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EXAMPLE OF SETTING UP A DATA LOGGING FILE

To use data logging to view the process variable (PV) during the tuning process, proceed as described below. (Refer to the DATA LOG MENU MAP in Section 12.)

1) From the principal menu press MENU-6-9 to step through to SETUP.
2) The process to be controlled is a typical heating application. Estimate a time between data samples that would yield a usable set of data. For this example, set INTERVAL to 003:00 minutes.
3) Since the default file will log 600 data points, we need not change the allocation of 600 samples for file #1. A sample every 3 minutes will permit a data record of up to 30 hours so enabling AUTOSTOP is not needed. By not enabling AUTOSTOP, the file will be overwritten after the initial 30 hour record so that a continuous record of the last thirty hours of operation is always available.
4) In this application, log the process variable. In the INPUTS sub-menu, select FILE1 IN and pick INPUT 1.
5) For this application, let the controller set the scale based on the range of data recorded. Therefore select "NO" under GR SCALE/MANUAL? to enable auto scaling.
6) It is good practice to start off with a clean record file. Therefore, select CLEAR to erase all data that may be remaining in the file from a previous application.

The data logger has now been setup and is ready to go. Select file #1 in menu item 65 to enable a review of file #1 once data has been recorded. Enable the data logger using the START command. STOP disables the data logger and prevents recorded data from being overwritten. Use the MARK BEG and MARK END to evaluate data using the STATISTICS sub-menu during controller operation or view and analyze the data in GRAPH.

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SECTION 10 - OPERATN

The OPERATN menu provides selections for accessing functions relating to the controller's operation. Many of these menu selections duplicate operating key functions that are available directly using the front keypad. These functions are also provided here in order to facilitate their inclusion in macros.

71 START L1 This item will START Loop 1 when selected.

72 START L2 This menu item will START Loop 2 when selected.

73 STOP L1 This menu item will STOP Loop 1 when selected.

74 STOP L2 This menu item will STOP Loop 2 when selected.

75 PAUSE This menu item will PAUSE both Loop 1 and Loop 2 if a profile is running in either or both loops. No action will occur in loops which are not running a profile.

76 RESUME This menu item will cause a profile running in either Loop 1 or Loop 2 that has been previously PAUSED to RESUME when selected. If no profile is running, selecting this parameter has no effect.

77 S/S CFG This menu item permits configuration of the way the front panel **START/STOP** key works for two loop controllers. Selecting **CURR LP** (CURRENT LOOP) restricts the **START/STOP** key to operate only the current loop. If the second loop is to be affected, then a press of the **"7"** (LOOP) key while at the Principal Display will allow use of the **START/STOP** key in the other loop.

Selecting **BOTH LPs** (BOTH LOOPS) enables the **START/STOP** key to affect both loops simultaneously.

For single loop controllers, this menu item has no effect. This selection is ignored when the controller is started or stopped through the OPERATN menu commands.

78 REM SP This menu item enables or disables the remote setpoint feature. DISABLE turns OFF the remote setpoint selection previously made. Selections of L1 RSP, L2 RSP and L1&2 RSP enable the remote setpoint for Loop 1, Loop 2 or Loop 1 and Loop 2 respectively. When enabled, remote setpoint preempts the front panel setpoint, a setpoint generated by a MATH routine or a profile setpoint.

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79 COMM The selections in this sub-menu allow operating parameters for the serial communication option to be entered. If a serial communications option card has not been installed, these parameters are ignored.

791 UNIT Enter the unit number from 0 to 63. Both the EIA-232 (RS-232) and RS-422/485 communications option cards require the use of the unit number in the communications protocol. Remember that no two units on the same communications link can have the same unit number. The default unit number is unit #1.

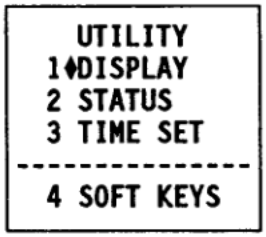
792 BAUD Select the baud rate to be used in serial communications. The list includes baud rates of 9600, 4800, 2400 and 1200 baud. The default baud rate is 9600 baud.

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SECTION 11 - UTILITY

Utility menu items provide a means to change some display characteristics, review the controller status, set the internal calendar/clock and write macros. (Refer to the UTILITY MENU MAP in Section 13.)

8 UTILITY From the Main Menu, select Item 8 "UTILITY".



81 DISPLAY Used to customize some of the parameters relating to the display.

813 DP - LP1 The decimal point position applies to both the process variable (PV1) and setpoint (SP1) in Loop 1. The decimal point location will only be saved on power down for loops with process inputs. The decimal point position is a display function only and does not change any data value previously entered. The decimal position affects all data entry displays such as proportional band where PV units are used. The decimal position is counted from the right and can be from 0 to 4 places.

814 DP - LP2 The decimal point position applies to both the process variable (PV2) and setpoint (SP2) in Loop 2. The decimal point location will only be saved on power down for loops with process inputs. The decimal point position is a display function only and does not change any data value previously entered. The decimal position affects all data entry displays such as proportional band where PV units are used. The decimal position is counted from the right and can be from 0 to 4 places.

82 STATUS Accesses the controller status screens.

821 ALARM Displays the number of any MONITOR (including ALARMS) that is tripped.

823 OUTPUT Displays the output percentage from 0 to 100.0% for each of the outputs (1 to 4).

824 PROFILE Displays the process variable (PV), target setpoint and profile number and step when profile control is active. For two loop controllers, the **"7"** key may be used to switch the display between the two loops.

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825 LOGIC IO This status display provides information on the 16 optional I/O channels. The bank "A" or "B" designation is assigned in the CONFIGURATION menu (972 or 973). The diamond symbol (◊) represents a logic input. The symbol changes to a filled diamond (♦) when the channel is active (TRUE). The round symbol (○) represents a logic output (the symbol looks like an "O"). The symbol changes to a filled circle (●) when the channel is active (TRUE).

The right arrow symbol (→) selects bank "A" or bank "B" and is switched by either the UP or DOWN ARROW keys. Pressing any of the number keys from 1 through 8 toggles that numbered channel in the selected bank. If the input channel is assigned to a logic card or if the output channel is driven by a monitor, toggling the channel will cause the channel indication to be overwritten with the current status and may not indicate the toggle state. If the I/O option card is not installed or if the I/O position has been de-selected (see 97 in Section 12), the bank may be used as switches for use in any place that a flag may be used such as in profiles or monitors. De-selecting a bank will also allow use of the status screen to manually simulate the logic I/O channel operation for checking the controller operation.

83 TIME SET Sets the internal calendar and clock. If the clock saver option (RTC) has been installed, then the controller calendar and clock will continue to run even though the unit has been powered down. If the RTC has not been installed, the clock stops on power down and restarts where it stopped on power up. If functions that use the clock such as the timer, printer, data logging or history functions must indicate the correct time, then the calendar and clock must be reset on power up for controllers without the RTC option. The presence of the RTC option is displayed in the third sign-on display.

831 HRS:MIN Enter the time in hours and minutes (left to right) based on a 24-hour clock. Set the time to some close future time since the START command is used to reset the clock after all of the values have been entered.

832 DATE Enter the day of the month from 1 to 31.

833 MONTH Enter the number corresponding to the month from 1 to 12.

834 YEAR Enter the 4-digit year.

835 START After all of the calendar and clock values have been keyed in, select START to reset the controller clock to the new values.

836 SHOW CLK Show clock displays the present calendar and clock information. The first line shows the month and year while the second line shows the "day-of-the-month/hours-minutes:seconds" based on a 24-hour clock.

837 SET BRTC This command is used to update the backup real-time clock/calendar option to the currently stored date and time. It has no affect for controllers which do not have the clock/calendar option.

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84 MACROS Macros allow a preprogrammed set of keystrokes to be invoked through a single keystroke, by a logic input or by a flag. Six keys (1, 2, 3, 4, 5 and 8) are available for assignment as macro keys. Flags 128 through 135, I/O channel flags 16 through 31 and logic input flags 32 through 34 may also be used to trigger a macro.

Keypad macros are usable only while at the Principal Display. To utilize a pre-recorded macro key, press the desired number key and the preprogrammed sequence of keystrokes will execute. If there is no macro recorded for the key pressed or if the macro has been locked, the key press is ignored.

Flag macros will only execute while the controller is at the Principle Display. If a macro flag is tripped while another top level display such as one of the status displays is being viewed, the controller automatically scrolls to the operator display for the running of the macro. If the user wishes the unit to return to a top level display other than the main operator display after completion of the macro, the key strokes needed to reach the desired display must be included at the end of the programmed macro.

Flag macros will not execute while the user is in the menu structure or while another macro is executing. Macros that have been tripped go into a queue and will be run after the user returns to the Principal Display and/or after the currently running macro has been completed.

Macros assigned to flags 128 through 135 are activated when the individual flag is set in either MONITORS or PROFILES. Macros may also be tripped from logic I/O channels (Flags 16 through 31) or logic input channels 1, 2 or 3 (Flags 32 through 34).

If no logic I/O option board is installed, macros tied to either bank's logic I/O channels may be toggled through the UTILITY/STATUS/LOGIC IO display (825). Toggling from its inactive to active state (the indicator changes from ○ to ● for an output or from ◊ to ♦ for an input) and returning to the Principal Display will allow a macro assigned to that Logic I/O channel to initiate. The flag must be toggled from OFF to ON and must be ON when the user leaves the LOGIC (825) display for the macro to run.

If a Logic I/O option board is installed, the I/O status display will indicate the state of the assigned logic inputs but cannot be toggled as described for controllers with no logic I/O option board installed. Attempting to toggle an I/O line will cause the display to flicker but the indicated state will not change. The flicker, however, is recognized as a tripping of the flag and the macro will run when the user returns to the Principal Display. Normally, an optional I/O channel is tripped by an external logic level signal change which will also initiate the assigned macro.

A single Logic I/O channel may be used to run two macros (to start and stop the controller for example) by using two of the user assignable macro flags (128 through 135) to trip off two separate MONITORS. The two macro flags will be set by two different triggers defined in MONITORS. One trigger will be defined to set a macro flag when the Logic I/O flag is active (= 1) and the second trigger will be defined to set another macro flag when the same Logic I/O flag is inactive (= 0). In this way, a single logic input can be used to start and stop the controller.

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Macros bypass keypad security. When recording a macro, keep in mind that macros should be set up only for functions that *any operator* is authorized to use. Do not end a macro within the menu system unless the purpose of the macro is to provide quick access to a particular display.

When a macro is run, the (9) key (LAST ENTRY) is automatically reset to display the USER ID screen. This is done to ensure that the operator cannot access an unauthorized path within the menu system since the "9" key ordinarily allows access to the last menu displayed which may not be privileged to the operator.

NOTE: Although using the ARROW keys while recording macros is valid, there is a potential for error. DO NOT use the ARROW keys to change a numeric value inside a macro since the base or starting number may be different at execution time than at recording time. For creating numeric values inside a macro, the user is advised to use direct digital entry.

CAUTION: Keys selected while recording a macro are ACTIVE and may alter preselected values or settings. After recording a macro, review the values and/or settings in those menu items that were accessed during macro recording.

841 MACRO # The macro number menu allows the user to select a front panel number key (1, 2, 3, 4, 5 or 8), macro flags #128 through #135, I/O channels A 1 through I/O A 8, I/O channels B 1 through I/O B 8 or LOGC IN1 through LOGC IN3 for use as a macro trigger. The macro assignment to that key, flag or logic channel may then be recorded, played back in slow motion or locked.

842 RECORD To program a new macro or overwrite an existing macro for the selected key, logic input or flag. Selecting RECORD changes the display to the Principal Display. REC is displayed in the message block. Subsequent keystrokes are recorded as the macro. At the Principal Display, keys 1 through 9 cannot be recorded and an error message will display. The keystrokes will not be recorded. Press any key to clear the message. Also note that the A/M key may be used in the creation of a macro (RECORD sub-menu) but can never be recorded in a step. Any of the number keys may be recorded when not at the Principal Display. A single macro may not have more than 250 keystrokes. If RECORD is selected while already in the process of recording a macro, the recording is restarted and the previous keystrokes are lost.

During the macro definition, pressing the **A/M** key will display the following RECORD sub-menu.

8421 END MAC Used to end the recording of a macro definition.

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8422 WAIT VAL This command allows a pause to be inserted in the macro. WAIT VAL may only be selected when in a numeric entry, switch entry or list entry display. The keystrokes used after selecting WAIT VAL are not recorded until the keystroke used to leave the data entry screen is pressed. When a WAIT VAL is encountered during the execution of a macro, the macro execution is suspended while the user enters a new value or selection. When the user exits the data entry display using any valid keystroke that will exit a display, the macro execution is resumed.

8423 IGNORE Used to return to the macro definition without entering additional keystrokes.

There are a number of error messages that may be displayed while recording a macro. If such a message does occur, note the message and press any key to clear the message.

EXAMPLE OF WRITING A MACRO - The following is an example of assigning key 5 as a macro so that a new PID set can be selected when the "5" key is pressed.

Starting from the Principal Display,
Press the MENU key to access the menu system,
Press "8-4-1" in sequence to reach the MACRO # display,
Scroll to "KEY 5", press "ENTER" and "ENTER" again to select KEY 5,
Press S/S followed by the Down Arrow (next list item) key to turn on the record function,

The Principal Display appears with REC in lower right corner,
Press "0-2-3-1" in sequence to access the display for PID set number entry,
Press the A/M key to access the RECORD sub-menu screen,
Press "2" to select WAIT VAL so that the user may select the required PID set,
Press "0-4" in sequence to enter the copy display,
Press "1", "ENTER" and "ENTER" again to copy the selected PID set to LOOP 1,
Press S/S followed by MENU to return to the Principal Display,
Press the A/M key to access the RECORD sub-menu,
Press "1" to end the macro,
The Principal Display will show and the MACRO definition is completed.

From the Principal Display, when the "5" key is pressed, the PID set display is immediately shown allowing the new set number to be entered. Pressing MENU causes the macro to resume, changing the PID set and returning to the Principal Display.

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843 SLO PLAY Used to execute, in slow motion, the macro selected by MACRO #. Each display in the macro is displayed briefly and a user key press is required at any WAIT VAL data entry display. If no macro is recorded for the macro number selected, an error message informs the user and pressing any key will clear the error message.

844 LOCKMAC? Used to lock or unlock the selected macro. A locked macro remains in memory but does not execute. If no macro is recorded for the selected key or flag, an error message informs the user and pressing any key will clear the error message.

86 PRINTER This sub-menu item includes setup parameters for the parallel printer option if installed and allows a selection for transmitting data generated within the controller to the printer. A printer output may also be initiated by using a monitor which sets an appropriate flag (see Section 7).

861 PRINTTST If a parallel printer option card is installed in the controller and connected to an external printer, selecting this menu item causes the controller to output a continuous string of test characters to the printer for use in testing the printer operation. The printer test output is discontinued by pressing any key on the controller keyboard.

862 TEXT LEN This selection allows you to select the number of lines to be printed on the printer page before a form feed. If set to zero, no form feed is transmitted and the controller assumes a continuous paper roll. The default selection is "0".

863 USE LF? Some printers require a line feed character to be sent after a carriage return in order to advance the paper to the next line. Answer YES if your printer requires a line feed character or NO if the line feed is not required. Refer to your printer manual for information on your printer specifications.

864 PRN DLOG If you respond YES at this menu item, the DATA LOGGING file will be sent to the printer after you have exited the menu item. If more than one file has been allocated in DATA LOGGING, all files will be printed. The default selection is NO.

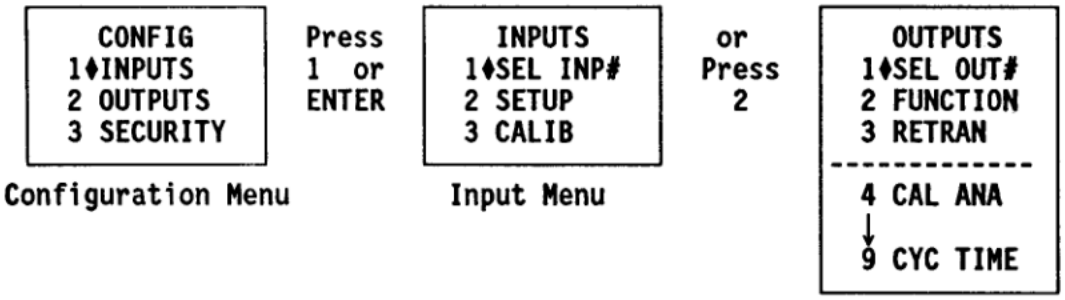
865 PRN STAT If you respond YES at this menu item, the statistics generated between MARK BEG and MARK END in menu STATISTICS (68) will be sent to the printer after you have exited the menu item. The default selection is NO.

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SECTION 12
CONFIGURATION PROGRAMMING

Configuration programming matches the controller to the application, i.e., select inputs and outputs, establish the security parameters and provide controller calibration. A controller configured prior to delivery may not need configuration. However, it may be desirable to review the selections. (Refer to the CONFIGURATION MENU MAP in Section 13.)

