$ $\overline{2.00}$	\blacktriangle or \blacktriangledown Single Step	Do not "Enter" $\overline{0.00}$. For factory use only. See "Input Wiring" for input type identification. Proceed to Condition U.

CON- DITION	Display Reads	Change Value in Upper Display by Pressing	Comments
T2.	Thermocouple T, R OR S <div> <div> <div>1.2P</div> <div>1.2P</div> </div> <div>or</div> <div> <div>1.2P</div> <div>1.2P</div> </div> <div>or</div> <div> <div>5.10</div> <div>5.10</div> </div> <div>or</div> <div> <div>1.2P</div> <div>1.2P</div> </div> </div>	<div> <div>▲</div> or <div>▼</div> </div> <div>Single Step</div>	Do not "Enter" <div>1.2P</div> . For factory use only. See "Input Wiring" for input type identification. Proceed to Condition U.
T3.	RTD CAL. 104, 105, or 106 <div> <div>104</div> <div>104</div> </div> <div>or</div> <div> <div>105</div> <div>105</div> </div> <div>or</div> <div> <div>106</div> <div>106</div> </div> <div>or</div> <div> <div>1.2P</div> <div>1.2P</div> </div>	<div> <div>▲</div> or <div>▼</div> </div> <div>Single Step</div>	Do not "Enter" <div>1.2P</div> . For factory use only. See "Input Wiring" for input type identification. Programming is complete. "Index" to "home" position or wait 8-10 seconds and "home" position will come automatically.
U.	Thermocouple short protection <div> <div>1.2P</div> <div>1.2P</div> </div> <div>or</div> <div> <div>1.2P</div> <div>1.2P</div> </div>	<div> <div>▲</div> to select <div>1.2P</div> </div> <div>Instrument constantly checks for a shorted thermocouple or an inoperative heater.</div> <div> <div>▼</div> to select <div>1.2P</div> </div> <div>Turns this function "OFF".</div>	Before turning this function "ON", see "Set-up for T/C Short Protection". This completes programming. "Index" to "home" position or wait 8-10 seconds and "home" position will come automatically.

37	<p>After programming, turn the power to the instrument off, then on, and verify each programmed value or function. After verification, the program may be secured in either "level 1" or "level 2" security. See "The Security Switch".</p>
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Input Selection	
(Current & Voltage Ranges Only)	Viewable & changeable in "Setup" Mode only
Change Value in Hz	

Current & Voltage Ranges Only) Viewable & changeable in "Setup" Mode only			
CON- DITION	Display Reads	Change Value in Upper Display by Pressing	Comments
T4.	#### $\frac{SCR}{A}$ Display low value	Δ or ∇ Variable Speed	This function sets the low end of the scale range. Any #### from 100 to 4000 counts below $\frac{SCR}{A}$
T5.	#### $\frac{SCR}{A}$ Display high value	Δ or ∇ Variable Speed	This function sets the high end of the scale range. Any #### from 100 to 4000 counts above $\frac{SCR}{A}$
T6.	\cdot $\frac{dP}{A}$ or \cdot or \cdot or \cdot or \cdot Decimal point position ← No decimal pt.	Δ or ∇ Single step.	This function sets the decimal point for 1, 2 or 3 numbers beyond the decimal point. Do not "Enter" \cdot . For factory use only.
T7.	$\frac{dP}{A}$ or $\frac{dP}{A}$ Zero Suppression	Δ to select $\frac{dP}{A}$ turns function "ON" ∇ to select $\frac{dP}{A}$ turns function "OFF".	Low end of scale range starts 20% above low end of input range. i.e., 0 to 20 MA input range becomes 4 to 20 MA input for scale.
T8.	$\frac{dP}{A}$ or $\frac{dP}{A}$ or $\frac{dP}{A}$ Engineering units descriptor	Δ or ∇ Single step.	Select Engineering Units Descriptors: $\frac{dP}{A}$ = No descriptors. Apply appropriate label from multiple Engineering Units Label Card supplied with instrument in upper R.H. corner of silver area opposite "Set Point/Index" on the front of the instrument. $\frac{dP}{A}$ = °F descriptor. $\frac{dP}{A}$ = °C descriptor.

Input Selection

Comments

in either "level 1" or "level 2" security. See "The Security Switch".

