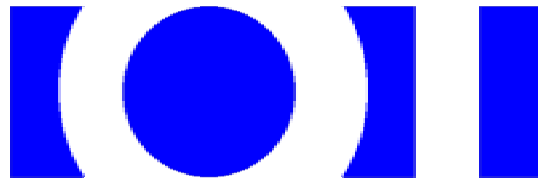


Oven Industries, Inc.



OPERATING MANUAL

Model 5C7-461



PC PROGRAMMABLE THERMOCOUPLE SENSING TEMPERATURE CONTROLLER

Introduction

Thank you for purchasing our controller. The Model 5C7-461 is an exceptionally versatile unit and we want you to understand its total capability.

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FEATURES:

- **ISOLATED TYPE J, K, OR S THERMOCOUPLE INPUT WITH COLD JUNCTION COMPENSATION OR ± 100 MV INPUT**
- **TEMPERATURE RESOLUTION: TO 0.1°C**
- **1500 VOLT INPUT ISOLATION**
- **15 AMPERE, 110/220 VAC SOLID STATE RELAY OUTPUT**
- **HEATING OR COOLING MODE SELECTION**
- **CONTROL ALGORITHM: PROPORTIONAL (P), INTEGRAL (I), AND DERIVATIVE (D) THAT CAN BE SELECTED AS P, PI, PD, OR PID; OR ON/OFF WITH AN ADJUSTABLE HYSTERESIS**
- **ALARM OUTPUTS: OPTICALLY ISOLATED 0.5 AMPERE, 110/220 VAC SOLID STATE RELAY. ADDITIONALLY, A 5 VOLT @ 20 MA DRIVE FOR AN OPTIONAL LED ALARM MONITOR, SOLID STATE RELAY, OR REED RELAY**
- **ALARM MODES: HIGH AND/OR LOW TEMPERATURE ALARMS OR TRACKING ALARMS THAT CAN BE SELECTED AS LATCHING OR NON-LATCHING ALARMS. THE ALARMS ARE RESET BY A COMMUNICATIONS INTERFACE OR OPTIONAL LOCAL SWITCH.**
- **STAND-ALONE OPERATION**
- **RS485 COMMUNICATIONS INTERFACE USED FOR SELECTING OR ADJUSTING FIELD PARAMETERS OR DATA ACQUISITION IN HALF DUPLEX MODE. UP TO 32 UNITS PER INTERFACE ARE ADDRESSABLE OVER A MAXIMUM OF 4,000 FEET OF COMMUNICATIONS CABLE.**
- **NO COMPUTER PROGRAMMING EXPERIENCE IS NEEDED TO USE THE INCLUDED COMMUNICATIONS SOFTWARE PROGRAM.**
- **COMMAND SET IS PROVIDED WHICH ENABLES USERS TO CREATE THEIR OWN SOFTWARE INTERFACE OR EMBEDDED CONTROLLER APPLICATION.**
- **NON-VOLATILE MEMORY RETENTION OF PARAMETERS**
- **OPTIONAL LOCAL ANALOG SET POINT: POTENTIOMETER, 4- 20 MA, OR 1 - 5 VDC WITH ADJUSTABLE RANGE CONFIGURED BY USER.**

Description:

Model 5C7-461 is a PC compatible temperature controller that accepts type J, K, or S thermocouple inputs or a ± 100 mv input. An RS-485 communications link is provided for direct interface to a PC with a 485 card or via an RS-232 to RS-485 converter. This allows the controller to be configured for different modes of operation from the PC. The RS485 communications interface is used to select or adjust field parameters or data acquisition in half duplex mode. Up to 32 units per interface are addressable over a maximum of 4,000 feet of communications cable. Once the controller is configured, the PC may be disconnected and the controller can be operated as a stand-alone unit. Communications can be re-established at any time to adjust the settings. All parameter settings are retained in non-volatile memory.

The controller package consists of a printed circuit card mounted to a metal mounting bracket that is DIN compatible and may be mounted either horizontally or vertically. The controller can be operated from either 110 VAC or 220 VAC which is field selectable. Input and power outputs are made via .250 and .110 fast tab connections. The sensor inputs and RS485 connections are via a Eurostyle screw terminal strip. A solid state relay output provides current capability up to 15 amperes at either 110 VAC or 220 VAC. In addition, an alarm output solid state relay is provided which is rated for 0.5 ampere at either 110 VAC or 220 VAC plus a 5 volt drive signal rated at 20 ma for an optional LED alarm monitor, solid state relay, or reed relay.

The PC permits the monitoring of actual temperature, set temperature, percent of power applied to the load, and alarm status. It allows selection of the set temperature, turning the power on or off, canceling an alarm condition by silencing the PC audio alarm, tuning the controller setting parameters and displaying the current sensor selection.

Controller tuning parameters consists of proportional bandwidth (P), integral gain in repeats per minute (I), and the derivative rate in minutes (D) for selecting P, PI, PD, or PID operation. An on/off operating mode with an adjustable hysteresis may also be selected. A controller configuration command allows for additional optional settings.