9 CONFIG From the Main Menu select Item 9 "CONFIG".



INPUT CONFIGURATION

91 INPUTS A large selection of thermocouple, RTD and current/voltage input programs are stored in the controller and may be selected from the Input configuration menus. There are three possible inputs (INPUT 1, INPUT 2 and INPUT 3). The selected input program must agree with the input hardware configuration (see Section 1 - INPUT HARDWARE CONFIGURATION). Each input may be a different type. If the controller has been preconfigured, these selections have already been performed and access to these displays will only be needed to change the selections. Each of the INPUTS is configured using the following displays.

Input configuration check list:

1. Select the input by number (911), i.e, 1, 2 or 3.
2. In SETUP (912): Select the type of input (9122)
   Select the proper calibration curve (9123)
   Select input averaging (9124)
   Select unit C or F (9125)
   Define CJC (9126 - 9127)
   Define RTD if used (9128 - 9129)
3. Input calibration (913) should not be necessary.
4. Check configuration of jumper on the input board (see Section 1).

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911 SEL INP# Select the input number to define or change from 1 to 3. Selecting this number will load the previously stored data for the selected input into each of the data displays for review or change.

912 SETUP To configure the input to match the application, use the following menu items.

9122 TYPE Used to select the input type from a list (T/C, RTD, CURRENT and VOLTAGE). The thermistor sensor is a special case and uses the slidewire selection on input 3. (Note that the thermistor input also requires a hardware kit which is not detailed in this manual.)

9123 CURVE Used to select the input linearization. Any of the thermocouple, RTD or thermistor linearizations may also be used with a non-linearized analog transmitter input. The thermocouple selection may be changed from one type to another on a unit calibrated for thermocouple input or an RTD selection may be changed on a unit calibrated for RTD input without needing to recalibrate the controller.

CURVE ID	CURVE DESCRIPTION	SPAN LIMITS	
TYPE J	I/C - Thermocouple	-350/+2100° F	-212/+1148° C
TYPE K	C/A - Thermocouple	-350/+2500° F	-212/+1371° C
TYPE T	Cu/C - Thermocouple	-400/+750° F	-240/+398° C
TYPE E	Cr/C - Thermocouple	-350/++1800° F	-212/+982° C
TYPE R	Pt/Pt13%Rh - Thermocouple	-50/+3200° F	-45/+1760° C
TYPE S	Pt/Pt10%Rh - Thermocouple	-50/+3200° F	-45/+1760° C
TYPE B	Pt6%Rh/Pt30%Rh - Thermocouple	+70/+3300° F	+21/+1815° C
TYPE N	NiCrSi/NiSiMn - Thermocouple	-200/+2300° F	-128/+1260° C
PLAT II	Platinel II - Thermocouple	-100/+2500° F	-73/+1371° C
W5/W26Re	W5%Re/W26%Re - Thermocouple	+32/+4200° F	0/+2315° C
W3/W25Re	W3%Re/W25%Re - Thermocouple	+32/+4300° F	0/+2315° C
W/W26Re	W/W26%Re - Thermocouple	+32/+4200° F	0/+2315° C
Ni/N18Mo	Ni/Ni18%Mo - Thermocouple	0/+2390° F	-15/+1310° C
98./3920	98.129Ω Pt @ 0° C - 3920 ppm RTD	-225/+1110° F	-142/+598° C
100/3850	100Ω Pt @ 0° C - 3850 ppm RTD	-225/+1560° F	-142/+848° C
100/3890	100Ω Pt @ 0° C - 3890 ppm RTD	-225/+1160° F	-142/+626° C
100/3911	100Ω Pt @ 0° C - 3911 ppm RTD	-225/+1160° F	-142/+626° C
100/3926	100Ω Pt @ 0° C - 3926 ppm RTD	-142/+1160° F	-142/+626° C
100/4270	100Ω Cu @ 0° C - 4270 ppm RTD	-148/+500° F	-100/+260° C
100/6180	100Ω Ni @ 0° C - 6180 ppm RTD	-75/+350° F	-59/+176° C
120/6720	120Ω Ni @ 0° C - 6720 ppm RTD	-110/+500° F	-78/+260° C
150/6704	150Ω Ni @ 25° C - 6704 ppm RTD	-58/+560° F	-50/+293° C
200/3850	200Ω Pt @ 0° C - 3850 ppm RTD	-300/+660° F	-184/+348° C
200/3900	200Ω Pt @ 0° C - 3900 ppm RTD	-32/+608° F	0/+320° C
200/3926	200Ω Pt @ 0° C - 3926 ppm RTD	-300/+660° F	-184/+348° C
OHMS	Ohmmeter Range	45 to 460Ω	
PROCESS0	Zero Based Process Input		
PROCESS4	Live Zero Process Input (20% od span)		
Thm 2252	2252Ω Thermistor (spcl hardware req'd)	-58/+300° F	-50/+150° C

Other input ranges and types may be supplied on special order from the factory.

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9124 INPUT AVG Most applications require some input signal averaging to prevent random noise and other transients from affecting the controller. Select from 1 to 64 samples to be averaged to alter the response to input changes. The default value is 5 samples.

9125 TO DEGREE C? Select YES to display in degrees C. Select NO to display in degrees F for all Thermocouple, RTD and Thermistor inputs.

> CAUTION
>
> Responding YES to this menu item does not automatically convert any parameter value previously entered in PV units such as proportional band, auxiliary setpoint, etc. All such items must be reentered in the converted values in their respective entry displays.

9126 EXT CJC? Select YES to allow the input to ignore the built-in internal thermocouple cold junction reference for thermocouple inputs. When the internal cold junction compensation is disabled, enter the external cold junction reference value in the next menu item.

9127 EXT CJC= When the internal cold junction compensation is turned off ("YES" in the above menu item), thermocouple inputs require another value to be used in the calculations. This value may be the reference value for an external thermocouple reference. Enter the value in millivolts referenced to ice.

9128 RTD 0.1? Select YES for 0.1° resolution RTD inputs. Select NO for 1° normal resolution. For 0.1° RTD, any parameters entered in PV units such as the proportioning band, setpoint, etc. must be reentered in the proper units in their respective entry displays.

9129 RTD LEAD The controller will compensate for 3-wire sensor lead resistance to indicate within its rated accuracy. For applications with high resistance leads, the accuracy will be improved if the lead resistance is entered at this display.

Enter the resistance in ohms measured between the ground lead (terminal 18) and the negative lead (terminal 16 or 19). (The leads must be disconnected from the controller when the measurement is made.) Lead resistance up to 5 ohms produces an error less than 0.1% of span when 0 (the default) is entered.

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913 CALIBRATE Used to recalibrate the controller. This procedure is rarely required and should only be performed by persons having the proper equipment. Field recalibration will replace the factory calibration. Do not recalibrate the controller unless a test of the instrument's indication shows that it must be recalibrated or a change in the input configuration is required.

9131 CALIB ZERO This display is used to calibrate each input to its low calibration reference.

For thermocouple and voltage inputs, the message "CALIB ZERO - APPLY 0.000mV" appears. For current inputs, the message CALIB - ZERO - APPLY 0.000mA" appears. For any of these inputs, shorting the input terminals will produce a suitable signal.

For RTD inputs, the message "CALIB ZERO - APPLY 249 Ohms" appears. Using copper wire, connect a precision decade box to the appropriate terminals in the 3-wire RTD configuration (refer to INPUT WIRING in Section 1). For RTD inputs, set the decade box for 249Ω±0.01Ω.

With the proper input signal applied, wait two minutes at this display, then press the A/M key to remeasure the input and replace the previous calibration data. Pressing any other key will leave the previous calibration data intact and the display will revert to the CALIBRATE menu.

9132 CALIB SPAN When INPUT 1 and 2 are configured as thermocouple or voltage inputs, the message "CALIB SPAN - APPLY 100.00mV" appears. For current inputs the message "CALIB SPAN - APPLY 20.000mA" appears. When INPUT 3 is configured for voltage, the message "CALIB SPAN - APPLY HI SIGNAL" appears.

For thermocouple inputs, apply 100 mVDC from a precision calibration source. For voltage and current inputs, apply the appropriate input signal from a precision calibration source. This may be 100mV, 500mV, 5V or 20mA as selected by the input configuration jumpers (refer to JUMPER BLOCK CONFIGURATION in Section 1). In some cases, other values may be used for special applications. Consult the factory.

For RTD inputs, the message "CALIB SPAN - APPLY 450 Ohms" appears. For RTD inputs, set the decade box for 450Ω±0.01Ω.

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With the proper input signal applied, wait two minutes at this display and then press the A/M key to remeasure the input and replace the previous calibration data. Pressing any other key will leave the previous calibration data intact and return to the CALIBRATE menu.

9133 CALIB CJC Calibrate CJC provides for calibration of the cold junction compensator used with thermocouple inputs. This step is not required for RTD, current, voltage or thermistor inputs. Connect a Type J thermocouple with the tip in stirred ice water to the input terminals. Press the A/M key to direct the controller to measure and store the input. Pressing any other key will direct the controller to ignore the command. After measuring the input, the previous menu is displayed.

9134 LOW DISP Used to scale the display for an analog input. The value entered here will be the displayed value in PV units at the LOW INPUT value (9136). The default value is zero. This menu item must be zero for thermocouple, RTD and thermistor inputs.

9135 HI DISP Used to scale the display for an analog input. The value entered here will be the displayed value in PV units at the HI INPUT value (9137). The maximum value that can be displayed is 20,000 counts. For thermocouple, RTD and thermistor inputs, this menu item should normally be zero.

9136 LOW INPT Used in scaling the display to enter the analog input value in normalized units that corresponds to the LOW DISP value (9134). When the controller is calibrated, values are stored that correspond to 0 and full input. These two calibration points set constants at 0 and +31,565 internal counts. The plus counts are mirrored at -31,565 counts to provide a full bipolar input. Thus, the LOW INPT value is entered in normalized units of the calibration range of -31,656 to 31,565 counts. For example, if the input range is 0 to 20 mA and the low display value is to begin at 4 mA, then the LOW INPT value should be (4/20 × 31,565) or you should enter 6313. For a 0 to 10V input calibration, if LOW DISP is to be at 1V, then LOW INPT should be (1/10 × 31,565) or 3156. The default value for LOW INPT is zero. This menu item should be zero for thermocouple, RTD and thermistor inputs which disables this function.

9137 HI INPT Used in scaling the display to enter the analog input value in normalized units that corresponds to the HI DISP value (9135). Like the LOW INPT, it is entered in normalized units of the calibration range of -31.656 to 31,565 counts. For example, if the input range is 0 to 20 mA and the high display value is to be equal to 20 mA, then the HI INPT value should be (20/20 × 31,565) or you should enter 31,565 counts. For a 0 to 10V input calibration with the HI DISP at 9V, then HI INPT should be (9/10 × 31,565) or 24,409. For thermocouple, RTD and thermistor inputs, this menu item should normally be zero.

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OUTPUT CONFIGURATION

92 OUTPUTS Each of the 4 outputs may be assigned to one of two control loops and may perform different applications. This configuration is accomplished as described below:

Output configuration check list:

1. Select the output by number (921), i.e, 1, 2, 3 or 4.
2. In FUNCTION (922): Assign the output to a loop (9221)
   Select the type of output (9222)
   Select output limits (9223 - 9226)
   For retransmission set parameters (923X)
3. Output calibration (924) should not be necessary.
4. Make sure output modules on output board agree with the output programming.

921 SEL OUT# Used to select the output number from 1 through 4 (the plug-in output module must be compatable with the configuration parameters selected below). Selecting an output number will load the previously stored data for the selected output into each of the data displays for review or change. An output must be selected before it can be configured.

922 FUNCTION Used to configure an output to the application.

9221 ASSIGNMENT Select the controller loop and output application for the list below.

NONE/ALM Use this item if no output is installed or if the output is not used. This selection is also used if the output is used for a monitor function (i.e., alarm).

L1 PRI R A primary reverse acting output in control loop 1. (Typically used to control a heater.)

L1 PRI D A primary direct acting output in control loop 1. (Typically used for cooling control.)

L1 PRI S Split output action may only be used with an analog output and splits the analog output so that it functions as a heating (reverse) output above 50% output and as a cooling (direct) output below 50% output. Primary tuning constants will be used for the reverse action and the secondary tuning constants will be used for the direct action. This selection often called "split range output" assigns the output to loop 1.

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L1 SEC R A secondary reverse acting output in control loop 1. (Typically used to control a heater.)

L1 SEC D A secondary direct acting output in control loop 1. (Typically used for cooling control.)

L1 SEC S Split output action may only be used with an analog output and splits the analog output so that it functions as a heating (reverse) output below 50% output and as a cooling (direct) output above 50% output. Primary tuning constants will be used for the reverse action and secondary tuning constants will be used for the direct action. This selection often called "split range output" assigns the output to loop 1.

L2 PRI R A primary reverse acting output in control loop 2. (Typically used to control a heater.)

L2 PRI D A primary direct acting output in control loop 2. (Typically used for cooling control.)

L2 PRI S Split output action may only be used with an analog output and splits the analog output so that it functions as a heating (reverse) output above 50% output and as a cooling (direct) output below 50% output. Primary tuning constants will be used for the reverse action and the secondary tuning constants will be used for the direct action. This selection often called "split range output" assigns the output to loop 2.

L2 SEC R A secondary reverse acting output in control loop 2. (Typically used to control a heater.)

L2 SEC D A secondary direct acting output in control loop 2. (Typically used for cooling control.)

L2 SEC S Split output action may only be used with an analog output and splits the analog output so that it functions as a heating (reverse) output below 50% output and as a cooling (direct) output above 50% output. Primary tuning constants will be used for the reverse action and secondary tuning constants will be used for the direct action. This selection often called "split range output" assigns the output to loop 2.

RETRANS This code assigns an analog output to serve as a retransmitting type output. The variable to be retransmitted is assigned in menu item RTRN SEL in this same OUTPUTS configuration menu.

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9222 TYPE Following the assignment of an output to a control loop and selecting its application use, the next display requires the output type to be selected from a list for that output.

NONE/ALM Only used when the output is not used or if the output is used for an alarm (MONITOR) function.

TIME PR Select Time Proportional control EMR, SSR, open collector and DC trigger outputs only.

FRQ PULS For pulse output using EMR, SSR, open collector and DC trigger outputs to operate displacement pumps. Pulse frequency varies from a minimum of 1 pulse every 8 minutes to the maximum pulse frequency selected in MAX PULS (9226). The pulse duration is 250 ms for low pulse rates and switches over to a 50% duty cycle when the pulse rate exceeds 2 pulses per second.

ANALOG For analog proportional outputs only.

ANAPHLIN This analog output drives a non-linearized phase-fired power controller so that a nearly linear control results.

ON/OFF Select ON/OFF control output for EMR, SSR, open collector and DC trigger outputs only. For a reverse output, the output will stay ON until the PV is the ± DIFF'L value (see TUNING) beyond the setpoint value and turns ON the ± DIFF'L value below the setpoint. For a direct output, this action reverses. ON/OFF outputs are not affected by slew rate or maximum or minimum output limits.

9223 MAX PWR Used to limit the output power. Enter the maximum power limit in percent. This setting may be overridden by a monitor if so configured. The default setting is 100%.

9224 MIN PWR Used to maintain a minimum level of output power to the load. Enter the minimum power level in percent. This setting may be overridden by a monitor if so configured. The default setting is 0%.

9225 MAX SLEW Used to set the maximum rate-of-change for an output in percent per minute. This setting may be overridden by a monitor if so configured. Monitors are unaffected by slew rate settings. Control outputs are constrained by slew rate limitations at all times including during START/STOP operation. The slew rate limit is 32,000 percent per minute.

9226 MAX PULS When the output is configured under OUTPUT TYPE as a FREQUENCY PULSE output, this menu item sets the pulse rate from 1 to 511 pulses per minute.

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923 RETRAN Used to configure an analog output for retransmission of one of the controller variables.

9231 RTRN SEL Used to select the variable to be retransmitted.

PV1	OUTPUT 1
PV2	OUTPUT 2
PV3	OUTPUT 3
SP LOOP1	OUTPUT 4
SP LOOP2	

9232 0% AT Used to set the value of the retransmitted variable at 0% output.

9233 100% AT Used to set the value of the retransmitted variable at 100% output.

924 CAL ANA The CAL 0% and CAL 100% entries allow you to adjust the actual voltage or current delivered by an analog output module at 0% output and 100% output. This procedure is rarely needed and should only be performed if the proper equipment is on hand to enable a proper calibration. Do not recalibrate an output unless a test of the output shows that it must be recalibrated or if the type of output is changed.

As a part of the procedure to calibrate an analog output, it is necessary to first set either 0% or 100% output under manual control for the output to be calibrated.

The actual number displayed (or entered) here represents internal controller values used in generating analog output signals. A larger number generates a larger analog output signal. Beyond this, the scale for these values is not standardized but most analog output cards will deliver the same output values within a few percent when given the same numbers here. Some nominal entries for analog outputs are listed below:

CURRENT OUTPUTS:			VOLTAGE OUTPUTS:		
0mA	≈	4360	0V	≈	958
4mA	≈	9600	1V	≈	2560
20mA	≈	31104	5V	≈	8968
			10V	≈	16976

Note that the output from normal Analog Output Modules in the voltage mode will not swing all the way to 0 volts; typically they swing below 500 mV depending on the load. The addition of an external load resistor (1K, ½W across the + and - output terminals) generally allows the output to fall below 50 mV (0.5% of a 10V span) if the application does not require the output to sink significant current. A hardware modification is available to allow these modules to swing to 0V without load. Modules with the hardware modification cannot be used in the current mode.