Set-up for T/C Short Protection

1. Leave **SET** **OFF** under the following conditions:
 - a. Control set value is not greater than 190°F.
 - b. If the control application is "cooling".
 - c. Where there is more than one controller on a machine and adjacent zones will keep the heat from dropping even through one zone fails to heat.
 - d. If **LOD** **INP** appears and **SET** is **ON** , then, control power is turned off, then on, and the process returns to the control set point.
 - e. While performing calibration or testing.
 - f. When using "ON-OFF" control.
2. Other considerations with **SET** **ON**
 - a. If T/C short or heater malfunction is intermittent, **LOD** **INP** may not appear until the controller can no longer do its best to keep the process under control.
 - b. If power to the controller is turned off and then turned on again and the process value is less than 10° below the set value, **LOD** **INP** may appear. Wait until the process value is greater than 10° below the set value or program **SET** **OFF** .
 - c. If controller is moved from one process to another process **SET** must be set up again.
3. To Set Up **SET** , proceed as follows:
 - a. Security switch #1 must be in the up (on) position for "Set-up".
 - b. Actuate the "Index" key pad repeatedly until **SET** appears on the lower display. Depress the **▲** key pad so that **Set** appears on the upper display. Press the "Enter" key pad to retain.
 - c. Turn power to the controller off, then on, and verify each programmed value or function.
 - d. Return to either "level 1" or "level 2" security. See "The Security Switch."

§ 102.1 and § 102.2 Selection

Mode Selected In Condition D1 or D2	Output Range Desired	Set $\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$ Condition I to	Set $\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$ Condition J to	For other Output Values
$\left[\frac{\text{§ P}}{\text{§ P}} \right]$ Current Proportional (Non-Isolated or Isolated)	0 TO 5 mA.	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	Multiply current (in mA.) desired by 5. S10H can be incremented to 102 (max.) = 20.4 mA.
	1 TO 5 mA.	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	
	2 TO 12 mA.	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	
	0 TO 20 mA.	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	
	4 TO 20 mA.	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	
$\left[\frac{\text{§ P}}{\text{§ P}} \right]$ Voltage proportional (Non-Isolated)	0 TO 1 V.D.C.	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	Multiply voltage (in V.) desired by 10. S10H can be incremented to 102 (max.) = 10.2 V.
	0 TO 2 V.D.C.	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	
	0 TO 5 V.D.C.	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	
	1 TO 5 V.D.C.	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	
	4 TO 7 V.D.C.	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	
$\left[\frac{\text{§ P}}{\text{§ P}} \right]$ Voltage proportional (Isolated)	0 TO 10 V.D.C.	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	Multiply voltage (in V.) desired by 20. S10H can be incremented to 102 (max.) = 5.1 V.
	0 TO 1 V.D.C.	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	
	0 TO 5 V.D.C.	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	
	1 TO 5 V.D.C.	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	
	0 TO 100% DUTY CYCLE	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	
$\left[\frac{\text{§ Y}}{\text{§ Y}} \right]$ * Time proportioning, fast triac or pulse	10 TO 90% DUTY CYCLE	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	Multiply duty cycle by 1. Increment to 100, 101, or 102 is still 100%.
		$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	$\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$	

*Varying cycle rate will usually produce better control than varying $\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$ or $\left[\frac{\text{§ 102.1}}{\text{§ 102.2}} \right]$

Changing Sensors

Your controller is calibrated for three sensor types. See "Model Identification" for your input. To change from one type to another is done in programming. See Condition T1, T2 or T3 under "Programming in the Set-up Mode" and follow instructions for programming to your desired sensor.

Changing Output Modules

Remove the controller from its housing as described under "Removal From the Housing". Locate the plug-in module and remove it by un-plugging both the small cable (if present) and the module from its socket.

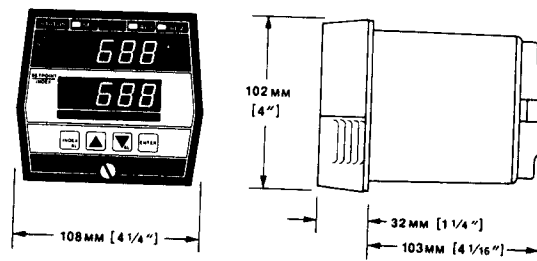
Install new module and cable (if present).

Re-wire rear terminals of control for the external wiring proper for the newly installed module.

Place the internal security switch into the "Set-Up" condition as described under "The Security Switch".

Re-install the control into its housing and re-program "Control Output Functions" as outlined under "Programming in the Set-up Mode".