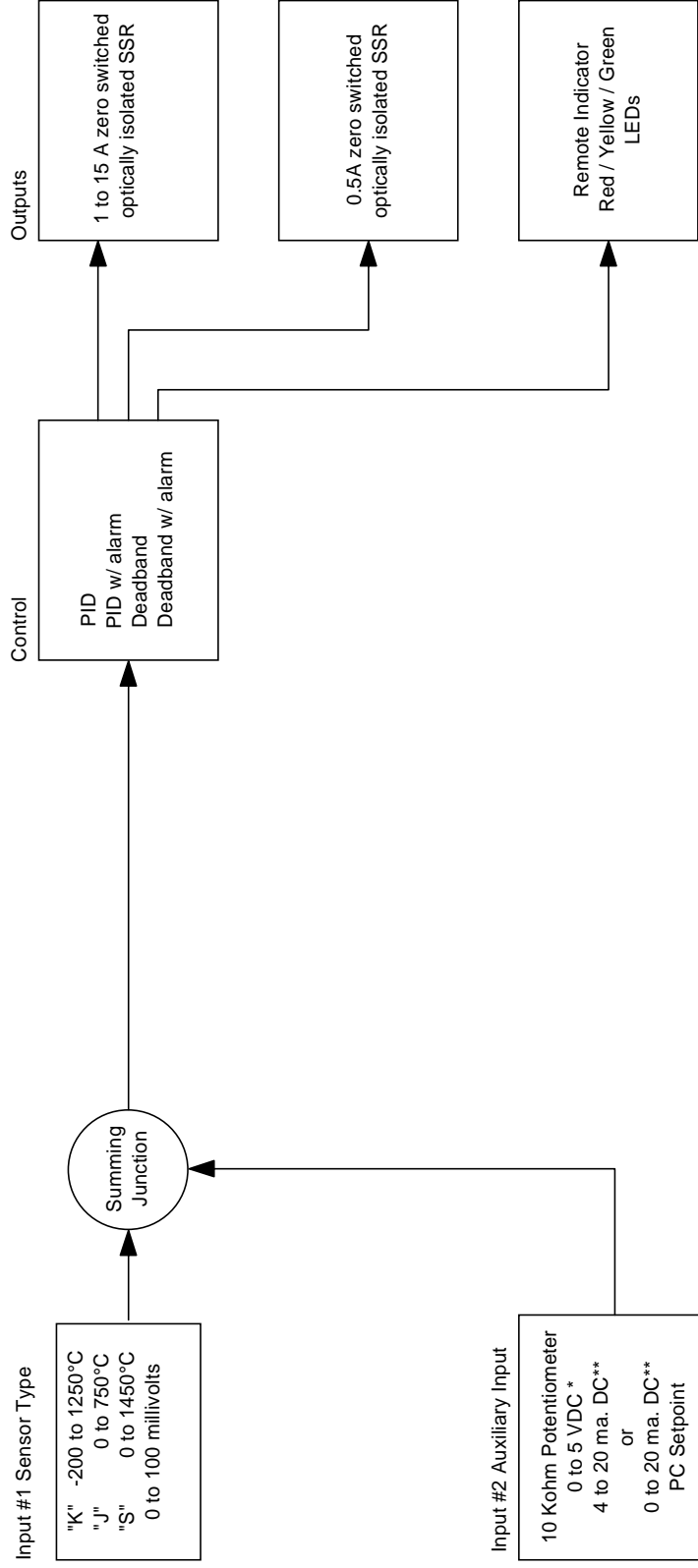
The configuration mode allows the operator to select the applicable type thermocouple or ± 100 millivolt input; type of optional auxiliary input; set control limits for the application; give the controller an identifying name; select either heating or cooling mode; plus select and enable a protective password.

The three thermocouple selections have an operating temperature range of 0°C. to 750°C. for type J, -200°C. to 1250°C. for type K, and 0°C. to 1450°C. for type S.

Alarm selections consist of no alarm function, a fixed high and/or low temperature alarm or tracking alarms. These alarms can be selected for either a latching or non-latching operation. Reset of the alarms is accomplished via PC communications interface or an optional local switch.