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9241 CAL 0% This item provides a method of calibrating an analog output at 0% output. Connect an appropriate instrument (either a voltmeter or milliammeter) to measure the output being calibrated. Use direct numerical entry or the UP or DOWN ARROW keys to change the displayed number to a new value. You ***MUST*** exit this display to the OUTPUTS display using the MENU key to enter the change on the output. Repeat this step until the output measures correctly.

9242 CAL 100% This item provides a method of calibrating an analog output at 100% output. Connect an appropriate instrument (either a voltmeter or milliammeter) to measure the output being calibrated. Use direct numerical entry or the UP and DOWN ARROW keys to change the displayed number to a new value. You ***MUST*** exit this display to the OUTPUTS display using the MENU key to enter the output change. Repeat this step until the output measures correctly.

925 DEFAULT This item is used only for unassigned outputs that have NONE/ALM selected for OUTPUT/FUNCTION/ASSIGNMENT. The default status of an output may either be ON or OFF. The DEFAULT setting determines the status of an output when de-energized. The default selection may be toggled to test a particular output, e.g, an alarm.

This menu item must be coordinated with MONITOR/FORCEOUT (417 and 427). When DEFAULT is OFF, then FORCEOUT must be ON and vice versa.

926 CYC TIME Used for time proportioning outputs only. The cycle time is the total of the ON plus the OFF time for a SSR, OC, DC TRIGGER or EMR output and should generally be set as long as practical without causing load cycling. Enter the CYCLE TIME from 1 to 511 seconds for the output being configured.

927 ANNUNS This selection provides a means for configuring the output annunciator display on the bottom row of the principal display. Each output (#1 to #4) may have the display logic inverted. Answering NO causes the output annunciator to be lit when the output is turned on by the controller. Selecting YES causes the annunciator to be lit when the output is off.

93 SECURITY The keypad security system utilized by the controller permits all of the first level menu items to be locked out to prevent unauthorized access and change of the parameters. The various aspects of the security system are described below:

931 SECURITY The security item is used to enable or disable the keyboard security system. Select YES or NO on the appropriate display. The use of digital communications and macros are not affected by the keypad security system.

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932 SEC VISI Use security visibility to set menu item blanking according to user privilege. Answering YES allows all menu texts to display even through the security system will prevent access to the same item. Answering NO will blank out all menu item text lines where security will not allow access. The MASTER user will automatically see all menu text lines.

933 SEC IDS Use security identification codes to assign up to 7 user security codes, all with different privileges, plus the security code for the MASTER user. Selecting any of the eight users presents a display allowing the entry of a 5-digit numeric code (either positive or negative) to identify users.

Please note that when supplied from the factory, the MASTER user ID is default "0". Since the USER ID number is automatically reset to zero after a power down, it is necessary to set the MASTER user to some number other than 0 to permit enabling of the security system. Take advantage of the user number reset on power down by retaining one of the user ID's set to zero. By doing this, you can program those screens available to an unprivileged user for USER ID "0" and only those screens will be available on power up.

Remember that once the security system has been enabled, you must remember the numbers assigned since there is no method of accessing menu items under control of the security system other than by entering the proper USER ID.

934 PRIVILG Use the security privilege assignment menu to set the menu item accessibility according to the user number. The MASTER user automatically has access to all menu items. Privilege levels are assigned by entering a numeric value from 0 to 127 which is the sum of the numbers assigned to each of the following menu topics:

TUNING	1
PROFILES	2
MONITORS	4
HISTORY/DATALOG	8
OPERATION	16
UTILITY	32
CONFIG	64
	127

To prevent a user from accessing one or more of the above topics, eliminate the number(s) representing that topic from the entered sum value and the controller will block that user from entering the menu topics so deleted.

When the USER ID is entered on power up or when ever the USER ID is changed, the corresponding security privilege assigned to the user number is enabled and only the screens allowed to that user may be accessed.

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94 MATH (OPTIONAL) This selection of menu entries can be used to configure relationships between inputs, outputs, setpoints and the process variable. PV bias as well as feed-forward, cascade, ratio control and linearization of an input can be accomplished with sixteen equations (EQ01-EQ16), 16 integer constants (K01-K16), 16 memory locations (M01-M16) and three 31-segment linearizations.

Each equation consists of two operands, an operator and a destination for the result. In the equation A + B = C, A and B are operands, + is the operator and C is the destination.

Equations can be chained for complex calculations (as shown in example #2 in this section). The equations are evaluated in sequential order from equation #01 through #16. Attention to parenthesis and the order of operations is important. To achieve a correct mathematical result, calculations may need to be entered in the equation list in a particular order.

NOTE: Using the MATH feature reduces the update rate for the display and outputs. MATH routines should be kept as short and simple as possible.

WARNING: To guard against hazard to personnel and property, the MATH feature should be programmed only by qualified technicians. Errors in logic, equation sequence or equation definition can result in unexpected control responses.

MATH menu selections are described in the following text.

941 CONSTNTS This menu entry enables the user to enter 16 integer constants (±32,000 counts per integer constant) for use in equations (described under 942). Constants K01 through K16 may be selected by using the UP and DOWN ARROW keys to scroll through the 16 constants. To set the value of a constant, press the ENTER key and use direct numeric entry of the value. Pressing the ENTER key again will accept the value and complete the entry procedure.

Select another constant using the UP/DOWN ARROW keys or return to the previous menu by pressing the MENU key.

For NON-INTEGER constants such as 1.25, set a constant (K01, for example) to 125 and a second constant (K02) to 100. The equation **K01 / K02 --> M01** divides the first constant by the second constant and puts the result in memory location (M01). (Memory locations are described under menu 942.) Memory locations can store real numbers. Memory location (M01) is now 1.25 which may be used in a subsequent equation.

942 EQUATION A list of 16 sequentially numbered equations are provided in this menu. The sample display illustrates how the non-integer constant equation from the example shown in 941 above would appear in EQ #01.

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MXX M 1 through M16 are memory locations. Memory locations used as an operand are read by the equation. When memory locations are used as a destination, they are written to and can be read in a subsequent equation. After a power down, the memory locations will be reset to zero and recalculated.

KXX K01 through K16 are integer constants which have been entered in menu item 941. Constants are saved in non-volatile memory and are restored after the controller has been powered down.

OUTX OUT1 through OUT4 are the final output values in counts (0 to +32,000). These variables are conditioned and are limited by such parameters as MAX PWR (9223) and MIN PWR (9224).

OTX% OT1% through OT4% are the final output values in percent (0.0 to 100.0 in 0.1% resolution). These variables are conditioned and are limited by such parameters as MAX PWR (9223) and MIN PWR (9224). These variables are the same as OUT1 through OUT4 except that they are in percent.

OTXR OT1R through OT4R are the output power levels requested by the control algorithm before they are conditioned by limiting parameters. These variables range in value from 0 to +32,000.

OPERATOR LIST The operators described below define the functions to be applied to the operands in an equation.

END The end operator is the default operator for an unprogrammed equation. END disables any equation in which it is selected. The controller begins with equation 01 and sequentially steps through the equations until it encounters an equation with an END operator. **Any equations beyond the first one with an END operator are ignored.**

STOR This operand is used to move operand 1 to the destination without performing any operation on it.

+ The addition operator is used to sum the first and second operand.

- The subtraction operator is used to obtain the difference between the first operand and the second operand.

× The multiplication operator is used to obtain the product of the first and second operands.

/ The division operator is used to divide the first operand by the second operand.

SQRT The square root operator is used to extract the square root of the first operand. The second operand should be blank spaces for this equation.

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LINX The linearizer operators (LINA, LINB and LINC) are used to process the value of an operand through one of three linearizations programmed by the user under LINEAR X (943/944/945). When the LINX operator is used, the second operand should be blank spaces.

NLOG The logarithm operator takes the natural logarithm of the first operand. The second operand should be blank spaces for this equation.

NOP The No Operation operator is used to temporarily turn off an equation without rewriting the equations further on in the list.

DESTINATION LIST The list of destinations includes 26 locations that may be selected for the output of an equation.

(BLANK) Blank spaces is the default destination for an equation before it has been programmed.

PVX PV1 through PV3 are the values that appear in double height on the Principal Display. They are also the process measurements used by the control algorithm.

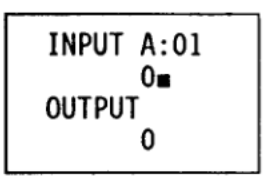
SPX SP1 and SP2 are the setpoint values for the respective loops in display units. NOTE: When setpoint is used as a destination, the display will indicate that remote setpoint is active and profile control will be prohibited.

SPBX SPB1 and SPB2 are the setpoint biases for Loop 1 and Loop 2.

ASPX ASP1 and ASP2 are the auxiliary setpoints for Loop 1 and Loop 2.

MXX M 1 through M16 are memory locations. Memory locations may be either read or written to and are used to save the output value of one equation for input to another equation. Values saved in memory are recalculated after the controller has been powered down.

943/944/945 LINEAR X These menus enables the user to define three 31-segment piece-wise linearizer curves. A linearizer is applied to an operand in a MATH equation by selecting the LINX operator. Refer to the drawing below for a typical view of the linearizer data entry display.



The letter and number at the right of the first line of the display identifies the linearizer as A, B or C and the breakpoint number from 01 through 32. The label, INPUT (on the first line), is shown above its assigned value (on the second line). The label, OUTPUT (on the third line), appears above its assigned value (on the fourth line).

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To display a breakpoint, enter the appropriate linearization menu and use the UP and DOWN ARROW keys to scroll through the list until the desired breakpoint appears.

To change the values for the breakpoint, display the breakpoint data, then press the ENTER key. The input value for the breakpoint must be expressed in the same units as the operand that will appear in the equation with the LINX operator. Use direct numeric entry to set the value for INPUT. When the desired number has been entered, press the ENTER key to accept it. NOTE: Consecutive input values must increase in magnitude as the breakpoints increase from 0 to 32.

The square cursor now appears to the right of the OUTPUT value. The output value for the breakpoint must be expressed in the same units as the destination. Use direct numeric entry to set the value for OUTPUT and then press the ENTER key to accept it. The controller uses the slope between consecutive breakpoints to determine the value for the destination.

The ARROW keys can now be used to select another breakpoint or press the MENU key to return to the previous menu.

MATH EXAMPLES The MATH routines provide a very flexible programming structure that enables the controller to handle sophisticated signal conditioning. The following examples are provided to aid in the understanding of the MATH programming steps and demonstrate some of the power inherent in the MATH package.

EXAMPLE #1 - We desire to operate the controller with two thermocouple inputs operating in differential to control a single output. This example assumes that INPUT 1 and INPUT 2 have already been configured and calibrated as thermocouple inputs of an appropriate thermocouple type and that appropriate output programming has been performed.

1. Move to the equation display (942) and use the UP/DOWN ARROW keys to arrive at the EQ01 (Equation #01) display.

2. Press the ENTER key to initiate the cursor at the Operand 1 entry. Use the UP/DOWN ARROW keys to scroll the operand list until the Operand INP1 is displayed. (This operand is the scaled and conditioned signal from Input 1.) Press the ENTER key to accept the selection and advance to the next line.

3. Use the UP/DOWN ARROW keys to scroll the operator list until the subtraction (-) operator is displayed. Press ENTER again to select the operator and advance to the third line.

4. Use the UP/DOWN ARROW keys to scroll the operend list until the Operand INP2 is displayed. (This operand is the scaled and conditioned signal from Input 2.) Press the ENTER key to accept the operand and advance to the fourth line.

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5. Use the UP/DOWN ARROW keys to scroll the output list until the destination PV1 is displayed. (This destination is the Loop 1 input to the control portion of the program.) Press the ENTER key to accept the selection.

6. The equation is now complete. Input 2 will be subtracted from Input 1 and the result sent to the control algorithm portion of the controller. Press the MENU Key 4 times to return to the Principal Display. The controller will now utilize Loop 1 to control the outputs that have been assigned based on the difference in the two thermocouple inputs.

EXAMPLE #2 - For this example, we chose to enter a complicated formula that will control the output based on the computation using two inputs. The two inputs are configured as a thermocouple temperature input for INPUT 1 and an input from a transducer on INPUT 2. It is assumed that proper output configuration has also been performed. The formula that we will use is shown below:

$$\text{Display} = \frac{33 * (\text{Ln}(TR/100)) + T}{1 - (7/54) * (\text{Ln}(TR/100))}$$

where:

T = the measured temperature (INPUT 1)
TR = the measured transducer input (INPUT 2)

1. The first step is to rewrite the formula to break it into a number of simple equations that can be handled by the controller MATH routines. These proposed equations are listed below.

```
(EQ01)    TR / 100  =  M01 (Memory #1)
(EQ02)    Ln(M01)   =  M02 (Memory #2)
(EQ03)    33 * M02  =  M03 (Memory #3)
(EQ04)    M03 + T   =  M04 (Memory #4)
(EQ05)    7 / 54    =  M05 (Memory #5)
(EQ06)    M05 * M02 =  M06 (Memory #6)
(EQ07)    1 - M06   =  M07 (Memory #7)
(EQ08)    M04 / M07 =  PV1
```

Equations 1 through 4 resolve the numerator and Equations 2 and 5 through 7 resolve the denominator. Equation 8 provides the final solution and displays it as PV1.

2. Move to the CONSTNTS menu (941) and enter the value 100 for K01 (Constant #1). Enter 33 for K02, 7 for K03, 54 for K04 and 1 as K05. Press the MENU key to return to the MATH menu.

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3. Change to the equation display (942) and start with equation EQ01. To enter the equation INP2 / K01 = M01 for (TR/100), press the ENTER key to initiate the cursor at the operand 1 entry. Use the UP/DOWN ARROW keys to scroll the operand list until the operand INP2 (processed input 2 - transducer input) is displayed. Press the ENTER key to accept the selection and advance to the next line.

4. Use the UP/DOWN ARROW keys to scroll the operator list until the division (/) operator is displayed. Press the ENTER key to accept the selection and advance to the third line.

5. Use the UP/DOWN ARROW keys to scroll the operand list until K01 (constant #1 with a value of 100) is displayed. Press ENTER again to accept the operand and advance to the fourth line.

6. Use the UP/DOWN ARROW keys to scroll the destination list until M01 (memory #01) is displayed. Press the ENTER key to accept the selection.

7. Use the UP/DOWN ARROW keys to change EQ02. We will enter equation #2 M01 NLOG N/A = M02 for (Ln(TR/100)).

8. Enter M01 (memory #01) as the first operand, NLOG as the operator, "blank" as the second operand and M02 (memory #02) as the destination.

9. Change to equation EQ03 which will be K02 * M02 = M03 for (33 * (Ln(TR/100)). Select K02 (which is 33) for the first operand, multiplication (*) as the operator, M02 (memory #02) for the second operand and M03 (memory #03) for the destination.

10. Equation EQ04 will be M03 + INP1 = M94 for (33 * (Ln(TR/100)). Select M03 (memory #01) for the first operand, addition (+) as the operator, INP1 (processed input 1 - temperature) for the second operand and M04 (memory #04) for the destination.

11. EQ05 will be K03 / K04 - M05 to calculate (7/54). EQ06 will be M05 * M02 = M06 for 7/54 * (Ln(TR/100)). EQ07 will be K05 - K06 = M07 for (1 - (7/54 * (Ln(TR/100))).

12. Equation EQ08 will be M04 / M07 = PV1 for {(33 * (Ln(TR/100)) + T)} / {1 - (7/54 * (Ln(TR/100)))}.

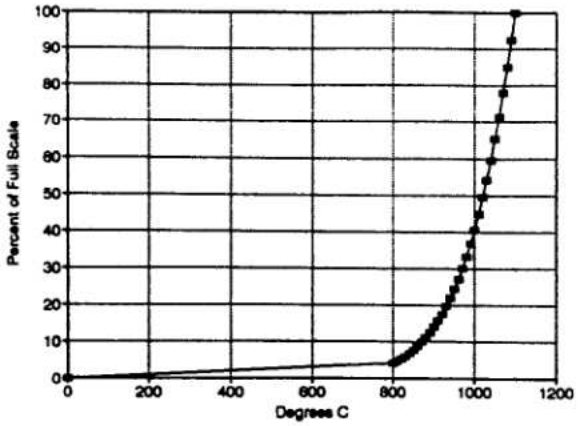
13. The formula entry is now complete using 5 constants, 7 memory locations and 8 equations. This math routine could have been accomplished reusing 3 constant locations but 7 were used to make the example earier to follow. Press the MENU key 4 times to return to the Principal Display. The controller will now respond to the two inputs as calculated by the MATH routines.

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EXAMPLE 3 - The third example demonstrates the use of piece-wise linearization for applications where no formula is available and only non-linear data can be provided. For this example, we want to set up the controller to take a 0/100 mVDC analog signal on INPUT 1 (terminals 19 & 20) from a radiation pyrometer and display linearized temperature from 800 to 1100°C.

When doing piece-wise linearization in MATH, it is very important to know what units the signal that will be linearized are in. This means that the calibration parameters are critical. As stated, the input signal is 0 to 100 mV and these values are used for the zero and span calibration. Since we desire to use the entire calibrated span, the LOW INPT should be 0 and the HI INPT should be 31,565. It will be easier to enter the linearization break point data if we scale the input from 0 to 10,000 counts so that the LOW DISP should be 0 and the HI DISP should be 10,000. (Note: Better resolution would occur if we used the full span of 31,565 counts but using 10,000 in this example makes the entry easier to understand.)

