

**DEVAR Inc.**  
MODEL 3015



HIGH LEVEL PROCESS SIGNAL INPUT  
INDICATOR - CONTROLLER  
Rev: 12 December 2002

**DEVAR Inc.**

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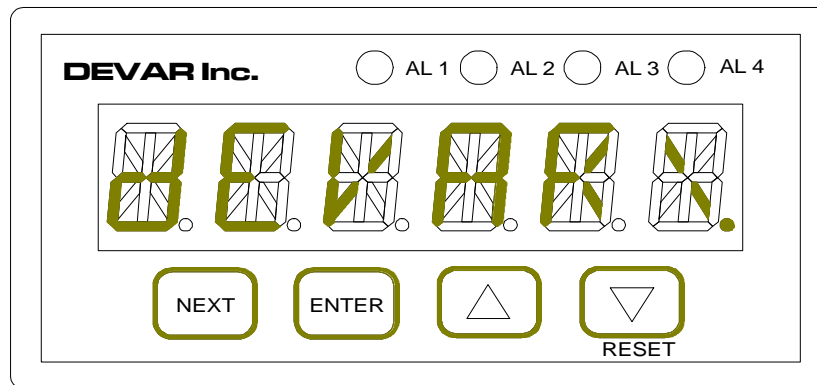
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## INTRODUCTION:

The 3015 is an accurate, sophisticated, easy to configure and operate, indicating controller with a highly visible display which was designed to accept thermocouples and RTDs as input.

## FEATURES

- 6 character alphanumeric display.
- High efficiency red LED characters, 0.54" high.
- 15 segments characters for easy to read prompts. "No more hieroglyphics!"
- Scrolling multi-word configuration prompts for clarity.
- Select either a 100 $\Omega$  Platinum RTD with  $\alpha = 0.00385$  or  $\alpha = 0.00392$ , a 120 Nickel RTD with  $\alpha = 0.00672$ , or a T, J, E, K, N, R, S, or B type thermocouple as input.
- Cold junction compensation for thermocouple inputs is performed with an integral high quality platinum sensor.
- Zero, two, or four alarm channels with front panel LED indication.
- Each alarm channel has one 10Amp SPDT relay.
- Each alarm channel has independently configured trip and reset points.
- Each alarm can be independently configured to latch.
- Each alarm can be independently configured to activate a horn.
- Each alarm can be independently configured to cause the display to flash.
- Each alarm is independently configured for Failsafe Polarity™, which controls whether the relay output goes to the tripped or reset state when power is removed.
- Four separate, menu selectable, horn actions for a variety of acknowledgments.
- A security code can be set to prevent unauthorized access.
- Optional analog or digital retransmission.



**Figure 2:Front Panel**

## GENERAL INFORMATION

### PHYSICAL LAYOUT

#### Front Panel

The six character display provides a process indication, a temperature indication, or plain English configuration prompts. Four LEDs indicate the status of each alarm. Four keys enable configuration and user input. See figure 1 above.

#### Rear Panel

All electrical connections are made through plug in screw clamp terminal blocks. A fifteen terminal connector is provided for AC power and relay contacts. A nine terminal connector is provided for temperature sensor input signals and optional retransmission connections. These connectors accept 24 to 14 AWG wire.

#### Mounting

The 3015 case is designed for panel mounting in a 1/8 DIN cutout. Two clamping brackets attach to and slide in milled slots on either side of the case. The brackets are clamped by screws attached to the rear panel.

### BASIC OPERATION

When power is applied or cycled, the unit identifies itself by displaying 'DEVAR MOdel 3015 <either zero, two or four> ALARMS BUILd <time> <day> <month> <year> Start <selected input signal>', and proceeds to indicate a process quantity based on the input signal. If the unit contains alarms, the relays will remain de-energized until the input is measured, analyzed and the alarm states are identified. The unit will periodically scan the front panel switches to detect any user input. At this point only NEXT and RESET are operational. Pressing NEXT causes the unit to enter the menu system, which allows the user to configure the 3015. RESET is used to silence the horn and clear latched alarms, if these options are enabled.