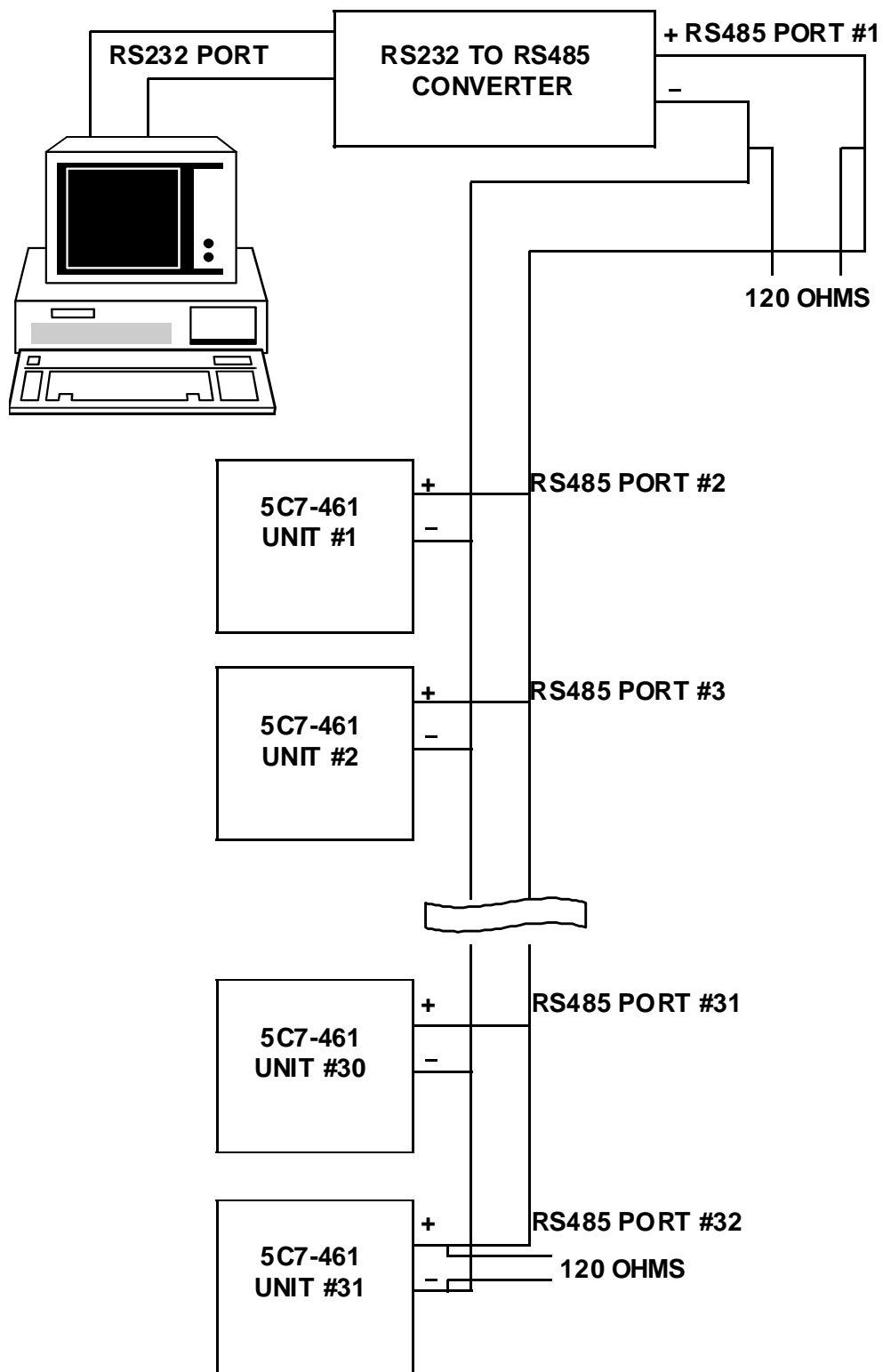
OI 5C7-461 Block Diagram

Revision -