Use the instructions in MENU 91 to setup INPUT 1 as a VOLTAGE type with PROCESS0 curve, then calibrate this input by entering the values listed in the previous paragraph for LO DISP, HI DISP, LO INPT and HI INPT. The input jumper blocks must also be configured as shown for 100 mV analog inputs on Page 1-7.



The graph at the left is typical of an infrared radiation pyrometer. The data for the graph is given below. Since the data indicates that as the temperature increases, the signal becomes more linear, we should be able to drop some data points to reduce the number of segments without materially affecting the accuracy of the display. For this reason, we will drop every other data point above 1000°C.

° C (OUTPUT)	% FS X 100 (INPUT)
0	0
800	400
810	460
820	530
830	600
840	680
850	770
860	880
870	990
880	1120
890	1260

° C (OUTPUT)	% FS X 100 (INPUT)
900	1410
910	1580
920	1770
930	1980
940	2210
950	2460
960	2720
970	3010
980	3330
990	3690
1000	4070

° C (OUTPUT)	% FS X 100 (INPUT)
1010	4490
1020	4850
1030	5430
1040	5960
1050	6530
1060	7150
1070	7800
1080	8500
1090	9240
1100	10000

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Now that we have described the data and how it will be interpreted by the controller, we can enter the linearization data into the MATH programming data entry screens.

1. Move to the LINEAR A menu (943). For each breakpoint, we need to enter the INPUT in units of the scaled signal data which runs from 0 to 10,000 counts (%FS * 100) and the OUTPUT as the desired temperature display.

2. Beginning with breakpoint A:01, press the ENTER key and enter the first set of data INPUT: 400 using direct numerical entry. Press the ENTER key again to accept the input value and advance to the output entry line. Use direct numerical entry to enter OUTPUT: 800 and press the ENTER key once more to accept the value. Advance to the breakpoint A:02 by pressing the UP ARROW key and enter INPUT: 460, OUTPUT: 810. Advance through the table entering the data for each data point through 1000°.

3. Beginning with 1020° up to 1100°, enter the data for each breakpoint in 20° increments. Once you have entered the data for 1100°, leave all remaining breakpoint entries at the default INPUT: 0, OUTPUT: 0.

4. Press the MENU key once to return to the MATH menu and select EQUATION to access the EQ01 equation entry display. In this example, we wish to process the scaled input signal from INPUT 1 through LINEARIZATION A. To accomplish this, press the ENTER key to initiate the cursor at the operand 1 entry. Use the UP/DOWN ARROW keys to scroll the operand list until the operand INP1 (processed input 1) is displayed. Press the ENTER key to accept the selection and advance to the next line.

5. Use the UP/DOWN ARROW keys to scroll the operator list until the LINA operator appears. (The linearizer data was entered in LINEAR A.) Press the ENTER key to accept the selection and advance to the third line.

6. The linearizer function is a single operand operation so that operand 2 should be left at blank spaces. Press the ENTER key to advance to the fourth line.

7. Use the UP/DOWN ARROW keys to scroll the destination list until PV1 (Loop 1 input to the control algorithm) is displayed. Press the ENTER key to accept the selection. This single equation is all that is required to run the linearization routine so press the MENU key four times to return to the Principal Display.

8. This ends the linearizer example. The controller should now be displaying linearized temperature based on the breakpoints entered.

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96 FUNCTION These standard controller types have been provided. Select the desired type from the list.

1. LOOP 1 - This is the standard single loop controller type needed for most applications.

2. LOOP 1&2 - This configuration provides two completely separate single loop controllers with separate parameters, setpoints, etc. and is referred to as a dual loop controller.

97 OPT CARD This menu accesses displays to specify the option card position(s) in the controller and to configure the logic I/O channel(s) if installed. NOTE: The installed position of the option card is displayed in the sign-on displays for reference.

971 PRN POS Enter the position number for the optional parallel printer option card. Position "1" is the option card connected directly to the CPU board while position "2" is the card connected to option card 1. Position "0" de-selects this option even if the card is installed.

972 IO A POS Enter the position number for the logic I/O option card to be identified as logic bank "A". Position "1" is the option card connected directly to the CPU board while position "2" is the card connected to option card 1. Position "0" de-selects this option even if the card is installed.

973 IO B POS Enter the position number for the logic I/O option card to be identified as logic bank "B". Position "1" is the option card connected directly to the CPU board while position "2" is the card connected to option card 1. Position "0" de-selects this option even if the card is installed.

974 IO A CFG Use this menu item to configure the logic I/O channels on optional logic card bank "A".

9741...8 IO A #X There are 8 channels on each logic I/O option card. This selection permits configuring each of the bank "A" channels individually as an input channel or as an output channel.

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975 IO B CFG Use this menu item to configure the logic I/O channels on optional logic card bank "B".

9751...8 IO B #X There are 8 channels on each logic I/O option card. This selection permits configuring each of the bank "B" channels individually as an input channel or as an output channel.

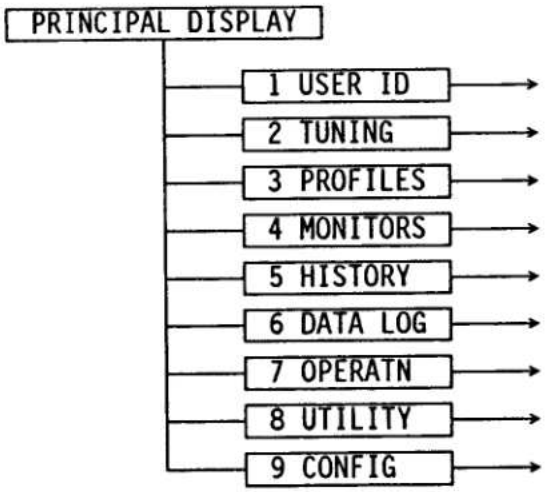
98 MEMORY CLEAR Selecting this menu item will erase all configuration and data programming except for the input configuration. Refer to MEMORY CLEAR PROCEDURE in Section 15 for a further explaination of the use of this process.

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SECTION 13 - MENU MAPS

This section illustrates the standard menu tree divided according to the main menu titles as shown below. All item subject titles are shown although the secondary data entry screens have been deleted to simplify the illustration and make the menu system easier to understand. These menu maps are useful in quickly determining the menu path to reach a given title.

At the end of this section is a directory of frequently used displays. This directory will be useful for quickly accessing commonly used displays.

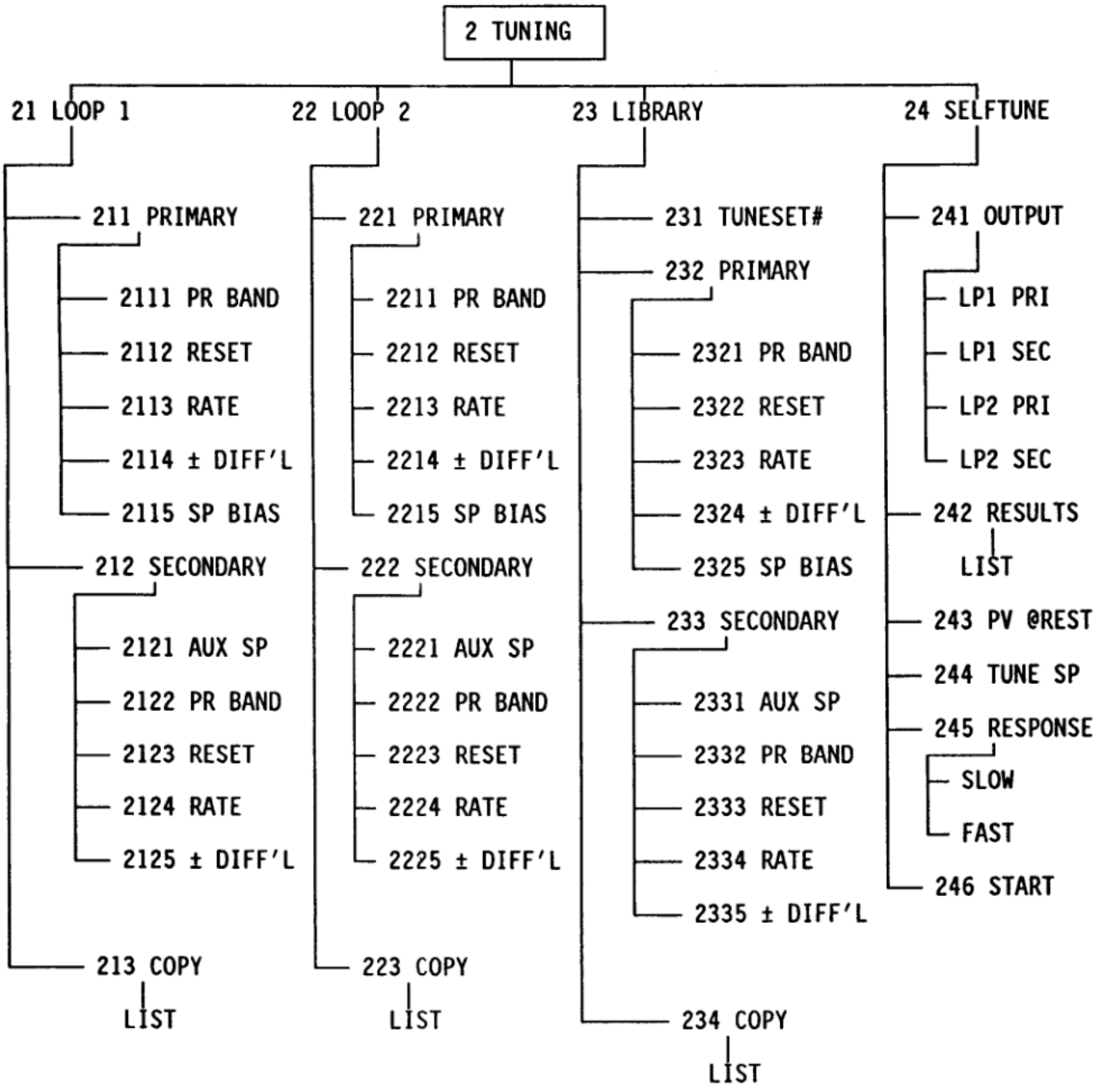


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(See Section 4 for details)

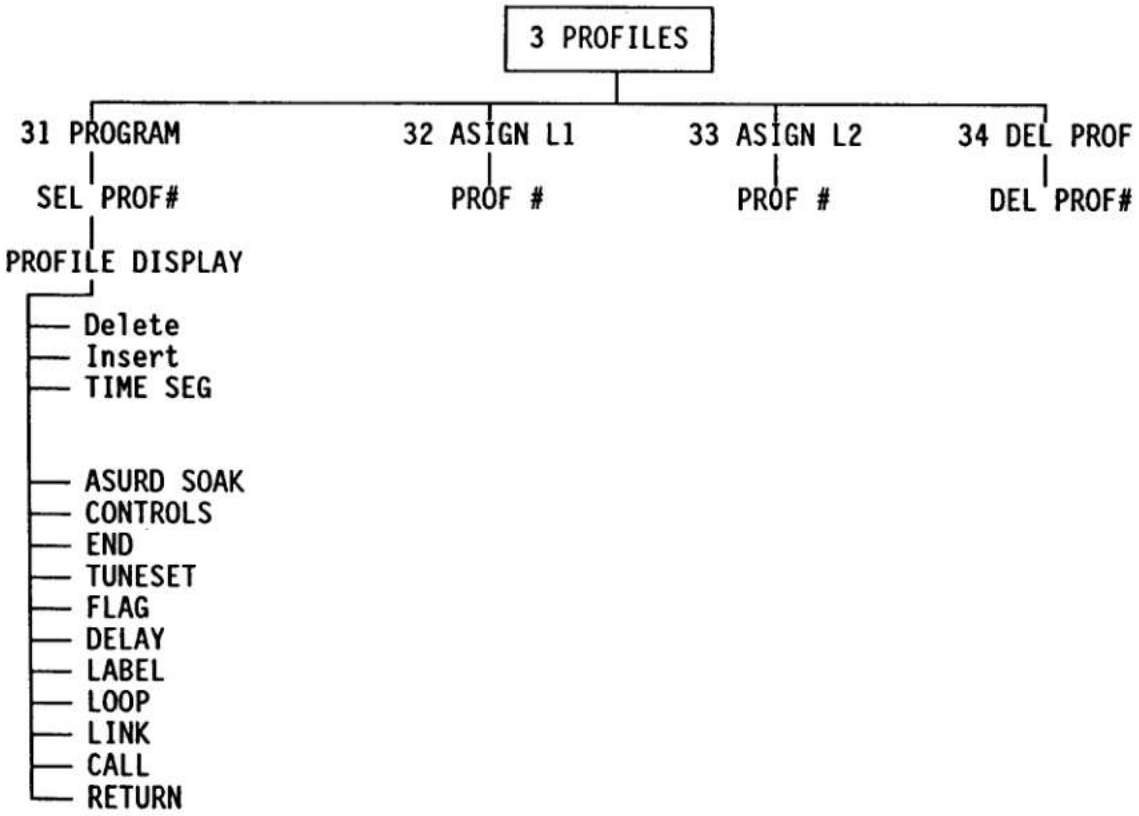
1 USER ID

(See Section 5 for details)



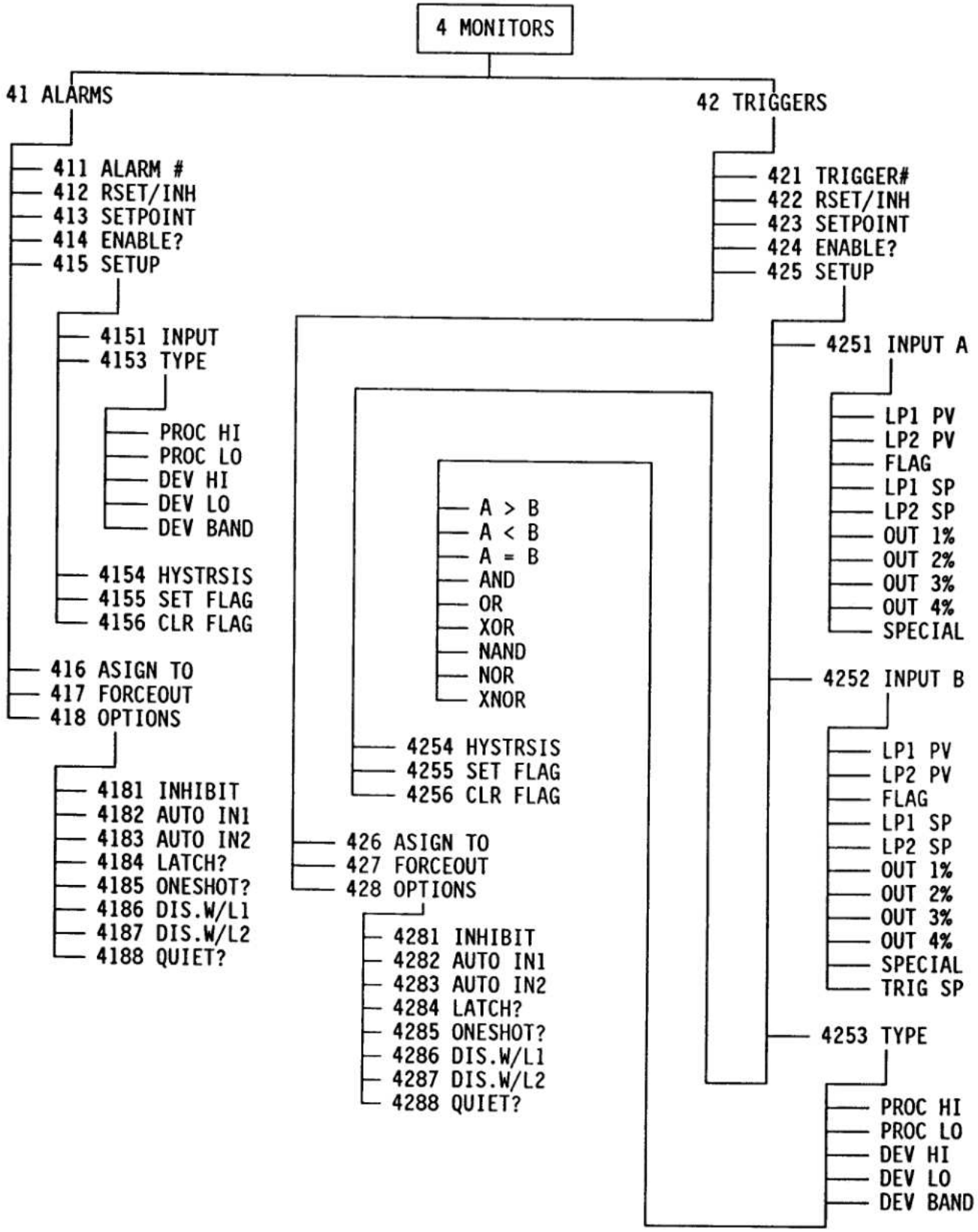
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(See Section 6 for details)