## ACCEPTABLE INPUTS

The 3015 accepts thermocouple or RTD sensors. Thermocouple types T, J, E, K, N, R, S, and B are provided. Cold Junction Compensation is accomplished by a platinum sensor embedded in the input connector. The 3015 directly accepts either a 100 $\Omega$  Platinum  $\alpha = 0.00385$ , a 100 $\Omega$  Platinum  $\alpha = 0.00392$ , or a 120 $\Omega$  Nickel  $\alpha = 0.00672$  RTD in either a 2 wire, 3 wire, or 4 wire configuration as input. Selecting the desired input sensor, temperature scale, and RTD wiring is accomplished by utilizing the front panel buttons.

## PROCESS INDICATION

Five characters are used to indicate the measured temperature. The sixth character indicates the displayed temperature scale, either 'F' or 'C'. If the input signal becomes too large for the selected input, the unit displays 'OUCH!'.

## DIP SWITCH SW2

This switch is accessed through a hole in the bottom of the case. The functions controlled by the poles of this switch are:

### Pole 4: SETUP PROTECTION

Set ON causes an access code check to enter the menu system.

### Pole 3: AUDIBLE ALARM

Set ON enables the horn to sound.

### Pole 1: FACTORY CALIBRATION

Set ON enables modification of the factory calibration constants by activating the 'INPUT CAL.' menu item. Performing a factory calibration requires specific equipment and technique for which a typical thermocouple and RTD calibrator is insufficient.

### Pole 2: SYSTEM INITIALIZATION

If all poles of SW2 are ON, the RESET front panel button is pressed and held, and the unit is restarted, the 3015 enters a menu where the option cards can be enabled or the EEPROM can be initialized with nominal configuration settings and calibration constants. If the EEPROM is reinitialized, a factory calibration, as described under the 'INPUT CAL.' section below, must be performed before placing the 3015 into service. The selection of configuration settings was arbitrary. A diagram of this menu is at the end of this document. The nominal configuration settings are tabulated below.

Table of Configuration Settings after EEPROM initialization:

Security code	000000 (six zeros)
Input type	TC-J, °C
Retransmission	None
ADJUST OFFSET	000.0

Table of Alarm Settings after EEPROM initialization:

channel	trip	reset	horn	latch	flash	fail safe polarity
1	150.0	100.0	silent	do not latch	never	fail reset
2	300.0	250.0	silent	do not latch	never	fail reset
3	450.0	400.0	silent	do not latch	never	fail reset
4	600.0	550.0	silent	do not latch	never	fail reset

## MENU SYSTEM

Utilize the menu system to set and view the parameters that define how the 3015 operates. The menu system is activated and controlled through the front panel keypad. The parameters that can be configured are: selecting the input type, adjusting the displayed temperature by adding an offset, setting the alarm trip points, setting the alarm reset points, defining how and when the audible alarm operates, activating latching alarms, activating a flashing display on alarm, set the relay contact Failsafe Polarity™, defining a security code, and controlling the action of any option cards. The menu system is also used to view or reset the peak and valley readings.

### Inactivity time out

The 3015 is not operational while in the menu system. If no key is pressed, after approximately 40 seconds the 3015 returns to the process indication mode.

### Menu Navigation

ENTER, NEXT, and RESET are used to move through the menu options. A diagram of the menu system can be found at the end of this document. The buttons used to move between different points on the diagram are clearly labeled. Press ENTER to enter a submenu or entry routine and to accept a selection. Press RESET to exit the current menu level. Press NEXT to move to the next available menu option.

example:      NEXT moves from 'ALARM1' to 'ALARM 2'  
                   ENTER moves from 'ALARM1' to submenu 'TRIP 1'  
                   RESET returns from submenu 'TRIP 1' to 'ALARM1'

### Selecting a parameter from a list

Certain parameters, such as input type, are selected from a list. ENTER is used to start the selection process. Scroll through the available choices with the <up arrow> and <down arrow> keys. Press ENTER to make the displayed item the current setting, 'STORED' will be displayed as confirmation. NEXT cancels the selection process and returns to the menu prompt.