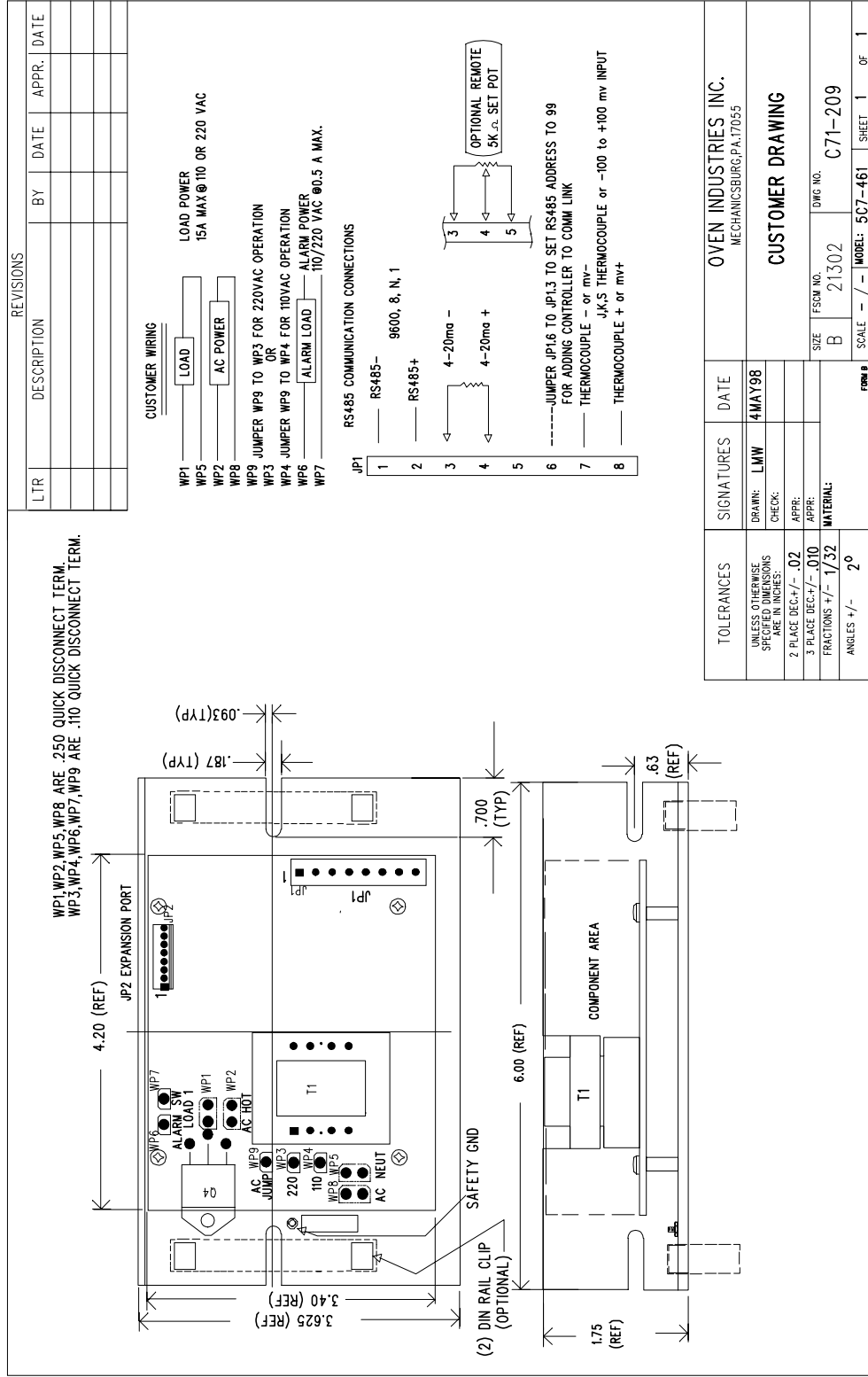
* Controller input impedance 10,000 ohms