DIMENSIONS



CUTOUT FOR ALL MODELS
92mm x 92mm (3 5/8" x 3 5/8")

PROGRAM SELECTION TABLE

Use this table to fill in programming choices as an aid when programming your controller. Make copies of this blank table or request additional copies from the factory.

SET POINTS

Index Item	Choices	Choice
#### <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> Set Point 1	Any value within <input type="text"/> <input type="text"/> and <input type="text"/> <input type="text"/>	
#### <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> Alarm Point 1	Any value within <input type="text"/> <input type="text"/> and <input type="text"/> <input type="text"/> If alarms are present	
#### <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> Alarm Point 2	Any value within <input type="text"/> <input type="text"/> and <input type="text"/> <input type="text"/> If alarms are present	

PROGRAMMING FOR AUTO-TUNE OR PID CONTROL

Index Item	Choices	Choice
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> or <input type="text"/> <input type="text"/> Self-Tune or manual tune PID	<input type="text"/> <input type="text"/> or <input type="text"/> <input type="text"/>	
<input type="text"/> # <input type="text"/> <input type="text"/> Proportional Band	6 to 1000 °F (or equivalent °C) for temp inputs or 6 to 4000 counts for current or voltage inputs.	
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> to <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> Automatic Reset time	Off=no reset or select from 0.1 to 99.9 minutes in 6 second increments.	
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> to <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> Manual offset Correct	Select from 0.1 to 99.9%. OFF=Must select reset time.	
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> to <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> Automatic Rate time	Off=no rate or select from 0.01 to 99.99 minutes in 0.6 second increments.	
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> or <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> Restart auto-tune learn Continue auto-tune learn	<input type="text"/> <input type="text"/> or <input type="text"/> <input type="text"/>	

CONTROL OUTPUT FUNCTIONS

Relay Output Module

Index Item	Choices	Choice
<div>##</div> <div>000</div> Cycle rate (time proportioning)	<div>00</div> to <div>99</div> seconds.	
or <div>000</div> <div>000</div> * Pulse output (Pulse proportioning)	<div>00</div> to <div>99</div>	
or <div>0000</div> <div>000</div> * on-off output	<div>0000</div> set point on-off differential <div>00</div> degrees to <div>0000</div> or <div>00</div> degrees to <div>9999</div>	

*When confirming these functions after programming, press "Enter" to display the pulse output or on-off differential choice.

Triac Output Module and 24 V.D.C. Output Module

Index Item	Choices	Choice
<div>##</div> <div>000</div> cycle rate (time proportioning)	<div>00</div> to <div>99</div> seconds	
or <div>000</div> <div>000</div> fast triac output	no other adjustment necessary for this index item	
or <div>000</div> <div>000</div> * Pulse output (pulse proportioning)	<div>00</div> to <div>99</div>	
or <div>0000</div> <div>000</div> * on-off output	<div>0000</div> set point on-off differential <div>00</div> degrees to <div>0000</div> or <div>00</div> degrees to <div>9999</div>	

*When confirming these functions after programming, press "Enter" to display the pulse output or on-off differential choice.

Current Proportional Output Modules

Index Item	Choices	Choice
<div>00</div> <div>000</div> Current proportional output	No other adjustment necessary for this index item	

Voltage Proportional Output Modules

Index Item	Choices	Choice
<div>00</div> <div>000</div> Voltage proportional output	No other adjustment necessary for this index item	

OTHER CONTROL FUNCTIONS

Index Item	Choices	Choice
<div>°</div> <div>or</div> <div>°C</div> <div>Degrees fahrenheit or degrees celcius</div>	<div>°</div> <div>or</div> <div>°C</div> <div>This condition not present on current or voltage inputs. See "Input Selection (Current and Voltage Ranges)."</div>	
<div>####</div> <div>SP_L</div> <div>Set Point low end</div>	any #### within range span	
<div>####</div> <div>SP_H</div> <div>Set Point high end</div>	any #### within range span	
<div>##</div> <div>SP_{1L}</div> <div>Set Point 1 output low end restriction</div>	<div>0</div> to <div>30</div> percent	
<div>##</div> <div>SP_{1H}</div> <div>Set Point 1 output high end restriction</div>	<div>100</div> to <div>10</div> percent	
<div>dir</div> <div>or</div> <div>SP_{1R}</div> <div>Set Point 1 action direct or reverse acting</div>	<div>dir</div> or <div>rev</div>	
<div>on</div> <div>or</div> <div>SP_{1U}</div> <div>Set Point 1 status light lit with output on or with output off</div>	<div>on</div> or <div>off</div>	