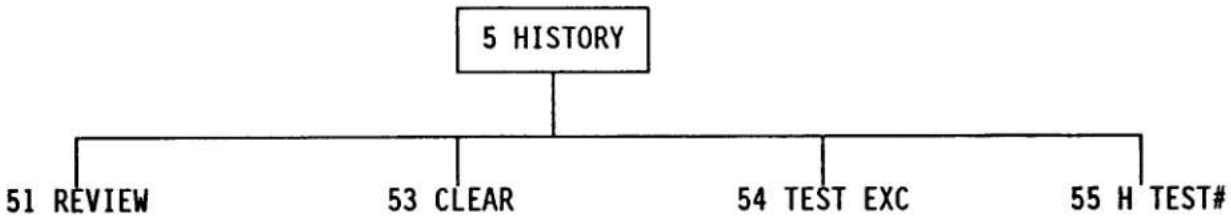
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(See Section 7 for details)

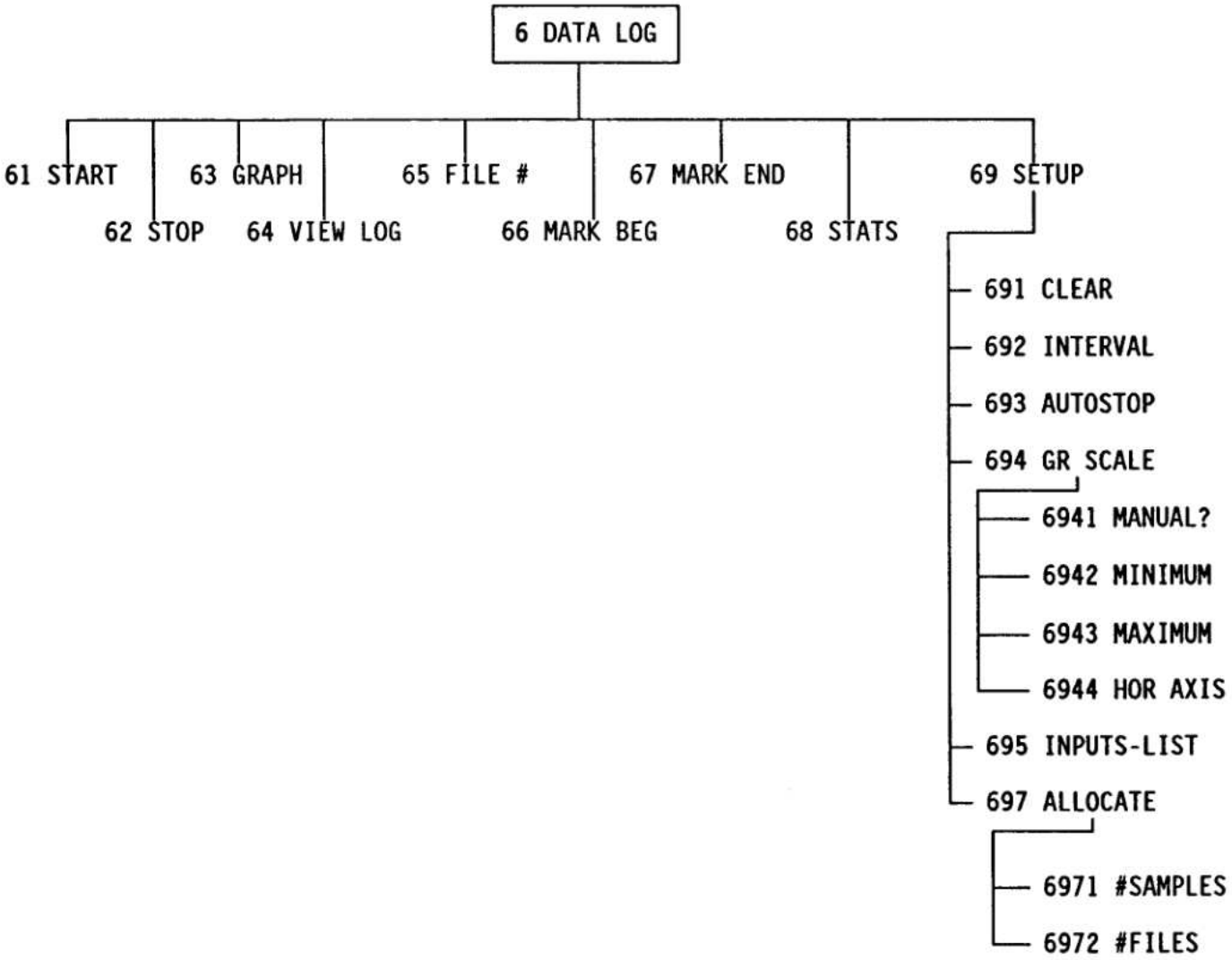


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(See Section 8 for details)

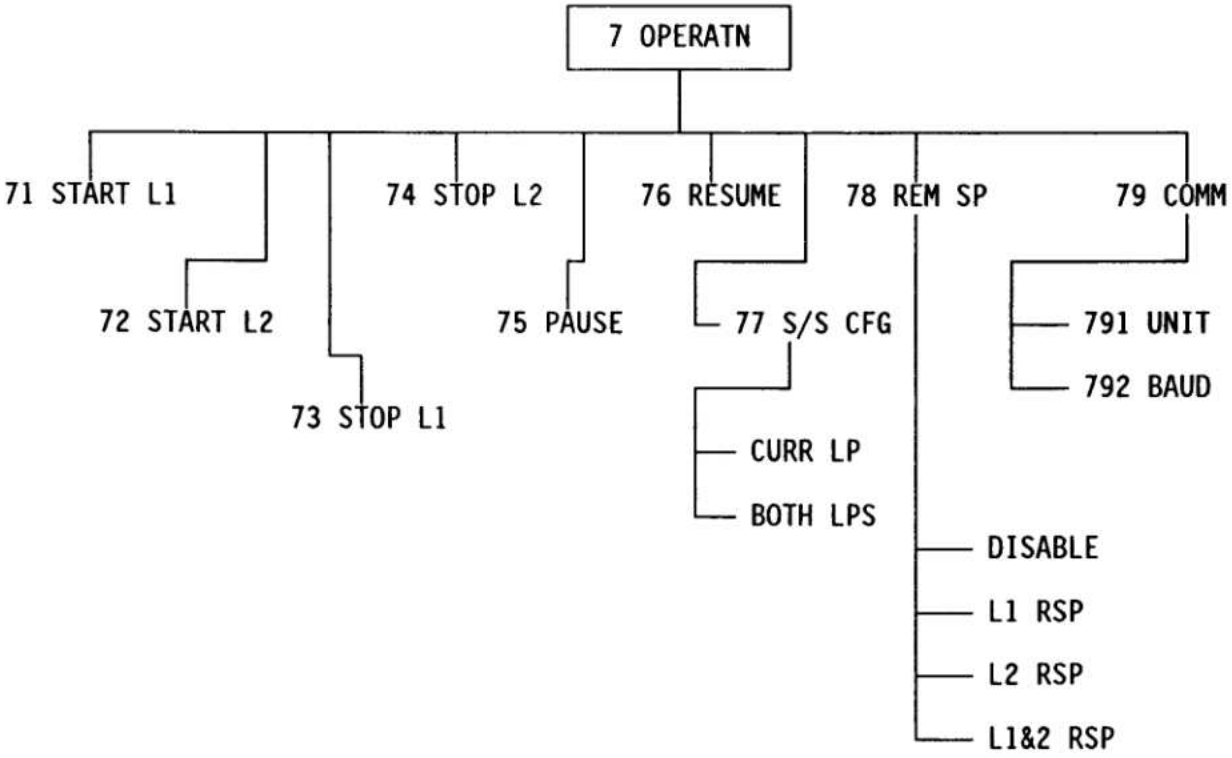


(See Section 9 for details)



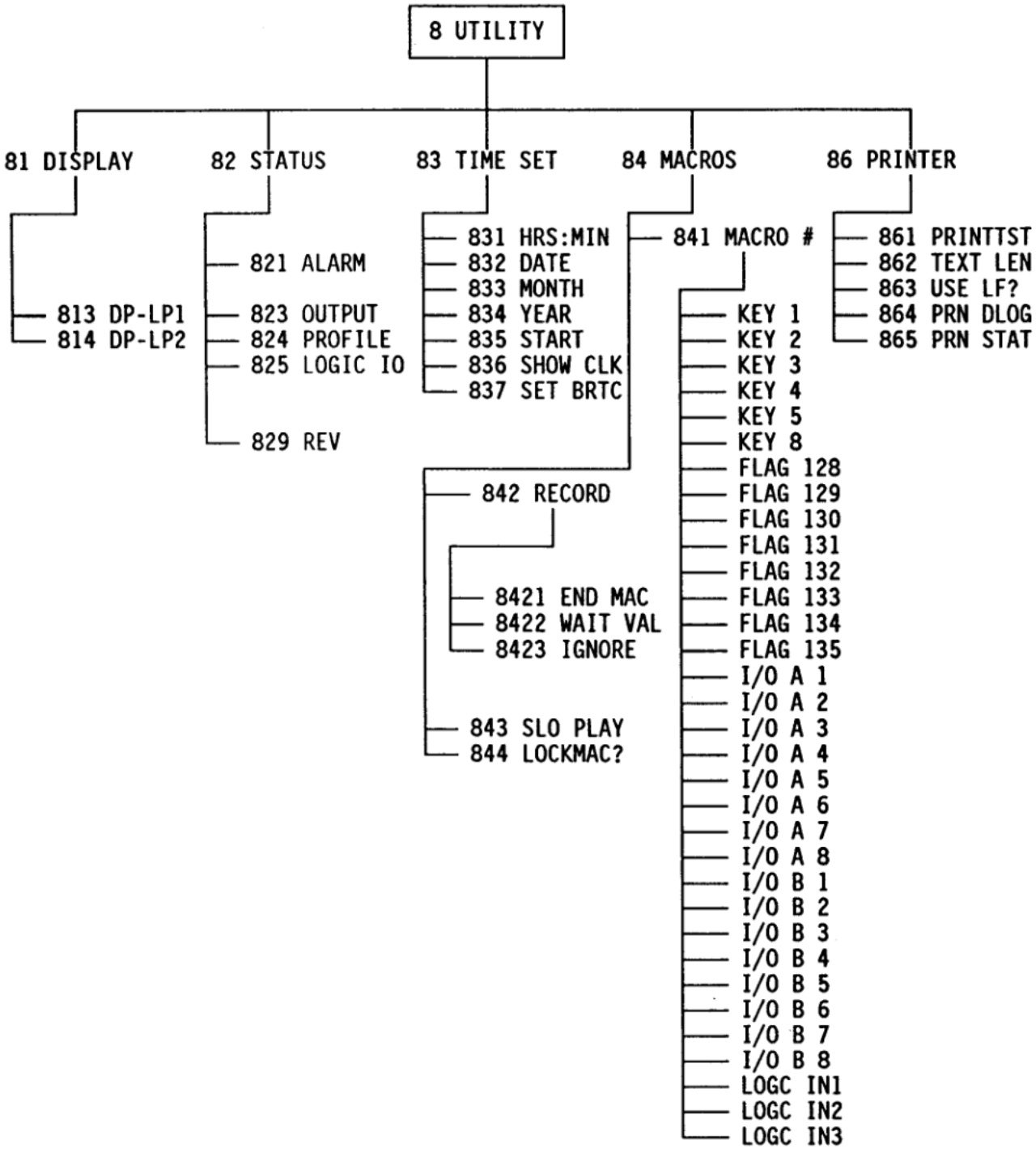
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(See Section 10 for details)



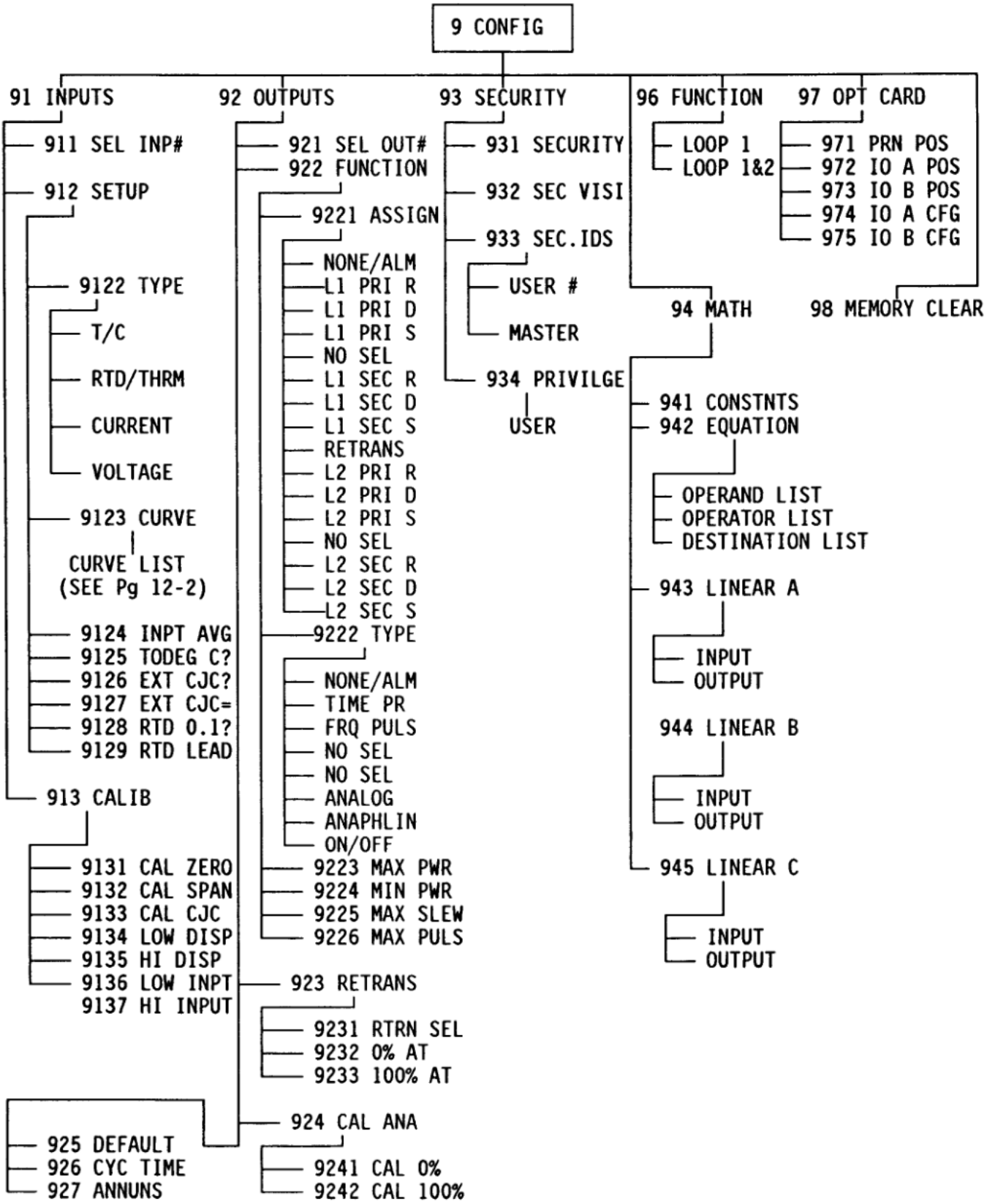
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(See Section 11 for details)



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(See Section 12 for details)



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DIRECTORY OF FREQUENTLY USED DISPLAYS

The menu system allow quick access to needed displays. To use this directory, locate the display title of interest in the directory and press the key sequence as indicated. All key sequences start from the principal display.

1 USER ID

USER ID			=	01

2 TUNING

LP1	PRI	P	=	02111
		I	=	02112
		D	=	02113
LP1	SEC	P	=	02122
		I	=	02123
		D	=	02124
	AUX SP		=	02121
LP2	PRI	P	=	02211
		I	=	02212
		D	=	02213
LP2	SEC	P	=	02222
		I	=	02223
		D	=	02224
	AUX SP		=	02221
LIB SELECT			=	0231
LIB	PRI	P	=	02321
		I	=	02322
		D	=	02323
LIB	SEC	P	=	02332
		I	=	02333
		D	=	02334
SELF-TUNE START			=	0246

3 PROFILES

LP1 PROFILE	=	032
LP2 PROFILE	=	033

6 DATA LOG

START	=	061
STOP	=	062
VIEW PLOT	=	063
VIEW DATA	=	064
MARK BEG	=	066
MARK END	=	067
VIEW STATS	=	068

While Viewing Plot (063)

Press 1	=	ZOOM IN
2	=	ZOOM OUT
3	=	BLOCK START
4	=	BLOCK END
5	=	MAX VALUE
6	=	MIN VALUE
7	=	MEAN VALUE (Mark window)
8	=	NUMBER OF SAMPLES
9	=	TIME INTERVAL

7 OPERATN

PAUSE L1 & L2	=	0733
RESUME L1 & L2	=	0736

8 UTILITY

VIEW CLOCK	=	0836

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SECTION 14 - OPTIONS BOARDS

The OMEGA CN3000 is available with a number of optional boards which facilitate its use. These are listed below for reference:

OMEGA No.	DESCRIPTION
CN3000-RS3	EIA-232 (RS-232) Isolated Communication (1 Board)
CN3000-RS4	RS-422/485 Isolated Communications (1 Board)
CN3000-PR3	Parallel Printer Port (1 Board)
CN3000-L31	8 Channel Logic I/O Board (1 Board)
CN3000-L32	16 Channel Logic I/O (2 Boards)

Each of the options boards interfaces with external equipment. Carefully read the description of the option in this section to determine the requirements for the interface equipment. You will also need an accessory cable to connect the option board with the external equipment or an edge card connector to mate with the CN3000 option card for customer wiring.