** Requires addition of external resistor



MULTIPLE MODEL 5C7-461 CONTROLLER WIRING DIAGRAM FOR PC'S WITH AN RS232 COMMUNICATIONS PORT

SYSTEM BLOCK DIAGRAM

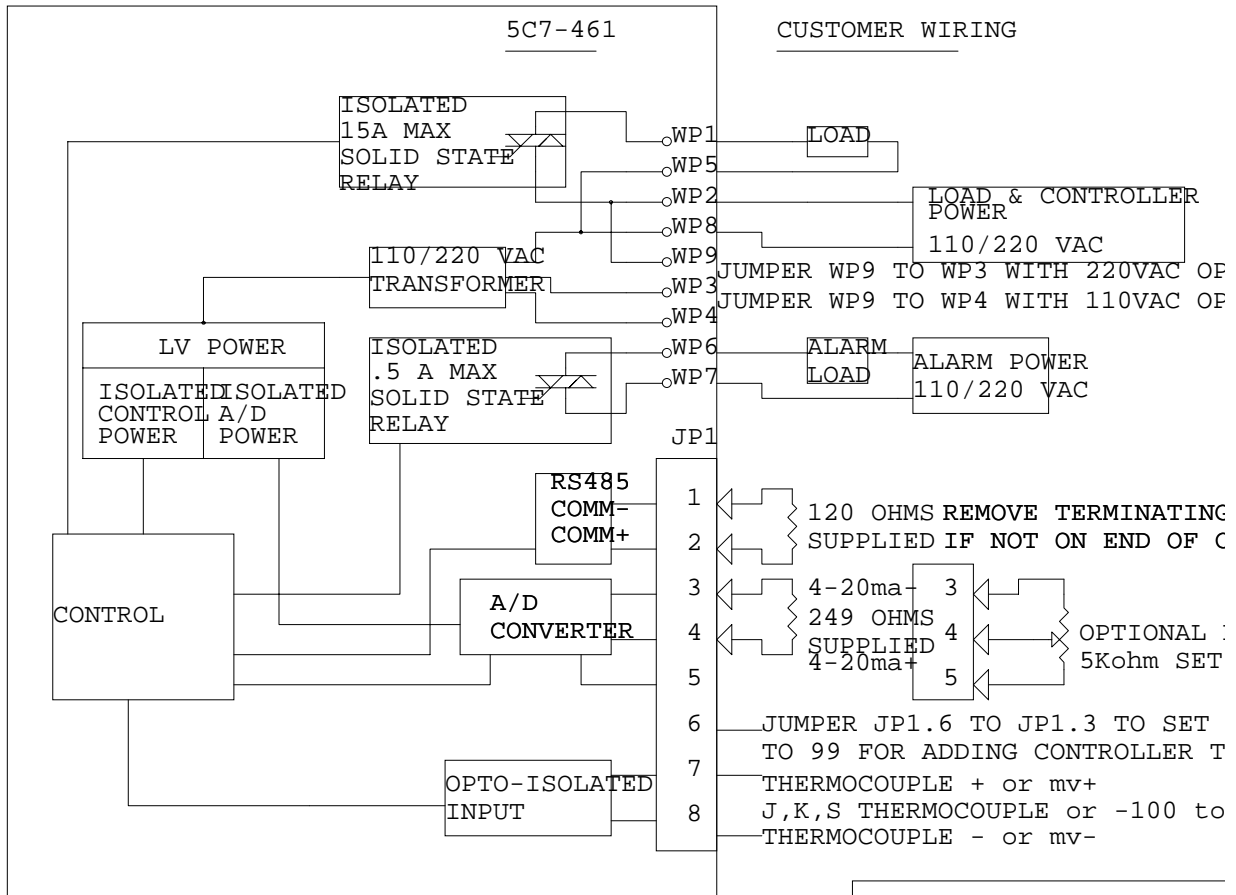


REVISIONS			
LTR	DESCRIPTION	BY	DATE

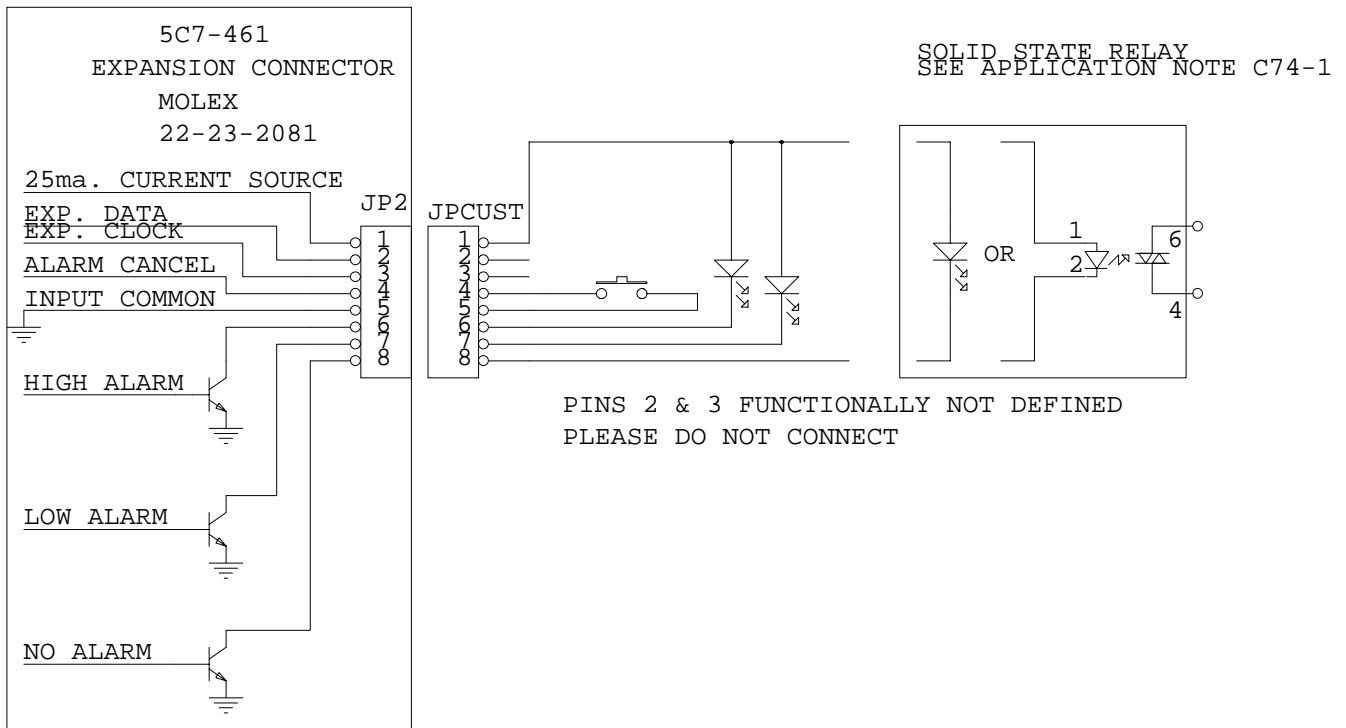
TOLERANCES	SIGNATURES	DATE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES:	DRAWN: LMW	4MAY98
2 PLACE DEC +/- .02	CHECK:	
3 PLACE DEC +/- .010	APPR:	
FRACTIONS +/- 1/32	MATERIAL:	
ANGLES +/- 2 $^{\circ}$	FORM #	

OVEN INDUSTRIES INC. MECHANICSBURG, PA. 17055	
CUSTOMER DRAWING	
SIZE	FSCM NO.
B	21302
SCALE	MODEL: 5C7-461
	DWG NO. C71-209
	SHEET 1 OF 1