ALARM FUNCTIONS (IF PRESENT)

Index Item	Choices	Choice
<div> <div>ABS</div> <div>or</div> <div>REL</div> <div>DEL</div> </div> <p>Alarm type absolute (non-tracking) or deviation (tracking)</p>	<div>ABS</div> or <div>DEL</div>	
<div> <div>DIR</div> <div>or</div> <div>ALR</div> <div>REV</div> </div> <p>Alarm 1 action direct acting (high alarm) or reverse acting (low alarm)</p>	<div>DIR</div> or <div>REV</div>	
<div> <div>ON</div> <div>or</div> <div>AL</div> <div>OFF</div> </div> <p>Alarm 1 status light lit with output on or with output off</p>	<div>ON</div> or <div>OFF</div>	
<div> <div>ON</div> <div>or</div> <div>AL</div> <div>OFF</div> </div> <p>Alarm 1 status light flasher on or off</p>	<div>ON</div> or <div>OFF</div>	
<div> <div>ON</div> <div>or</div> <div>AL</div> <div>IR</div> <div>OFF</div> </div> <p>Alarm 1 reset type, on-off (automatic) or alarm (manual)</p>	<div>ON</div> or <div>AL</div> * IF <div>AL</div> is selected, then also select <div>AL</div> , alarm 1 power interrupt function <div>ON</div> or <div>OFF</div>	
<div> <div>DIR</div> <div>or</div> <div>AL</div> <div>REL</div> <div>REV</div> </div> <p>Alarm 2 action direct acting (high alarm) or reverse acting (low alarm)</p>	<div>DIR</div> or <div>REV</div>	
<div> <div>ON</div> <div>or</div> <div>AL</div> <div>OFF</div> </div> <p>Alarm 2 status light lit with output on or with output off</p>	<div>ON</div> or <div>OFF</div>	
<div> <div>ON</div> <div>or</div> <div>AL</div> <div>OFF</div> </div> <p>Alarm 2 status light flasher on or off</p>	<div>ON</div> or <div>OFF</div>	

ALARM FUNCTIONS (IF PRESENT) (Continued)

Index Item	Choices	Choice
<div>0n0F</div> <div>or</div> <div>8L2P</div> <div>8L</div> <p>Alarm 2 reset type, on-off (automatic) or alarm (manual)</p>	<div>0n0F</div> or <div>8L</div> * if <div>8L</div> is selected, then also select <div>8L2P</div> , alarm 2 power interrupt function <div>0n</div> or <div>0FF</div>	

*When confirming these functions after programming, if

8L

 has been selected, press "Enter" to display the alarm power interrupt function choice.

INPUT SELECTION (THERMOCOUPLE AND RTD ONLY)

Thermocouple Types E, J or K

Index Item	Choices	Choice
<div>E-</div> <div>or</div> <div>J-10</div> <div>1nP</div> <div>or</div> <div>KR</div> <p>Thermocouple input</p>	<div>E-</div> = Type E, Chromel/Constantan <div>J-10</div> = Type J, Iron/Constantan <div>KR</div> = Type K, Chromel/Alumel	
<div>0n</div> <div>or</div> <div>0CS</div> <div>0FF</div> <p>Thermocouple short protection</p>	<div>0n</div> or <div>0FF</div>	

Thermocouple Types T, R or S

Index Item	Choices	Choice
<div>T-</div> <div>or</div> <div>R-13</div> <div>1nP</div> <div>or</div> <div>S-10</div> <p>Thermocouple input</p>	<div>T-</div> = Type T, Copper /Constantan <div>R-13</div> = Type R, Plat, 13% RH./Plat. <div>S-10</div> = Type S, Plat, 10% RH./Plat.	
<div>0n</div> <div>or</div> <div>0CS</div> <div>0FF</div> <p>Thermocouple short protection</p>	<div>0n</div> or <div>0FF</div>	

RTD Calibrations 104, 105 or 106

Index Item	Choices	Choice
<div>104</div> <div>or</div> <div>105</div> <div>1nP</div> <div>or</div> <div>106</div> <p>RTD input</p>	<div>104</div> =Platinum 100 OHMS at 0°C. (American curve) alpha =.00392 OHMS/OHM/°C. <div>105</div> =nickel 120 OHMS at 0°C. <div>106</div> =platinum 100 OHMS at 0°C. (DIN curve) alpha=.00385 OHMS/OHM/°C.	