### Entering a number or text

ENTER is used to start the entry process. The currently selected character will be flashing. Press NEXT to select which character to edit. Press <up arrow> or <down arrow> to change the value of the currently selected character. Press ENTER to accept the displayed value and return to the menu prompt.

## DETAILS OF THE MENU SYSTEM

### 'PEAK AND VALLEY'

This menu item is not blocked by setup protection. Submenu choices provide a method to observe and/or reset the largest and smallest process value detected.

### 'INPUT CAL.'

**WARNING!** The following process, if not properly executed, invalidates any accuracy claims for the 3015 and puts the unit in an undefined state of operation. The menu system will remain active, so calibration attempts can be executed until success is achieved.

Set SW2 pole 1 ON to enable input calibration through the 'INPUT CAL.' menu prompt. Input calibration consists of allowing the 3015 to sample several defined inputs. A complete calibration requires sampling the calibration points tabulated below. The overall accuracy of the 3015 depends on the accuracy of these points. An abbreviated calibration can be performed with the calibration points that correspond to the selected input of the unit. The calibration points and what they affect are contained in the table below.

To sample a calibration point, apply the signal, navigate to the menu prompt for that signal and press the ENTER key. For example, apply -100.00mV, navigate to the '-100.0mV' prompt, and press ENTER. The display will alternate between 'SAMPLE' and a number several times. When sampling is complete, the unit will alternately display 'ACCEPT' and the number. Press ENTER to accept this value as the new calibration constant. Repeat this process for each of the calibration points. The number indicated during sampling corresponds to the A/D converter output for that input. The table below lists the nominal values for the calibration points. The values observed for a particular 3015 will be slightly different. Look for problems if the observed number varies significantly from the nominal value, such as observing 32689 when 2822 is expected.

Table of Calibration Points, What They Affect, and Values Returned

Calibration Point	'SAMPLE' result	Calibration Point	'SAMPLE' result	Affects
'-100.00mV'	6501	'100.00mV'	59034	TC-J, TC-E
'-50.000mV'	6501	'50.000mV'	59034	TC-K, TC-N
'-25.000mV'	6501	'25.000mV'	59034	TC-R, TC-S, TC-T
'-12.500mV'	6501	'12.500mV'	59034	TC-B
' 10.00Ω'	1193	'400.00Ω'	47758	all RTD's
'-40°C 84.92Ω'	955	'85°C 132.75Ω'	57309	Thermocouples



### 'SELECT INPUT TYPE'

Press ENTER at this menu prompt to enter the selection routine. The current selection is displayed, use <up arrow> and <down arrow> to choose either 'Pt385', 'Pt392', 'Ni672', 'TC-T', 'TC-J', 'TC-E', 'TC-K', 'TC-N', 'TC-R', 'TC-S', or 'TC-B'. Press ENTER to select the displayed temperature sensor. The currently selected temperature scale is then displayed. Use <up arrow> and <down arrow> to display either '°C' or '°F', then press ENTER to select the desired temperature scale. If a RTD was selected, the currently selected wiring style is displayed. Use <up arrow> and <down arrow> to display either '2 WIRE', '3 WIRE', or '4 WIRE', then press ENTER to select the desired wiring style. 'STOREd' is displayed to confirm the new selection. Press NEXT at any time before pressing the final ENTER to return without making a new selection.

### 'AdJUST OFFSET'

The offset allows a fixed value to be added to, or subtracted from, the indication.

EXAMPLE: A kiln is being fired to 450°F, but the 3015 is indicating '447.8F' due to normal variation of the attached probe. The user navigates the menu system to 'AdJUST OFFSET' | 'NEW OFFSET' and edits the entry to 2.2. The 3015 now displays '450.0F'.

### ALARMS

The 3015 can have either zero, two, or four alarms. The status of each alarm is indicated by a front panel LED.