Option board(s) may be installed at the factory or may be installed in the field. If your controller has the options board(s) factory installed, skip over the installation section below and proceed to the section describing the options board functions, jumper selection and wiring.

OPTIONS BOARD INSTALLATION (ALL OPTION BOARDS)

Each controller can accommodate two option boards which can be installed on the center bracket between the two outer boards. An options board may be installed in either position. Installation of the option board(s) is described in the following procedure.

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1. Loosen the bracket by removing the two long screws holding the bracket to the bezel and gently remove the bracket. (Refer to Figure #1.)

2. Remove the option board from its protective antistatic envelope taking care to hold the board by its edges and protecting the board from static damage. Mount the board on either side of the bracket with the card edge fingers to the rear and the component side of the board facing the CPU board (the board with a battery) using the screws provided. It is recommended that if a single option board is to be installed, it should be installed in option position #2 for ease of installation. Refer to Figures 1 and 2.

3. If two boards are being installed, the two boards must first be connected together prior to assembly into the controller. Connect the white/red lead from the board in position 1 on to the pin marked with a plus sign (+) on the board in position 2. Plug the white/black lead to the minus (-) pin in the same fashion. Now connect the flat cable from the option board in position 2 to the connector on the option board in position 1.

4. Plug the two (2) loose wires from the option board onto power board pins +20V (white/red) and -20V (white/black).

5. Direct the white/red and white/black wires so that they do not interfere with assembly. If a board is installed in position 1, preform the flat cables in a "V" shape to provide the proper lead forming as shown in Figure 2. Re-insert the bracket into the controller from the top side of the controller. Make sure that the component side(s) of the options board(s) are inserted as shown in the drawing with the jumper pins at the bottom edge of the controller. Take care not to unduly stress the option boards or the controller boards during insertion to prevent damage to the components or copper foil.

6. When the bracket is firmly seated, reinstall the two long bracket retaining screws.

7. Now connect the remaining flat cable from the option board into the connector at the edge of the CPU board. Make sure that the flat cable was pre-folded as shown in Figure 2 before installation for cables coming from option position #1.

8. Punch out the corresponding knock-out at the rear of the case, insert the options cable with connector pin 1 down (watch that the key position between pins 3 and 5 is matched in the cable connector) and screw the connector to the rear case.

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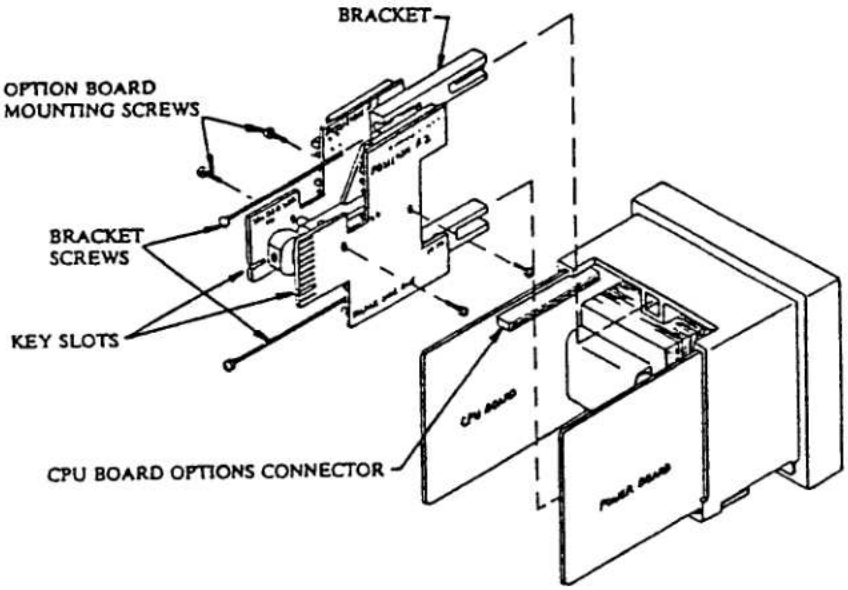


Figure 1

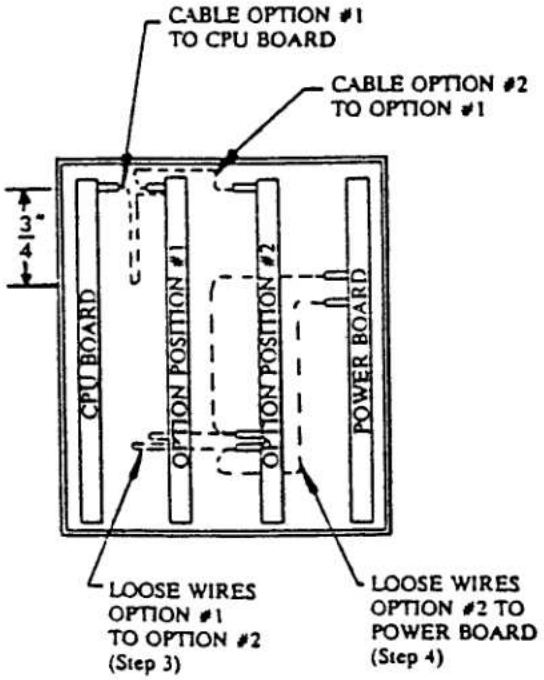


Figure 2 (REAR VIEW)

SERIAL COMMUNICATIONS OPTION (EIA-232, EIA-422/EIA-485)

The CN3000 controller serial communications option conforms to EIA-232 (RS-232), EIA-422 (RS-422) or EIA-485 (RS-485) for communications with a remote MS-DOS based host computer. The EIA-232 interface may be the easier interface to implement since most MS-DOS host computers have a built-in EIA-232 port. Use of the EIA-422 or EIA-485 interface normally requires an additional interface card to be installed in the host in order to facilitate EIA-422/485 communications. EIA-232 communications is intended for communications between the host and a single CN3000 controller (refer to the discussion on multi-drop EIA-232 communications later in this section) while EIA-422 is specified for use in communication systems of up to 10 controllers and EIA-485 is designed for use with communication systems with up to 32 controllers.

Full duplex (separate transmit and receive lines) EIA-232 transmission can be accomplished with three leads in its simplest form while EIA-422/485 transmission requires 5 leads. Transmission distances between the controllers and the host will vary with the EIA-232 usable over the shortest distance. The EIA-422/485 balanced interface will permit the longest transmission distances. However, all digital communication interfaces are distance limited by the baud rate, the resistance of the cable leads and the capacitance between leads of the interconnecting cable.

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THE EIA-232 (RS-232) COMMUNICATIONS OPTION

The EIA-232 communications board enables full duplex serial communications with a remote MS-DOS based host computer. In the simplest form, only the TXD (transmitted data), RXD (received data) and GND (common signal return) are needed for full duplex transmission. If only a 3-wire cable is used between the controller and the host, then the CTS (clear to send), DSR (data set ready) and DCD (data carrier detect) lines may need to be tied to the DTR (data terminal ready) at the host computer to disable handshaking. If an OMEGA supplied transition cable assembly is used with a standard communications cable which connects these lines between the controller and the host, disabling of handshaking is taken care of in the wiring and does not need to be done by the user.

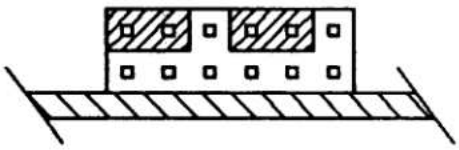
A number of hardware options are configurable using four jumper blocks. Although the board does not support handshaking, the CTS (clear-to-send) line may be set up so that the host can see when the controller is transmitting (the CTS line will be set to "OFF" or negative when transmitting). (NOTE: This "CTS" feature is different from the normal use of the CTS line which ordinarily responds to an RTS "ON" state by the host.) When the "CTS" feature is disabled, it is tied high. All other handshaking lines are internally tied high.

The EIA-232 option board is isolated but may be configured to operate from either the internal isolated controller supply or from a single +12VDC to +24V @ 50 mA external supply.

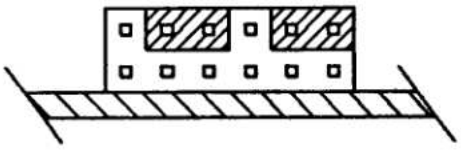
Although EIA-232 communications is intended for communications between a single controller and a host, the CN3000 communications board may be jumper configured for tri-state operation so that multi-drop communications may be utilized.

JUMPER SELECTION - EIA-232

The jumper selection positions are located at the edge of the communications board and are accessible on the bottom side of the controller. Because the CN3000 may be supplied with two option boards, make sure that you properly identify the EIA-232 board before changing configuration jumpers. The jumper positions are shown below:

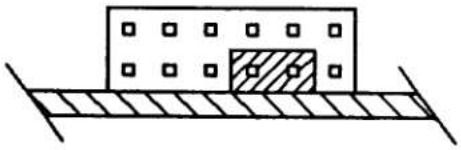


INTERNAL SUPPLY
(Factory Default)

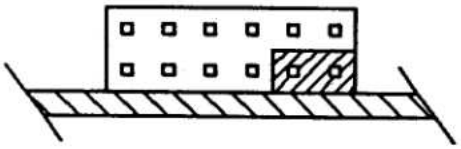


EXTERNAL SUPPLY

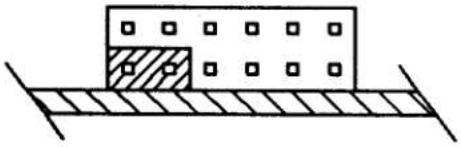
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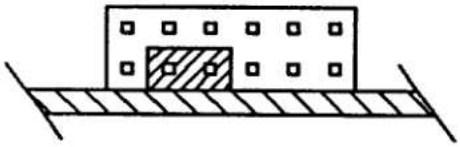
"CTS" DISABLED
(Factory Default)



"CTS" ENABLED



TRI-STATE DISABLED
(Factory Default)



TRI-STATE ENABLED

THE EIA-422/EIA-485 COMMUNICATIONS OPTION

The EIA-422/EIA-485 communications option allows either full or half duplex serial communications with a remote MS-DOS based host computer. For full duplex (separate transmit and receive lines) communications, the TXD-A (transmit data), TXD-B (transmit data complement), RXD-A (receive data), RXD-B (receive data complement) and GND lines are needed. For half-duplex (only a single pair of wires for transmit/receive plus GND), the TXD-A and TXD-B wires are used for both transmit and receive connections. The "A" terminal is negative with respect to the "B" terminal fpr a binary 1 (MARK or OFF) state. The "A" terminal is positive with respect with the "B" terminal for a binary 0 (SPACE or ON) state.

The CTS-A (clear to send), DSR-A (data set ready) and DCD-A (data carrier detect) lines, if present on the host EIA-422/485 interface card, may need to be tied to the DTR-A (data terminal ready) at the host and the CTS-B (clear to send complement), DSR-B (data set ready complement) and DCD-B (data carrier detect complement) lines may need to be tied to the DTR-B (data terminal ready complement) at the host to disable handshaking. If an OMEGA supplied transition cable with standard communications cable is used between the controller and the host, disabling of handshaking is taken care of in the wiring and does not need to be done by the user.

Several hardware options are configurable using four shunt jumper blocks. This board does not support handshaking and all handshake lines are tied high.

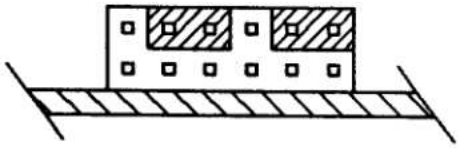
The EIA-422/EIA-485 option board is isolated and may be configured to operate from either the internal controller isolated supply or a single +7 to +13VDC external power supply capable of supplying 150 mA continuously under normal operating conditions and 250 mA under fault (shorted line) conditions. The EIA-422/EIA-485 interface is solely intended for multiple unit operation from a single host computer. This board will operate in systems of up to 32 units on the same data interface.

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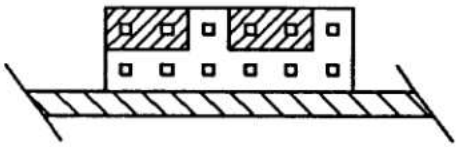
Most EIA-422 and EIA-485 applications involve operation at fairly high baud rates over lengthy cable networks and must be terminated with a pair of 120Ω terminating resistors (100Ω terminating resistor for EIA-422) to prevent ringing on the cable. **For these applications, it is mandatory that an external power supply be used since the CN3000 internal supply cannot supply the load required.** For low baud rates and short cables where the terminating resistors are not needed to prevent ringing, it may be possible to use the internal CN3000 power supply for communications.

JUMPER SELECTION - EIA-422/EIA-485

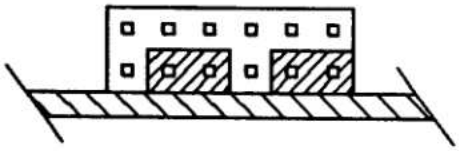
The jumper selection positions are located at the edge of the communications board and are accessible on the bottom side of the controller. Because the CN3000 may be supplied with two option boards, make sure that you properly identify the EIA-422/EIA-485 board position before changing configuration jumpers. The jumper positions are shown below:



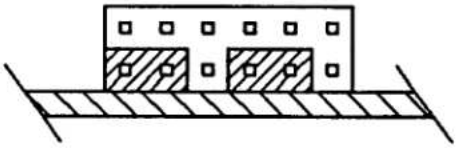
EXTERNAL SUPPLY
(Factory Default)



INTERNAL SUPPLY



FULL DUPLEX
(Factory Default)



HALF DUPLEX

WIRING - EIA-232 AND EIA-422/EIA-485

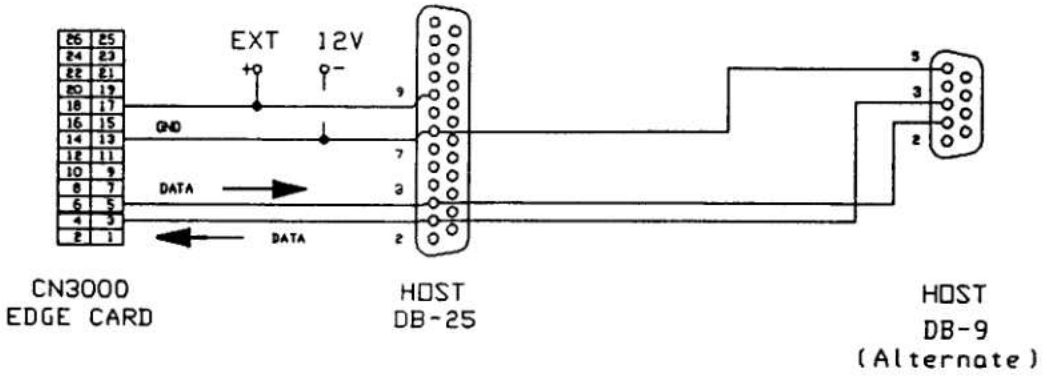
All connections to the communications board are made through a 26-pin edge card connector (OMEGA P/N CN3000-CONNECTOR supplied separately) which mounts to the plastic housing using two screws. Provisions have been made for an edge card connector key between edge card pins 3 and 5 to prevent backward mounting of the connector. The pin layout on the edge card has been set up so that mass terminated flat communication cables will match the standard EIA-232D DB-25 pin out for DCE (data circuit-terminating equipment) when pin 1 on the option board is connected with pin 1 on the DB-25 connector. For EIA-422/EIA-485, the pin layout for the corresponding DB-25 connector conforms with EIA-530 when pin 1 on the option board is connected with pin 1 on the DB-25 connector. The table below shows the pin arrangement for both the edge card and DB-25 connections. OMEGA offers edge card connectors and a 5" pre-assembled edge card to 25-pin D transition cable as accessory items. Consult the factory for more information.