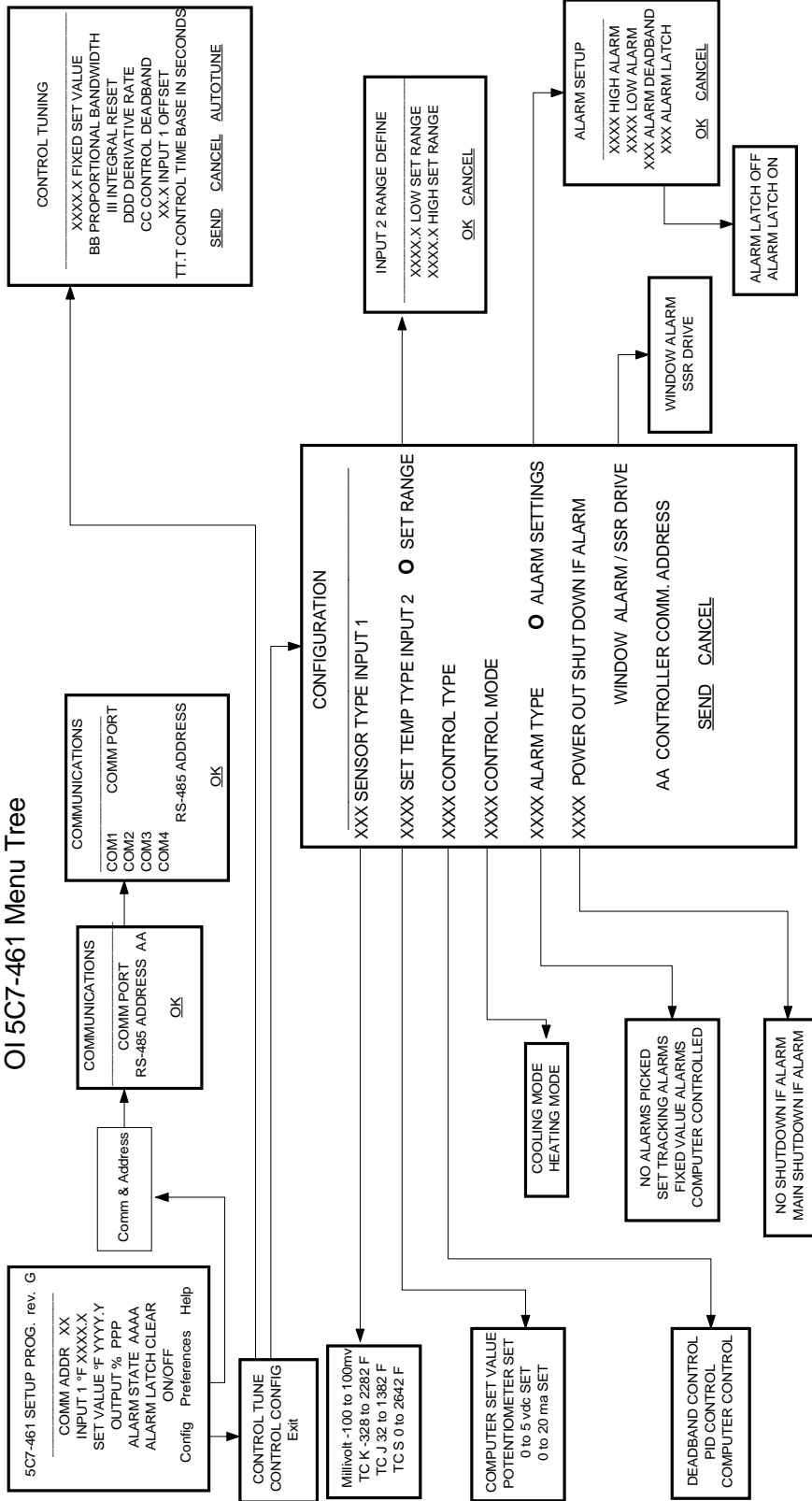
MECHANICAL/SYSTEM WIRING DIAGRAM



CONNECTOR WIRING EXPANSION DIAGRAM



OI 5C7-461 Menu Tree



SET-UP INSTRUCTIONS FOR MODEL 5C7-461, THERMOCOUPLE SENSING, PC PROGRAMMABLE, TEMPERATURE / PROCESS CONTROLLER

1. Connect the appropriate AC power to the controller in accordance with the customer hook-up drawing. Select the correct configuration for either 110 VAC , jumper from WP4 to WP9, or 220 VAC, jumper from WP3 to WP9. Connect the AC power between WP2 and WP8.
2. Connect the RS-485 Communications Port from the controller to the RS-485 input on the PC or to an RS-485 to RS-232 converter. If a converter is used, connect the RS-232 port to an available RS-232 port on the PC. Do Not remove any of the resistors on the JP1 terminal strip.
3. Turn power on to both the PC and controller.
4. Insert the 5C7-461 software disk into the computer A:/ drive. To install the software from the floppy disk, select "START", "RUN" from your Windows Desktop and then enter A:/oi460.exe and OK. This will load the PC interface into your computer's RAM.
5. NOTE: Refer to the OI 5C7-461 Menu Tree
6. The Main Menu screen will appear on your PC monitor.
7. NOTE: If you receive an error message, please refer to Appendix A.
8. Select "preferences" from this menu screen. The "Comm & Address" menu will be shown. Select this option and the "COMMUNICATIONS" menu appears. Select the "COMM PORT" (1 through 4) which will be your communications link to the controller. Assign an RS-485, two digit address code of "00" to the controller for the initial set-up. The "00" code is the universal address which will communicate with all the controllers in a multiple unit system. Refer to Appendix B for additional address code information. Select OK and you will return to the Main Menu.
9. From the Main Menu select "config" which will present the "CONTROL TUNE" and "CONTROL CONFIG" menu. Select "CONTROL CONFIG" from this menu to present the "CONFIGURATION" menu screen. The "CONFIGURATION" menu is used to establish the basic operation criteria for the controller.
10. First, select the type of input sensing element that is to be used with this controller. Clicking of "SENSOR TYPE INPUT 1" and the "down" key will provide the menu for the various acceptable input sensors. Select one of the options that is appropriate for you application.
11. Next, click on the "SET TEMP TYPE INPUT 2" selection and the "down" key to reveal the menu options available. "COMPUTER SET VALUE" is to be set for the desired control set temperature. The other selections, "POTENTIOMETER SET", "0 to 5 vdc SET", and "0 to 20 ma SET", are for external set temperature adjustments. The controller default settings for these options is the full range of the input sensor type selected.
12. Associated with the external set temperature adjustments is the "SET RANGE" option. By clicking on the "SET RANGE", a drop down menu, "INPUT 2 RANGE DEFINE" is presented. This permits the selection of limitations on the temperature range of the external adjustments. Set the lower temperature

limitation by entering that temperature in the “LOW SET RANGE” option and the high temperature limitation in the “HIGH SET RANGE” option. Clicking OK will establish these limits and return you to the “CONFIGURATION” MENU.