### 'TRIP' and 'RESET'

Independent trip and reset points allow alarm action (high or low alarm) and hysteresis (value between trip and reset points) to be precisely controlled. Setting the trip point to a value higher than the reset point configures that alarm as a high alarm. Setting the trip point to a value lower than the reset point configures the alarm as a low alarm. Setting the trip and reset points to the same value disables the alarm, which is held in the non-alarm condition.

### 'HORN'

Each alarm can be set to activate the horn.

### 'LATCH'

An alarm configured to latch will return to the nonalarm condition when the process meets the reset condition and the RESET button is pressed.

### 'FLASH SCREEN'

Each alarm can be set to cause the screen to flash.

### 'FAIL SAFE POLARITY'<sup>TM</sup>

Each alarm can be set so that on a power failure the relay will go to either the tripped or reset state. The combinations of settings and wiring can make set up confusing, but the following procedure will always produce the desired results. First, wire up the relays so the controlled function is in the proper state for failsafe. If failsafe is a closed

contact, wire between 'P' and 'NC'. If failsafe is an open contact, wire between 'P' and 'NO'. Second, change the failsafe configuration setting to agree with the alarm state when in failsafe.

Example: A two channel 3015 is measuring the temperature of an oven. Alarm one controls the heating elements, and alarm two causes an external horn to sound if the temperature should go above an extreme. Should the power fail, we want the heater to be off and the external horn to be on. An open contact turns off the heater, which corresponds to a tripped alarm, so alarm 1 is wired to 'P' and 'NO'. A closed contact activates the horn, which corresponds to a tripped alarm, so alarm 2 is wired to 'P' and 'NC'. Set alarm 1 and alarm 2 failsafe mode to 'FAIL TRIPPd' in the configuration menu.

The Failsafe Polarity™ setting should only be used to set the correct polarity for failsafe operation, and should NEVER be used to compensate for improper wiring. After installation, perform this safety test: turn everything on except for the 3015. If the controlled functions are all in their failsafe condition, the relays are wired correctly.

#### 'HORN ACTION'

DIP switch SW2 pole 3 set ON allows the horn to sound. The horn is controlled by the change in the status of an alarm. Each alarm has a setting that causes the horn to sound, therefore, none, any, or all of the alarms can activate the horn. The horn can be set to operate in any of the methods detailed below. Note: "RESET" is a front panel button and "reset" is an alarm condition. To avoid confusion, an alarm which has been reset will be called clear.

#### 'SOUND WITH ALARM'

The horn will sound when an alarm is set and is silent when all alarms are clear. If any of the alarms are configured to latch, RESET must be pressed to unlatch those alarms that are clear.

#### 'SOUND UNTIL RESET'

The horn will sound when an alarm is set and is silent when either all alarms are clear or the RESET button is pressed. If any of the alarms are configured to latch, pressing RESET a second time will unlatch those alarms that are clear.

#### 'LATCH GOING ACTIVE'

The horn will sound and stay on after an alarm trips. The horn can only be silenced by pressing the RESET button. If any of the alarms are configured to latch, pressing RESET a second time will unlatch those alarms that are clear.

#### 'LATCH WITH CHANGE'

The horn will sound and stay on after an alarm either trips or clears. The horn can only be silenced by pressing the RESET button. If any of the alarms are configured to latch, pressing RESET a second time will unlatch those alarms that are clear.