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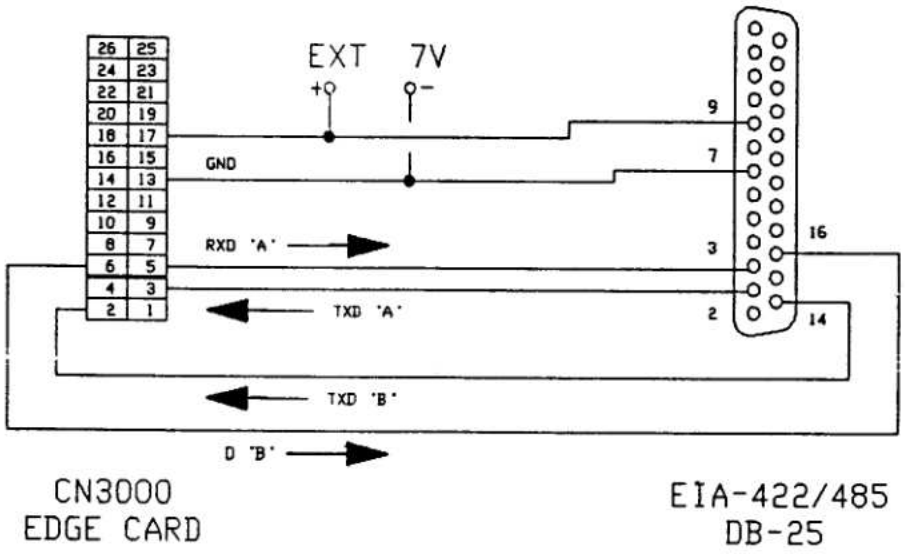
		DESCRIPTION	
EDGE CARD	DB-25 PINS	EIA-232	EIA-422/EIA-485
1	1	NONE	NONE
3	2	TXD	TXD-A
5	3	RXD	RXD-A
7	4	NONE	NONE
9	5	CTS	CTS-A
11	6	DSR	DSR-A
13	7	GND	GND
15	8	DCD	DCD-A
17	9	EXT +12V	EXT +7V
19	10	NONE	DCD-B
21	11	NONE	NONE
23	12	NONE	NONE
25	13	NONE	CTS-B
2	14	NONE	TXD-B
4	15	NONE	NONE
6	16	NONE	RXD-B
8	17	NONE	NONE
10	18	NONE	NONE
12	19	NONE	NONE
14	20	NONE	NONE
16	21	NONE	NONE
18	22	NONE	DSR-B
20	23	NONE	NONE
22	24	NONE	NONE
24	25	NONE	NONE
26	N/C	NONE	NONE

For short cable lengths in areas that are not noisy, unshielded cable may suffice. In noisy environments, it may be necessary to use shielded twisted pair cables to avoid noise pick up. If a shield is used, connect the shield to pin 1 of the DB-25 connector at the host. Do not intermingle cables for data and power lines. Make sure that data cables are not run in the same conduit or cable tray with supply power wiring.

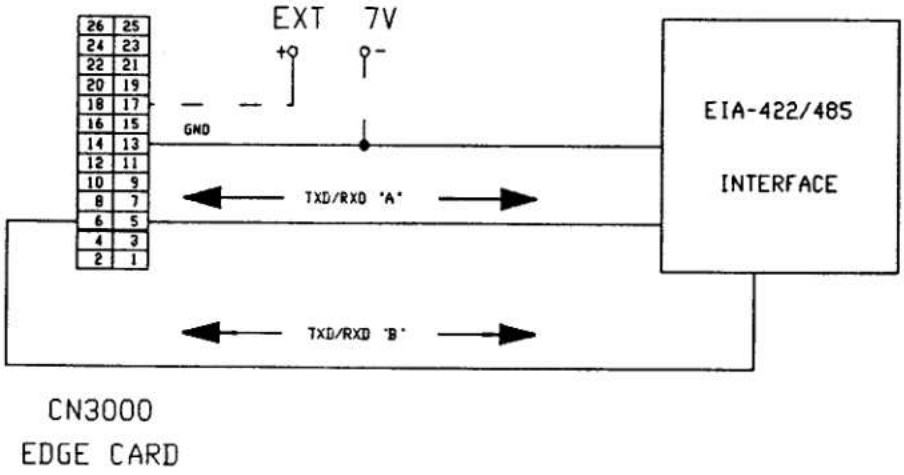
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TYPICAL EIA-232 CONNECTIONS



TYPICAL FULL DUPLEX EIA-422/485 CONNECTIONS (per EIA-530)



TYPICAL HALF DUPLEX EIA-422/485 CONNECTIONS

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OPERATION - COMMUNICATIONS (EIA-232, EIA-422/EIA-485)

Before the communication link may be used, each CN3000 controller must be software configured to set the baud rate, parity, unit address and other communications parameters. Refer to Menu 79 in Section 10 for details on this configuration.

In order to communicate to a controller through the serial communication interface, you must have the OMEGA operating software package which is to be installed in an MS-DOS based host computer. This software package enables the host computer to read and write the operating parameters to each unit controller. Consult the factory for more information on this package.

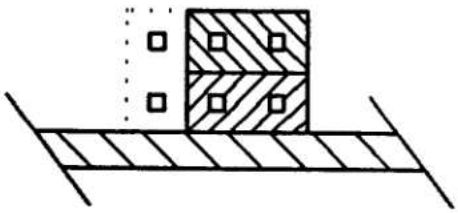
THE PARALLEL PRINTER OPTION

The parallel printer output enables the controller to send data to a remote printer using the IBM-PC parallel printer interface. Although there is space for two option boards, only one parallel printer board may be used in each controller.

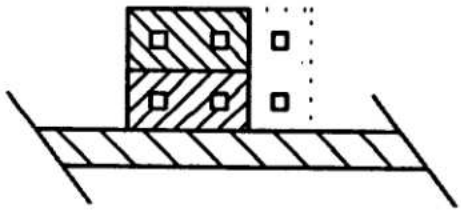
The CN3000 parallel printer output will interface with almost all printers that are designed for use on an IBM-PC parallel printer port. In addition to the printer option board, you will need to prepare an interconnecting printer cable between the controller and the printer or may purchase a 5" transition cable assembly as an accessory from the factory which mounts to the controller edge card and terminates in a 25-pin D connector and mates with a customer supplied PC printer cable.

JUMPER SELECTION - PRINTER OPTION

The printer board is isolated but may be configured to operate from either the internal isolated controller supply or from an external single +7 to +12VDC @ 50 mA supply using two shunt jumper blocks (supplied on the option board). The jumper positions are shown below:



INTERNAL SUPPLY
(Factory Default)



EXTERNAL SUPPLY

NOTE

SINCE THE TRANSITION CABLE USES A DB-25 CONNECTOR AND THE +SUPPLY VOLTAGE IS ON PIN 26, THE TRANSITION CABLE CANNOT BE USED WHEN AN EXTERNAL SUPPLY IS SELECTED.

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WIRING - PRINTER OPTION

All connections to the parallel printer board are made through a 26-pin edge card connector (OMEGA P/N CN3000-CONNECTOR supplied separately) which mounts to the plastic housing using two screws. Provisions have been made for a card edge connector key between edge card pins 3 and 5 to prevent backward mounting of the connector. The pin layout on the card edge has been set up so that mass terminated flat cables will match the standard DB-25 IBM-PC parallel printer connections when pin 1 on the option board is connected with pin 1 on the DB-25 connector. The table below shows the pin arrangement for both the edge card and the DB-25 connections. OMEGA offers card edge connectors and a pre-assembled transition cable as an accessory item. Consult the factory for more information.

EDGE CARD	DB-25 PINS	DESCRIPTION
1	1	STROBE
3	2	DATA 1
5	3	DATA 2
7	4	DATA 3
9	5	DATA 4
11	6	DATA 5
13	7	DATA 6
15	8	DATA 7
17	9	DATA 8
19	10	N/C
21	11	BUSY
23	12	N/C
25	13	N/C
2	14	PULLED UP TO +5V
4	15	N/C
6	16	PULLED UP TO +5V
8	17	GROUND
10	18	GROUND
12	19	GROUND
14	20	GROUND
16	21	GROUND
18	22	GROUND
20	23	GROUND
22	24	GROUND
24	25	GROUND
26	N/C	EXTERNAL +7 TO +12V

For short cable lengths in areas that are not noisy, unshielded cable may suffice. In noisy environments, it may be necessary to use shielded cables to avoid noise pick up. All installations are distance limited by the resistance of the cable leads and the capacity between leads of the interconnecting cable. DO NOT intermingle cables for data with power lines. Make sure that data cables are not run in the same conduit or cable tray with supply power wiring.

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OPERATION - PRINTER OPTION

Before the parallel printer output may be used, the CN3000 controller must be software configured to identify the card position in the controller and select the information to be supplied to the printer. Refer to Menu 971 in Section 12 and Menu 86 in Section 11 for details on this configuration. You may also use flag trigger monitors (Menu 42 in Section 7) to initiate printer output.

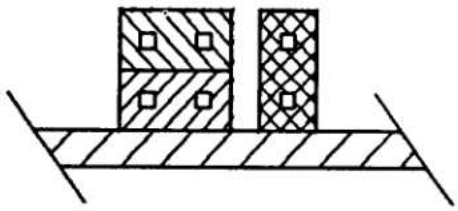
THE LOGIC I/O OPTION

The logic I/O option enables a CN3000 controller to send or receive digital signals to or from remote digital I/O logic modules. You may have either 8 I/O channels (1 board) or 16 logic I/O channels (2 boards). The logic board is designed to work with external modules operating with negative true logic (active low) operating at 5VDC. Each channel may be set up as an input or an output channel in the controller software programming but not both. This option will work with a number of manufacturers' standard input/output mounting boards with appropriate 5V I/O modules. Contact OMEGA for suggestions on a suitable mounting board and logic modules.

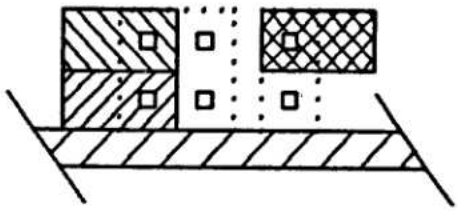
All I/O channels are pulled up on the option board through a 22K resistor to the +5V supply. The saturation voltage is approximately 1.1V at 12 mA.

JUMPER SELECTION - LOGIC I/O

The Logic I/O option board is isolated but may be configured to operate from either the internal isolated controller supply or from an external single +5VDC @ 50 mA supply using three shunt jumper blocks (supplied on the option board). The jumper positions are shown below:



INTERNAL SUPPLY
(Factory Default)



EXTERNAL SUPPLY
(No jumper connections)

CAUTION: When the internal supply is selected, it also connects to pins 1 and 25 of the edge connector. The controller internal power supply must not be used to operate the remote logic I/O mounting board and its modules. Make sure that pins 1 and 25 are NOT connected to the remote module's power supply. (There usually are jumpers on the remote rack for this purpose.) Connector pins 1 and 25 are to be used only when the external supply is used to power the CN3000 logic I/O option board.

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WIRING - LOGIC I/O

All connections to the logic I/O board are made through a 26-pin edge card connector (OMEGA P/N CN3000-CONNECTOR supplied separately) which mounts to the plastic housing using two screws. Provisions have been made for an edge card connector key between card edge pins 3 and 5 to prevent backward mounting of the connector. The pin layout on the card edge has been set up so that mass terminated flat cables will match the standard 26-pin edge card connector on a remote logic I/O mounting board when pin 1 on the option board is connected with pin 1 on the 26-pin mounting board connector. The table below shows the pin arrangement for the 26-pin edge card connector. OMEGA offers a pre-assembled unshielded 3' logic I/O cable (OMEGA P/N CN3000-I/O CABLE) as an accessory item. Consult the factory for more information.

EDGE CARD	DESCRIPTION
1	Vcc = +5VDC
3	N/C
5	N/C
7	N/C
9	Logic I/O #8
11	Logic I/O #7
13	Logic I/O #6
15	Logic I/O #5
17	Logic I/O #4
19	Logic I/O #3
21	Logic I/O #2
23	Logic I/O #1
25	Vcc = +5VDC

EDGE CARD	DESCRIPTION
2	Logic Ground
4	Logic Ground
6	Logic Ground
8	Logic Ground
10	Logic Ground
12	Logic Ground
14	Logic Ground
16	Logic Ground
18	Logic Ground
20	Logic Ground
22	Logic Ground
24	Logic Ground
26	Logic Ground

The remote digital I/O logic mounting board(s) and modules should be as close to the controller as possible. For short cable lengths in areas that are not noisy, unshielded cable may suffice. In noisy environments, it may be necessary to use shielded cables to avoid noise pick up. All installations are distance limited by the resistance of the cable leads and the capacitance between leads of the interconnecting cable. DO NOT intermingle logic cables with power lines. Make sure that logic cables are not run in the same conduit or cable tray with supply power wiring.

OPERATION - LOGIC I/O

Before the logic I/O option may be used, the CN3000 controller must be software configured to identify the board position in the controller and configure each channel for use within the controller. Refer to Menu 97 in Section 12 for logic I/O configuration and Section 7 to configure a trigger monitor for use with the logic channel. Refer to Menu 825 in Section 11 for special logic status displays.

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SECTION 15 - SERVICE

If difficulty is experienced with a controller, first recheck all wiring. Also pull the electronic assembly forward out of the case to check that all plug-in components including cables are snugly in their connectors.

Check that the correct key sequence has been used and that the setpoints and tuning values set into the controller are appropriate for the application.

DIAGNOSTIC DISPLAYS

On start-up and throughout normal operation, the controller monitors internal operations and power levels. Upon detection of an out-of-tolerance condition, the controller will shut off the control output(s), activate alarm(s) and display an appropriate message. Some simple messages such as "OPEN SENSOR" are obvious and can be easily by corrected. Other messages may indicate that service is required. A listing of error messages along with some suggestions for dealing with the problem follows:

Cannot delete the end of profile
You cannot delete the step following the last programmed step of a profile.

Cannot insert twice
The "insert new step" command in profiles must be followed by a command other than INSERT. Two blank steps may not be inserted consecutively.

Can't delete while a profile is running
You must de-select or STOP a profile before you can delete.

Can't program while a profile is running
Profiles may be programmed or edited only when no other profile is running.

CJ CAL BAD
The measured cold junction calibration (9-1-3-3) value was not within a reasonable range. Wait a few minutes and repeat the step. If this message is still displayed, consult the factory.

CONFIG DATA LOST PRESS ENTER
An error has been detected in the configuration data. Reprogram the configuration data (Section 12) to restore the data. NOTE: All installed outputs should be initialized as described in MEMORY CLEAR PROCEDURE (step E) in this section.

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Key storage full. Ending recording.

This message appears when the memory allocated for macros has been filled.

Label not found

A label number that does not exist has been used in a profile LOOP command.

LOCKMAC cannot be selected.

This message appears if an attempt is made to include LOCKMAC while recording a macro. You cannot lock or unlock a macro using a macro key.

MACRO # cannot be changed

This message appears if you attempt to select another macro key while recording a macro. Chaining macros is not allowed.

MACRO DATA LOST PRESS ENTER

The data for a macro has been damaged or erased and cannot be run. Press ENTER. Reenter the macro if it is still needed.

No recording found for this macro

An unused macro number has been selected under SLO PLAY or LOCKMAC?.

No room left for another profile.

The memory allocated for profiles has been filled.

No room left for recording.

The memory allocated for macros has been filled.

No room left for this command.

The memory allocated for profiles has been filled.

PBID ERR

The P-BUS ID routine has not identified an output or option board correctly. Make sure that all output and option cards are securely in their connectors. Try a power-down reset to see if the error may be cleared.

PROFILE DATA LOST PRESS ENTER

An error has been detected in the profile data. Reprogram the profiles to restore the data.

Profile does not exist.

A profile number that has not been programmed has been selected in a profile DELETE command.

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Profile not found
A label number that does not exist has been used in a profile LINK or CALL command.

RECORDING: Last key pressed is illegal.
An illegal key has been pressed while recording a macro.

SLO PLAY cannot be selected.
SLO PLAY has been selected while recording a macro.

THERE CANNOT BE MORE THAN 99 STEPS
The profile being programmed already has 99 steps. Break the profile into two or more profiles and use the LINK command to chain them together.

Too Many Calls
A profile has been programmed with more CALL commands than allowed.

Too Many Flags
A profile has been programmed with more FLAG commands than allowed.

Too Many Loops
A profile has been programmed with more LOOP commands than allowed.

MEMORY CLEAR PROCEDURE

NOTE

This process should only be performed as a last resort. Use of this procedure will cause configuration parameters to be lost requiring reprogramming and reconfiguring of the controller.

The following procedure should be used to clear the memory:

A. Key in MENU-9-8 to reach a display that says "HAVE YOU LOST DATA & NEED TO START NEW?".

B. If the answer is yes, press the "YES" key which results in a display that says "YOU MUST RE-CONFIG OK?". Pressing the "NO" key returns you to the CONFIG menu.

C. If you respond "YES", you will be requested to enter the numbers "7-3-2-8-ENTER" in sequence to confirm that you wish to proceed. If you do not wish to reconfigure the unit, respond "NO".

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D. The controller program will clear the memory. Input configuration and calibration will be retained.

E. It is recommended that you enter the following key sequence:

Menu-9-2-1
0-1-UP
0-1-UP
0-1-UP
0-0-0-0

The purpose of this sequence is to initialize any installed outputs. Failure to do so may result in a loss of configuration data message following a power down.

F. The controller must now be reconfigured for the application.

BATTERY REPLACEMENT

The controller contains a field replaceable lithium battery used to power the internal memory. The battery voltage is measured and the result is shown in the third sign-on display (see Section 2). If the battery needs to be replaced, remove the controller from its housing and replace the battery located on the left printed wiring board from the rear using a Ray-O-Vac BR2330, CR2330 or equivalent. When replacing the battery, take care not to distort the battery retaining clip.

Before replacing a battery, make a record of the controller configuration and saved profiles since removing the controller from its case and replacing the battery will cause this data to be lost.