13. Now, click “CONTROL TYPE” on the menu and select which type is appropriate for your application. The “DEADBAND CONTROL” is an on/off control and “PID CONTROL” is a proportional/integral/derivative control. The “COMPUTER CONTROL” acts like an electronic variac in that a fixed percentage of power may be applied to the load.
14. Clicking on “CONTROL MODE” will present a drop down menu that permits the selection of either “COOLING MODE” or “HEATING MODE”. In the “COOLING MODE”, power increases as the temperature rises above the set point temperature. In the “HEATING MODE”, power increases as the temperature falls below the set point temperature.
15. The “ALARM TYPE” setting permits the selection of available alarm options with this controller. The drop down menu allows for four selections. “NO ALARM PICKED” indicates that no alarm parameters are desired. “SET TRACKING ALARMS” allows an alarm to be set with respect to the set temperature and will move, accordingly, with a change of the temperature setting. This option can be used for a high alarm, low alarm, or both settings. “FIXED VALUE ALARMS” permits the setting of a fixed, absolute temperature either above or below the set point temperature or both. “COMPUTER CONTROLLED ALARM” is not an actual alarm, but a user activation of the alarm relay via the PC.
16. Associated with the “ALARM TYPE” configuration is the “ALARM SETUP” selection. By clicking on this option, a drop down menu will appear with the “ALARM SETTINGS” menu. This is where the desired temperature settings for the “HIGH ALARM” and “LOW ALARM” values are entered. The “ALARM DEADBAND” option is to set the hysteresis of the alarm values from 0.1°F. to 100°F. The “ALARM LATCH” option permits the selection of an “ALARM LATCH OFF” where the controller will automatically reset if the alarm condition is self-correcting; “ALARM LATCH ON” will maintain that an alarm condition existed and must be manually cleared from the Main Menu. Upon completion of the “ALARM SETUP”, clicking on OK will complete the setup.
17. The “POWER OUT SHUT DOWN IF ALARM” provides a drop down menu that allows the two selections. “NO SHUT DOWN IF ALARM” which will let the power output stage of the controller to continue to function or “MAIN SHUTDOWN IF ALARM” which disables the power output stage under an alarm condition.
18. The “WINDOW ALARM / SSR DRIVE” provides a window alarm for an on-temperature indication somewhere between the high and low alarm settings or may be configured to drive an external solid state relay. Refer to Appendix D for external configuration.
19. Review all of your controller configuration selections. If all the configuration selections are correct for your application, select the SEND button to download these settings to the controller. This will also return you to the Main Menu.
20. In the Main Menu, click on “config” to reveal the “CONTROL TUNE” and “CONTROL CONFIG” menu. Select the “CONTROL TUNE” option which will then display the “CONTROL TUNING” menu.
21. The “CONTROL TUNING” menu provides the method to enter the various constants required by the controller to optimize the system performance .

22. NOTE: Refer to Appendix C for the factory default settings for the following parameters.
23. The “FIXED SET VALUE” is the set temperature value entered in degrees F. This temperature is one within the range of the selected input sensor or the limits of low and high set ranges from the controller configuration setup. The “COMPUTER CONTROL” selection in the “CONTROL TYPE” configuration provides a fixed percentage of power to the load. This power resolution with an entry of 0.0 is equal to 0% power and 24.0 equals 100% power.
24. “PROPORTIONAL BANDWIDTH” is the temperature band in which 0% to 100% power will be applied to the load. The acceptable bandwidth values that may be entered are 1°F. and 100°F.
25. “INTEGRAL RESET” shifts the proportional bandwidth with respect to the set point to compensate for droop. This value is expressed in repeats per minute and the acceptable values that may be entered are .01 to 10 repeats per minute.
26. “DERIVATIVE RATE” senses the rate of rise or fall of the system temperature and adjusts the cycle time of the controller to minimize overshoot or undershoot. This value is expressed in cycle rates per minute and the acceptable values that may be entered are .01 to 10 cycles per minute.
27. “CONTROL DEADBAND” is the temperature band where the controller is turned on and off by either rising or falling temperatures where no heating or cooling takes place. This band is expressed in °F. and the acceptable values that may be entered are 0.1°F. to 100°F.
28. “INPUT 1 OFFSET” is a manual method of compensating for droop.
29. “CONTROL TIME BASE IN SECONDS” is the period in which the controller completes one full cycle. This value is normally expressed in seconds and the acceptable values that may be entered are 0.1 to 1.0 seconds.
30. “AUTOTUNE” is the ability of the controller to sample the operating system which selects the proportional, integral, and derivative constants for one set of conditions and downloads these values to the selected controller. If the system conditions change, the “AUTOTUNE” function must be repeated.
31. Review the tuning parameters for correctness and then select SEND to download these constants to the controller. This will also return you to the Main Menu.
32. Initial set-up of your Model 5C7-461 controller is complete.