### 'CHANGE ACCESS CODE'

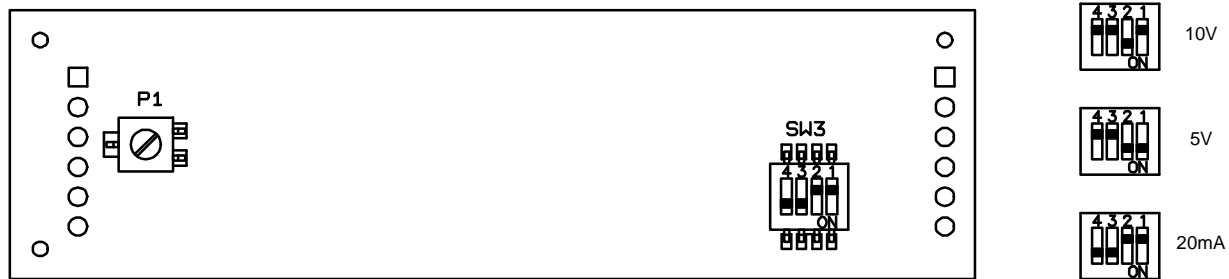
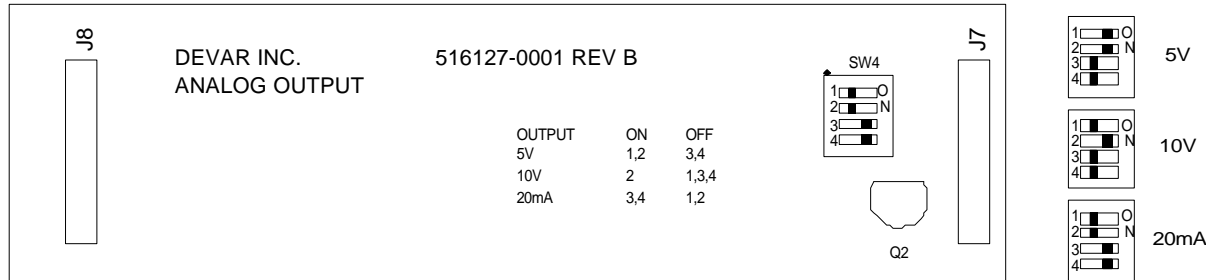
The entry routine for changing the access code is described in Entering a number or text on page 4. The access code can be any six digit number from 000000 to 999999. The factory default is 000000.

When enabled by setting DIP switch SW2 pole 4 ON, the correct access code must be entered to access the menu system. The access code check entry routine starts with an indication of 000000. Enter the code and, if correct, 'OKAY' is displayed before proceeding, otherwise 'DENIED' is displayed before returning to process indication.

## OPTION CARD: ANALOG RETRANSMISSION

### Configure the card

The analog output card is located within the case, and can be configured to produce a full scale output of either 5V, 10V or 20mA by setting DIP switch SW3 according to the following table. Note that the retransmitted signal does NOT have to be the same type of signal as the input, so a 0/10V input can be retransmitted as a 4/20mA signal.



OUTPUT	ON	OFF
10V	2	1, 3, 4
5V	1, 2	3, 4
20mA	3, 4	1, 2

### Enable firmware support

Support for the analog card is provided through the 'ANALOG REXMIT' menu item, which is activated in the system initialization routine. The system initialization routine can only be activated by turning all poles of SW2 ON, then press and hold the RESET button and apply power. When 'Cont' is displayed, release the RESET button. Press NEXT until 'enable option card' is displayed, press ENTER, then press NEXT until "analog card" is displayed. Press ENTER and 'OKAY' is displayed to confirm the choice. Press RESET to return to 'Cont' and press ENTER.

### Analog retransmission calibration overview

The retransmitted signal is controlled by, and linear to, the displayed process value. Any linearization applied to the input is incorporated into the retransmitted signal. The two process values that define the points at which the minimum and maximum retransmitted signal are produced are set in the menu system. The independent settings allow the retransmitted signal to have a scaling different from the input. For example, if

the scaling on the input signal is -20.0°F to 500.0°F, the scaling of the output signal can be set to something such as 0.0°F to 400.0°F or any other values that were found useful. The observed resolution of the output signal will not be better than the resolution of the display, and will never be better than 0.05% of the output signal span. To access the menu items that allow the adjustment of the settings that control the analog retransmission, press NEXT repeatedly to navigate to 'ANALOG REXMIT' and press ENTER.

Analog retransmission calibration details: set process values

Press ENTER at the menu items 'DISPLY @ MIN OUTPUT' or 'DISPLY @ MAX OUTPUT' to review or edit the process values that correspond to the minimum and maximum analog retransmission output levels.