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INDEX

"0" key 2-5
"6" key 2-4
"7" key 2-4, 10-1
"9" key 2-5, 3-2, 11-4
0% AT 12-9
100% AT 12-9
3-wire 12-3
+ 12-14
- 12-14
× 12-14
/ 12-14
± DIFF'L 5-4, 5-5, 5-6, 12-8
FILES 9-4
#SAMPLES 9-4

A

A < B 7-9
A = B 7-9
A > B 7-9
A/M 2-2
A/M key 2-3, 11-4, 12-4, 12-5
AC SUPPLY WIRING 1-6
active loop 5-7
active set 5-7
ALARM 11-1
ALARM # 7-4
alarm 12-6, 12-7
ALARMS 7-1, 7-4
Alarm/mode indicator 2-1
ALLOCATE 9-4
ANALOG 12-8
analog input 12-5
analog output 12-6, 12-7, 12-9, 12-10
ANALOG VOLTAGE OR CURRENT OUTPUT 1-11
ANAPHLIN 12-8
AND 7-9
Annunciator messages 2-1
ANNUNS 12-10
ARROW keys 2-2, 2-4
ASIGN 6-2
ASIGN Lx 6-2
ASPX 12-13, 12-15
ASSGN TO 7-5, 7-10
ASSIGNMENT 7-5, 7-10, 12-6, 12-10
Assured soak CONTINUE 6-3
Assured soak DISCRETE 6-3
ASURD SOAK 6-3
AUTHORIZED USER 4-1
AUTO 2-1, 2-3, 5-7, 5-8
AUTO IN1 . . . . . 7-6, 7-11
AUTO IN2 . . . . . 7-6, 7-11
AUTO INHIBIT 7-6, 7-11
AUTO/MANUAL 2-3
AUTO-MEASURE 2-2, 12-4
AUTOMATIC 2-2
AUTO STOP 9-3
AUX SP 5-3, 5-4, 5-6
averaging 12-1

B

Backspace 2-5
BAUD 10-2
BATTERY REPLACEMENT 15-4
(BLANK) 12-13, 12-15
BLOCK END 9-2
BLOCK START 9-2
Breakpoints 12-15, 12-16

C

CAL 0% 12-9, 12-10
CAL 100% 12-9, 12-10
CAL ANA 12-9
CALIB CJC 12-5
CALIB SPAN 12-4
CALIB ZERO 12-4
CALIBRATE 12-4
calibration 12-4, 12-9, 12-10
CALL 6-4, 6-5
CJC 12-1, 12-3
CLEAR 8-1, 9-3
CLEAR FLAG 7-5, 7-10
Clock Saver Option 11-2
COMM 10-2
CONFIG 12-1
CONFIGURATION PROGRAMMING 12-1
constants 12-17
CONSTNTS 12-12, 12-17
CONTINUE 6-3
CONTROLS 6-4
COPY 5-3, 5-5, 5-6
Copy library set 5-7
COPY TO 5-5, 5-7
COUNT 6-4
CREATE OR REWORK A PROFILE 6-2
CURR LP 10-1
CURRENT 1-11, 12-2
current output 12-9
Cursor 3-1, 3-3, 5-2
CURVE 12-1, 12-2
curve ID 12-2
CYC TIME 12-10
CYCLE TIME 5-2, 5-3

D

DATE 11-2
DATA LOG 9-1
DC TRIGGER 1-10, 12-10
DEFAULT 7-5, 7-10, 12-10
DELAY 6-4
DELETE A PROFILE 6-5
Delete current step 6-3
DELTA TIME 9-2
Derivative 5-1
DESCRIPTION & INSTALLATION 1-1
destination 12-12
DESTINATION LIST 12-14, 12-15, 12-17, 12-18
DEV BND 7-5, 7-9
DEV HI 7-5, 7-9
DEV LO 7-5, 7-9
DEVIATION 5-1, 7-2
Deviation alarm 7-1

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DEVIATION BAND 7-2
Deviation band alarms 7-1
Deviation setpoint 7-4
DIAGNOSTIC DISPLAYS 15-1
Differential band 5-1
DIFF'L 5-3, 5-5, 5-6
Digital Communications 1-12, 4-1, 10-2, 12-10, 14-1
Direct acting (COOL) 5-2, 12-6, 12-7
DIS.W/L 7-6
DIS.W/L1 7-11
DIS.W/L2 7-11
DISCRETE 6-3
displacement pumps 12-8
DISPLAY 2-1, 11-1
DISPLAY AND KEYPAD 2-1
DP - LP1 11-1
DP - LP2 11-1
dual loop 12-20

E

EIA-232 . . . . . 10-2, 14-3, 14-4
EIA-422 14-3
EIA-422/EIA-485 14-5
EIA-485 14-3
EIA-530 14-6
ELECTROMECHANICAL RELAY OUTPUT 1-9
EMR 1-9, 12-8, 12-10
ENABLE 7-4, 7-7
ENABLE/DISABLE 3-3
END 6-4, 6-5, 12-14
END MAC 11-4
ENTER key 2-3
EQ1..EQ16 12-12
EQUATION 12-12, 12-13, 12-14, 12-16, 12-17, 12-18
ERROR MESSAGES 15-1
EXAMPLE - DATA LOGGING FILE 9-5
EXAMPLE - MACRO 11-5
EXAMPLE - MATH 12-16
EXAMPLE - MONITOR 7-12
EXAMPLE - PROFILE 6-5
EXT CJC? 12-3
EXT CJC= 12-3

F

"failsafe" type operation 7-1
FAST RESPONSE 5-7
feed forward 12-12
FILE # 9-3
FLAG 6-4
FLAG # 7-8
Flag macros 11-3
FLAGS 7-2
FORCEOUT 7-5, 7-10, 12-10
FRQ PULS 12-8
FREQUENTLY USED DISPLAYS 13-9
Full duplex 14-3, 14-5
FUNCTION 7-5, 7-10, 12-6, 12-10, 12-21, 12-20

G

gain 5-1
GR SCALE 9-3
GRAPH 9-1, 9-2

H

Half duplex 14-5
HTEST # 8-2
HI DISP 12-5
HI INPT 12-5
HISTORY 8-1
History file 7-1
HOR AXIS 9-4
HRS:MIN 11-2
HYSTERESIS 7-1
HYSTRSIS 7-5, 7-10

I

ID # 4-1
IDENTIFICATION 1-2
IGNORE 11-5
INHIBIT 7-3, 7-4, 7-6, 7-7, 7-11
INPUT 7-4, 12-15, 12-16
input board 12-1
INPUT CONFIGURATION 12-1
Input linearization 12-2
INPUT RANGES 1-3
INPUT WIRING 1-8
INPUTS 9-4, 12-1
INPUT A 7-7
input AVG 12-3
INPUT B 7-8
INPUT HARDWARE CONFIGURATION 1-6, 12-1
Input menu 12-1
INPX 12-13
Insert new step 6-3
INSTALLATION 1-1
integer 12-12
Integral 5-1
INTERMITTENT 9-3
INTERMITTENT INTERVAL 9-2, 9-3
INTERVAL 9-3
IO A #X 12-21
IO A CFG 12-21
IO A POS 12-21
IO B #X 12-22
IO B CFG 12-22
IO B POS 12-21
I/O Channels 1-12, 7-8, 11-4, 12-21

J

JUMPER BLOCK CONFIGURATION 1-7
JUMPER SELECTION - EIA-232 14-4
JUMPER SELECTION - EIA-422/EIA-485 14-6
JUMPER SELECTION - LOGIC I/O 14-11
JUMPER SELECTION - PRINTER OPTION 14-9

K

Keypad macros 11-3
K01...K16 . . . . . 12-12, 12-14, 12-18

L

L1 PRI D 12-6
L1 PRI R 12-6
L1 PRI S 12-6
L1 SEC D 12-7
L1 SEC R 12-7
L1 SEC S 12-7
L2 PRI R 12-7

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L2 PRI S 12-7
L2 SEC D 12-7
L2 SEC R 12-7
L2 SEC S 12-7
LABEL 6-4
LAST ENTRY 2-5, 3-2, 11-4
LATCH 7-3, 7-4, 7-6, 7-7, 7-11
LEFT or DOWN ARROW key 2-4
Library 5-2, 5-5
LIBRARY FILES 5-7
Library sets 5-3
LIN 12-15
LINEAR X 12-15
linearization 12-2, 12-12, 12-15
LINK 6-4
LIST SELECTION 3-3
LOCKMAC? 11-6
LOGC IN1 11-4
LOGC IN3 11-4
LOGIC IO 11-2, 11-3, 12-20
LOGIC I/O OPTION 14-11
LOOP 2-4, 6-4, 10-1, 12-20
LOOP 1 ..... 5-3, 5-4, 12-21
LOOP 2 ..... 5-3, 5-5
LOOP 1&2 12-21
LOW DISP 12-5
LOW INPT 12-5

M

M1...M16 12-18
MACRO # 11-4
MACROS 4-1, 11-3
MAN 2-2
MAN# 5-8
MANx 2-1
MANUAL 2-3
MANUAL? 9-4
MANUAL CONTROL 2-2, 12-9, 12-10
MANUAL mode 5-8
MANUAL tuning 5-2, 5-4
MARK BEG 9-3
MARK END 9-3
MASTER user 12-11
MATH 12-12, 12-16, 12-17
math equations 12-16
MAX 9-2
MAX PULS 12-8
MAX PWR 12-8
MAX SLEW 12-8
MAXIMUM 9-3, 9-4
MEAN 9-2, 9-3
MEMORY CLEAR PROCEDURE 15-3
memory locations 12-12, 12-17, 12-18
MENU 2-5
menu key 2-4, 12-10
MENU MAPS 5-2, 13-1
MENU SYSTEM 3-1
MIN 9-2
minutes 5-1, 5-5
MIN PWR 12-8
MINIMUM 9-3, 9-4
MODELS AND ACCESSORIES 1-2
modules 12-9
MONTH 11-2
monitor 12-6, 12-8, 12-10
MONITORS 7-1, 7-3
MOUNTING 1-4
MXX 12-14, 12-15

N

NAND 7-10
NLOG 12-15, 12-17
NOISE SUPPRESSION 1-5
NONE/ALM 7-5, 7-10, 12-6, 12-8, 12-10
NOP 12-15
NOR 7-10
NUMERIC ENTRY 3-2

O

OC 1-8, 12-10
OFF 6-3
offset 5-1, 5-5
ON/OFF 2-3, 5-1, 5-2, 5-4, 5-5, 5-6, 12-8
ONE SHOT 7-3, 7-6, 7-11
OPEN COLLECTOR/DC TRIGGER OUTPUT 1-10
operand 12-12, 12-17, 12-18
OPERAND LIST 12-13
OPERATOR LIST 12-14
OPERATING KEYS 2-2
OPERATN 10-1
OPERATION - COMMUNICATIONS 14-9
OPERATION - LOGIC I/O 14-12
OPERATION - PRINTER OPTION 14-11
operators 12-12, 12-17, 12-18
OPT CARD 12-21
OPTIONS 7-6, 7-11
OPTIONS BOARD INSTALLATION 14-1
OPTIONS BOARDS 14-1
OPTIONS CARD WIRING 1-12
OR 7-9
OTX% 12-14
OTXR 12-14
OUTPUT 5-7, 11-1, 12-7
OUTPUT ACTION 7-2
OUTPUT CONFIGURATION 5-2, 12-6
output board 12-6
output menu 12-1
output modules 1-9, 12-6
output type 12-8
OUTPUT WIRING 1-9
OUTPUTS 7-5, 7-10, 12-6, 12-10
OUTX 12-14
Overrange 2-1
overshoot 5-1

P

P M# 5-8
P ON 2-2, 5-7, 6-2
PANEL CUTOUT 1-4
parallel printer 12-20
PARALLEL PRINTER OPTION 14-9
PAUS 2-1
PAUSE 10-1
phase-fired 12-8
PID 5-1, 5-4, 5-5, 5-7, 12-13, 12-16

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PID constants 5-7
PID set 5-5, 5-6
PID sets 5-2
Piece-wise linearization 12-15
PR Band 5-1, 5-4, 5-5, 5-6
position 1, 2 12-20
PREVIOUS/NEXT ITEM 3-2
Primary Output 5-3, 5-4, 5-5, 12-6, 12-7
Principal display 2-1
PRINTER 11-6
PRINTTST 11-6
PRIVILGE 12-11
PRN DLOG 11-6
PRN POS 12-21
PRN STAT 11-6
PROC HI 7-4, 7-9
PROC LO 7-4, 7-9
PROFILE 2-2, 5-8, 11-1
PROFILE COMMAND LIST 6-1
PROFILE COMMANDS 6-3
PROFILE CONTROL 6-1
Profile number 6-2
Profile ramp 5-8
Proportional 5-1
PROPORTIONAL BAND 5-1, 5-3
Pulse duration 12-8
Pulse frequency 12-8
Pulse output 12-8
PV @REST 5-7
PV BIAS 12-12
PV units 2-1, 5-1, 5-4
PVX 12-15

Q

QUIET 7-1, 7-6, 7-11, 8-1

R

RAMP 6-1
RATE 5-1, 5-3, 5-4, 5-5, 5-6
ratio 12-12
REC 11-4
RECORD 11-4
REM SP 10-1
Remote setpoint 2-1
repeats/min 5-1, 5-4, 5-5, 5-6
RESET 5-1, 5-3, 5-4, 5-5, 5-6, 7-4, 7-7
RESET/INH 7-4, 7-7
RSET/INH 7-4, 7-6, 7-7, 7-11
RESPONSE 5-7
RESULTS 5-7
RESUME 10-1
RETN SEL 12-7
RETRAN 12-9
RETRANS 12-7
retransmission 12-6
RETURN 6-5
Return key 2-5
Reverse acting (HEAT) 5-2, 12-6, 12-7
REVIEW 8-1
RM 2-1
RS-232 . . . . . 10-2, 14-3, 14-4
RS-422 14-3
RS-422/485 10-2
RS-485 14-3
RSP 2-1
RTC 11-3
RTD 12-2
RTD 0.1? 12-3
RTD LEAD 12-3
RTD/THRM 12-2
RTRN SEL 12-9
RUN A PROFILE 6-2

S

S/S CFG 10-1
S/S key 2-4
S/S (shift) key 3-2
S/S (sign) key 3-2
SAMPLE COUNT 9-2
samples 12-3
scaling 12-5
SEC IDS 12-11
SEC VISI 12-11
Secondary Output 5-3, 5-4, 5-6, 12-7
SECURITY 4-1, 5-2, 11-4, 12-10
security code 4-1, 12-11
Security system 4-1
SEGMENT 6-1
SEL INP# 12-2
SEL OUT# 12-6
SELFTUNE 5-1, 5-7, 5-8
Self-Tuning 5-2
SENSOR BREAK 7-3
SERIAL COMMUNICATIONS OPTION 14-3
SERVICE 15-1
SET BRTC 11-2
SET FLAG 7-5, 7-10
Setpoint 7-1, 7-4, 7-7
SETPOINT BIAS 5-3, 5-5, 5-5, 5-6
SETPOINT CHANGES 2-5
SETUP 7-4, 7-7, 9-3, 12-2, 12-2
Shift DOWN 3-2
Shift UP 3-2
SHOW CLK 11-2
SIGN 2-4
SIGN-ON DISPLAYS 2-2, 12-20
slew rate 12-8
SLO PLAY 11-6
SLOW RESPONSE 5-7
SOAK 6-1, 6-3
SOLID STATE RELAY OUTPUT 1-10
SP BIAS 5-4, 5-6
span limits 12-2
SPBX 12-13, 12-15
SPECIAL FUNCTIONS 7-2
Split output 12-7
Split range output 12-6, 12-7
SPX 12-13, 12-15
SQRT 12-14
SSR 1-10, 12-8, 12-10
START 2-4, 5-7, 7-6, 9-1, 11-2
START L1 10-1
START L2 10-1
STATISTICS 9-3
STATUS 2-4, 6-2, 11-1
Step number 6-2
STOP 2-1, 2-4, 5-8, 9-1, 10-1
STOP L1 10-1
STOP L2 10-1

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STOP mode 2-2
STOR 12-14
SWITCH ENTRY 3-3

T

TEST EXC 8-2
TEXT LEN 11-6
Thermistor 12-2
Thermocouple 12-2
TIME PR 12-8
Time Proportional 5-2, 12-10
TIME INTERVAL 9-3
Time remaining 6-2
TIME SEG 6-3
TIME SET 11-2
TO DEGREE C? 12-3
TPR 5-2
TRANSDUCER POWER SUPPLY 1-11
TRIGGER 7-7
TRIGGERS 7-1, 7-7
TUNE 5-2, 5-7
Tune sets 5-5
TUNE SP 5-7
TUNING 5-1
TUNING CHOICE 5-2
Tuning constants 5-2, 12-6, 12-7
TUNING MENUS 5-2
Tuning parameters 5-3
TUNSET 6-4
TYPE 7-4, 7-9, 12-1, 12-2, 12-8

U

UNIT 10-2
units - F or C 12-1, 12-3
UNPACKING 1-3
UP or RIGHT ARROW key 2-2
UP/DOWN ARROW keys 2-5
USE LF? 11-6
USER ID 4-1, 5-2, 11-4, 12-11
USER IDENTIFICATION 4-1
UTILITY 11-1

V

VIEW LOG 9-2
VOLTAGE 1-11, 12-2
voltage output 12-9

W

WAIT FLAG 6-4
WAIT VAL 11-5
WIRING 1-5
WIRING - EIA-232 AND EIA-422/EIA-485 14-6
WIRING - LOGIC I/O 14-12
WIRING - PRINTER OPTION 14-10

X

XNOR 7-10
XOR 7-9

Y

YEAR 11-2

Z

ZOOM IN 9-2
ZOOM OUT 9-24

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