APPENDIX A

Troubleshooting Communications Port and RS-485 Address:

For troubleshooting always set the RS-485 port to 00, until correct communication is established.

Error Message:	Cause:	Solution:
Comm Port Timeout	No power to 5C7-461 unit	Apply power to 5C7-461, review Customer Drawing for proper hookup.
Comm Port Timeout	RS-485 Address is wrong	Set to 00 the universal address.
Comm Port Timeout	Wrong Comm Port Selected	Check Computer hardware setting and set to the correct Comm Port.
Comm Port Timeout	Comm Port is not connected to converter or computer.	Check for correct connection of the converter to the computer, review Converter Specifications & Computer for proper hookup.
Comm Port Timeout	Incorrect wiring of Comm Port to the converter or computer.	Check for correct wiring of the converter to the computer, review Converter Specifications & Computer for proper hookup.
Comm Port Timeout	Converter is not connected to 5C7-461	Check for correct connection of the converter to 5C7-461, review Converter Specifications & 5C7-461 Customer Drawing for proper hookup.
Comm Port Timeout	Incorrect wiring of the converter to 5C7-461.	Check for correct wiring of the converter to 5C7-461, review Converter Specifications & 5C7-461 Customer Drawing for proper hookup.
Comm Port Open Error	No Comm Port available at this port setting.	Check Computer hardware setting and set to the correct Comm Port.

Appendix B

RS-485 Communications Port Addresses for Model 5C7-461

The “00” Communications Port Address code is the universal address to which all controllers will respond.

Placing a jumper between pins JP1-6 and JP1-3 on the host controller will initiate a “99” Communications Port Address code, when the controller is powered. This code is used to set-up a newly added controller to the serial link. This jumper should be removed upon completion of this set-up.

Additional Communications Port Address codes from “01” to “98” are used to identify individual controllers of the serial link. The total number controllers that make up the serial link is 32 ports.

Model 5C7-461 Menu Tree

The screenshot shows the 'SERVO' menu of the Model 5C7-461 setup program. The interface includes various control parameters and their factory default values, which are highlighted in red in the original image. Callouts provide detailed descriptions for these values.

- TEMP:** 100.0 (MILIVOLT -100 TO 100mv, TCK -328 TO 2282°F, TCJ 32 TO 1382°F, TCS 0 TO 2642°F)
- SET TEMP:** 100.0 (COMPUTER SET VALUE POTENTIOMETER SET 0 TO 5vdc SET 0 to 20ma SET DIFF. SET=INPUT2+FIXED SET)
- OUTPUT:** 0.0 (DEADBAND CONTROL PID CONTROL COMPUTER CONTROL)
- ALARM LATCH OFF:** 0.0 (HEATING MODE COOLING MODE)
- NO SHUTDOWN IF ALARM:** 0.0 (NO ALARM PICKED SER TRACKING ALARMS FIXED VALUE ALARMS COMPUTER CONTROLLER)
- WINDOW ALARM:** 0.0 (NO SHUTDOWN IF ALARM MAIN SHUTDOWN IF ALARM)
- SSR DRIVE:** 0.0 (ALARM LATCH OFF ALARMLATCH ON)
- COM 1:** 0.0 (COM 1, COM 2, COM 3, COM 4)
- OUTPUT POWER %:** 0.0 (WINDOW ALARM SSR DRIVE)

NOTE: THE FACTORY DEFAULT VALUES ARE SHOWN ON THE SCREEN IN RED.

5C7-461 Expansion Connector Application

Using the Expansion Connector as a High Alarm, Low Alarm, and No Alarm Indicator (Diagram #1):

Using the Window Alarm Menu selection provides LED indicators for High Alarm temp, Low Alarm temp and No Alarm (On Temp). JP2 pin 8 may be selected to show a No Alarm condition. The No Alarm LED is on when neither a High nor Low Alarm condition exists. The total current to the Expansion Connector is 25 ma. The selection of series resistors should limit the current through each LED to less than 25ma. Diagram #1 limits the current to 10 ma through the LEDs at 10ma @ 6 volts.

The No Alarm becomes a visual indicator that the unit is within the configured alarm limits.

Using the Expansion Connector as a High Alarm, Low Alarm, with SSR Output (Diagram #2):

Using the SSR Drive Menu selection provides an LED indicator for High Alarm temp, Low Alarm temp and SSR Drive output. JP2 pin 8 may be selected to drive a SSR in synchronization with the load circuit control. The total current to the Expansion Connector is 25 ma. If a High and/or Low Alarm LED is used in this form, the current draw must be limited to provide a suitable current for the SSR. The High and Low Alarm LEDs should be limited to 10ma. @ 6 volts to insure 15 ma. drive to the SSR. Series resistors in the LED circuits will insure the desired current sharing.

The SSR drive can be used to drive higher wattage loads than available from the provided load output.

Using the Expansion Connector as a High Alarm, Low Alarm, and Load On Indicator:

Using Diagram #1 and the SSR Drive configuration from the Menu selection, the No Alarm LED becomes an isolated low voltage indicator of the load output. The No Alarm LED is in synchronization with the load circuit control, but is a separate low voltage indicator of the load output.