Analog retransmission calibration details: adjust output signal

*Do not attempt to trim the output signal without monitoring it!* The output of the analog retransmission board is controlled by sending it a number. The number can be from 0 to 4095, and the larger the number, the larger the output. Calibration consists of adjusting the value of the number to achieve the desired output level. The menu items 'TRIM MIN OUTPUT' and 'TRIM MAX OUTPUT' allow the numbers that control these signal levels to be adjusted.

Connect an appropriate meter to the correct output terminals on the real panel, navigate to the 'TRIM <XXX> OUTPUT' menu item, and press ENTER. The display indicates the number that produces the current output level for this calibration point. Adjust the value of the displayed number to achieve calibration. The value of the flashing digit can be increased and decreased with the UP and DOWN arrow buttons. Changing the value of the displayed number will cause a decimal point to appear, which indicates that the analog output no longer corresponds to the displayed number. Press the NEXT button to update the analog output and remove the decimal point. Press the NEXT key when the decimal point is NOT displayed to select which digit to edit. ENTER acts just like NEXT if the decimal point is on, otherwise press ENTER to accept the displayed value as the calibration point and return to the menu system.

## SPECIFICATIONS

### GENERAL

Power	90-140VAC Single Phase 50/60Hz or 130 - 190VDC, 10VA max
Operating Temperature	0°C to 70°C
Dimensions	Front Bezel 48mm H x 96mm W x 12mm polycarbonate NEMA 4X Panel Cutout 45mm H x 91mm W Overall 48mm H x 96mm W x 166mm D 1- <sup>15</sup> / <sub>16</sub> " H x 3- <sup>3</sup> / <sub>4</sub> " W x 6- <sup>1</sup> / <sub>2</sub> " D Black anodized aluminum body
Weight	0.522Kg = 1.15lbs. = 18.4oz
Display	Six characters, 0.54" high, 15 segment, high efficiency red LED.
User Input	Four button integrated membrane switch front panel keypad
Relay Output	SPDT (form C) relays; 1 Phase; 7.5A at 240VAC / 24VDC ; 1/3 HP at 120VAC (7.2 FLA); 1/2 HP at 240VAC (4.9 FLA)
Max Terminal Screw Torque	7 lb./in.
Relay Operation	1) Relay de-energizes on power failure, which causes closure between P and NC. An energized relay has closure between P and NO. 2) A failsafe polarity of fail tripped de-energizes the relay in the alarm (tripped) condition, the LED is lit. A failsafe polarity of fail reset de-energizes the relay in the non-alarm (reset) condition, the LED is dark.

### INPUT

A/D converter	24 bit $\Delta - \Sigma$ type
Reference	2.5V $\pm 15$ ppm / °C typical 11KS $\pm 50$ ppm / °C Maximum
Input Impedance	90 MegOhms
-3dB frequency	12Hz.
Acceptable inputs	Thermocouple: T, J, E, K, N, R, S, B RTD: 100 $\Omega$ Pt $\alpha = 385$ , 100 $\Omega$ Pt $\alpha = 392$ , 120 $\Omega$ Ni $\alpha = 672$
Cold Junction Sensor	100 $\Omega$ Platinum RTD (IEC 751 grade B) embedded in connector
Display update rate	2 Hz
Accuracy	$\pm 3^\circ\text{C}$ { 1 <sup>st</sup> 10% of defined span } $\pm 0.5^\circ\text{C}$ { remaining 90% of defined span } for response defined by ITS 90
Indication Resolution	0.1°C or 0.1°F

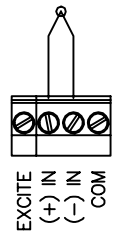
### OPTIONAL ANALOG RETRANSMISSION

D/A converter	12 bits
Available full scale outputs	5V, 10V, 20mA
Accuracy relative to display	<0.05% of full scale output
Output Voltage Compliance	1mA maximum
Output Current Source	20mA @ 24V, or maximum load 1200 $\Omega$
Output Current Sink	Minimum burden to loop 60 $\Omega$ , maximum 30V loop supply