Input Selection (Current and Voltage Ranges Only)

Index Item	Choices	Choice
<div>#### 5684</div> <div>Display low value.</div>	Any #### from 100 to 4000 counts below 5684	
<div>#### 5684</div> <div>Display high value</div>	Any #### from 100 to 4000 counts above 5684	
<div>.</div> <div>or</div> <div>.</div> <div>or</div> <div>00</div> <div>.</div> <div>or</div> <div>.</div> <div>Decimal point position</div>	<div>.</div> .1 resolution <div>or</div> <div>.</div> .01 resolution <div>or</div> <div>.</div> .001 resolution <div>or</div> <div>1</div> 1 unit resolution. No decimal point	
<div>000</div> <div>or</div> <div>0500</div> <div>000</div> <div>20% zero suppression</div>	<div>000</div> or <div>000</div>	
<div>0</div> <div>or</div> <div>0 000</div> <div>or</div> <div>0</div> <div>Engineering units descriptor</div>	<div>0</div> no descriptor (apply label) <div>or</div> <div>0</div> °F descriptor <div>or</div> <div>0</div> °C descriptor	
<div>000</div> <div>to</div> <div>0.0 1000</div> <div>to</div> <div>5400</div> <div>Input fault time</div>	<div>000</div> to <div>5400</div> minutes in <div>0.0</div> minute (6 second) increments	

OMEGA ... Your Source for Process Measurement and Control

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- ☐ Computer Sensor Interface

PRESSURE/STRAIN

- ☐ Transducers
- ☐ Strain Gauges
- ☐ Load Cells
- ☐ Pressure Gauges
- ☐ Instrumentation

FLOW

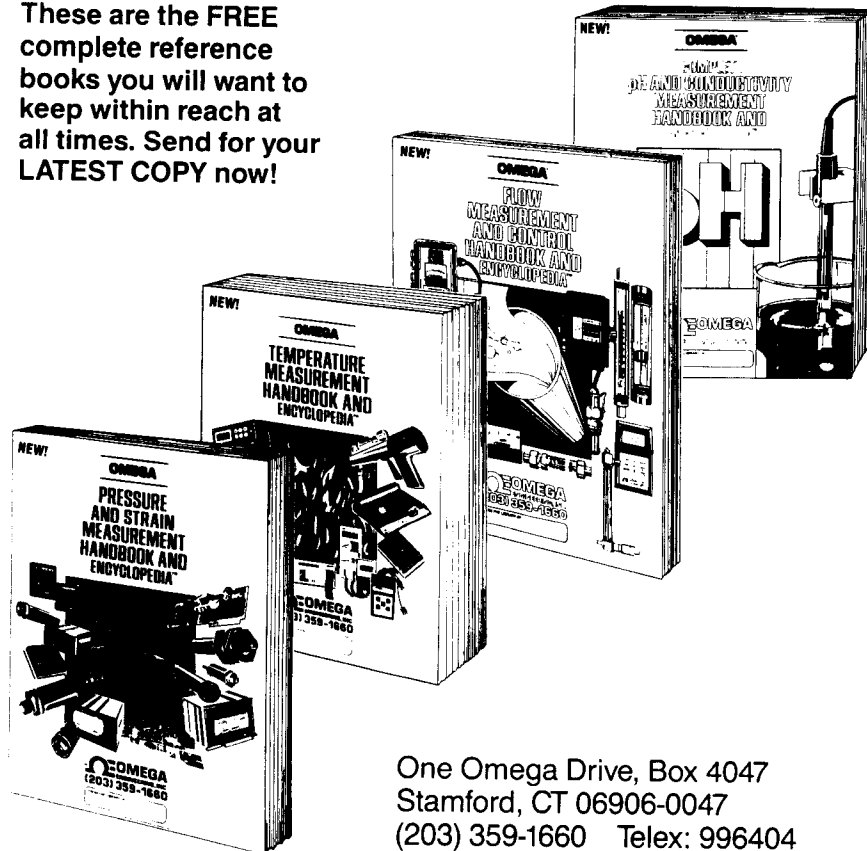
- ☐ Rotameters
- ☐ Flowmeter Systems
- ☐ Air Velocity Indicators
- ☐ Turbine/Paddlewheel Systems
- ☐ Vortex Meters and Flow Computers

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- ☐ Electrodes
- ☐ Benchtop/Laboratory Meters
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