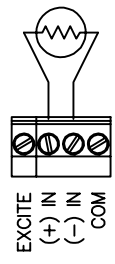
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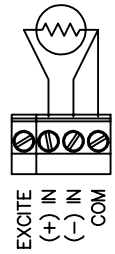
**THERMOCOUPLE**



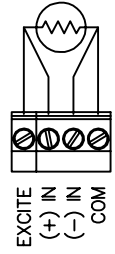
**2 WIRE RTD**



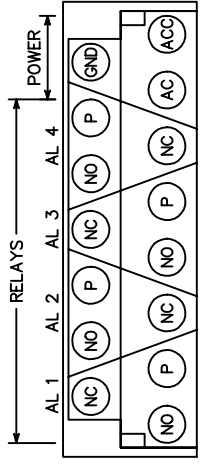
**3 WIRE RTD**



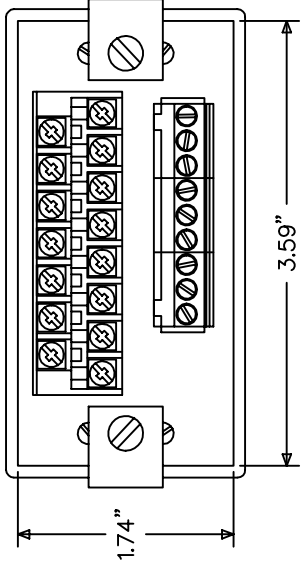
**4 WIRE RTD**



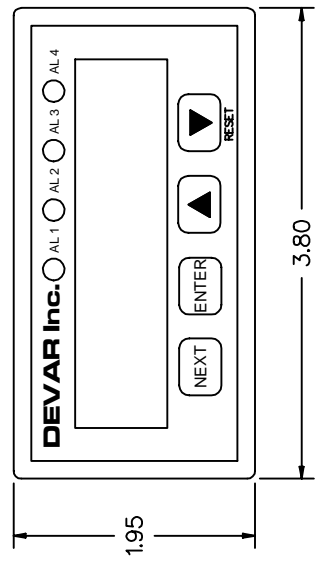
**SENSOR WIRING**



**REAR VIEW**



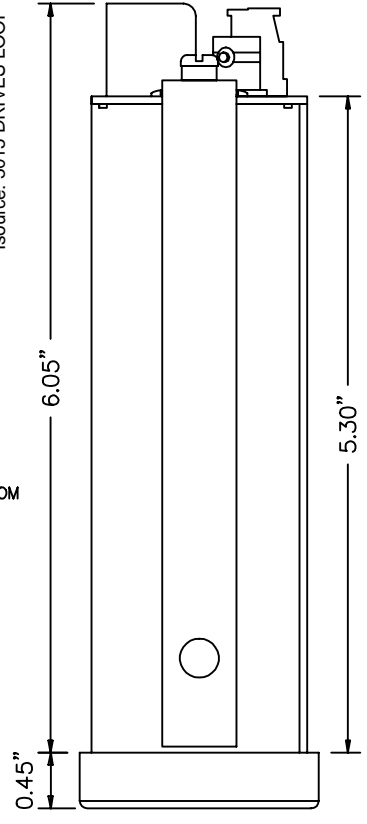
**FRONT VIEW**



POWER: 90/140 VAC 50/60 HZ  
 OR 125/190 VDC  
 AC = AC LIVE OR ±DC ( FUSED LINE )  
 ACC = AC NEUTRAL OR DC RETURN

OPTION	OUT_COM	OUT_B	OUT_A
Yout	COMMON	Yout	NC
Isink	mA return	+mA in	NC
Isource	NC	mA return	+mA out
RS-232	COMMON	Tx	Rx
RS-485	COMMON	B	A

NOTE:  
 Isink: EXTERNAL SUPPLY DRIVES LOOP  
 Isource: 3015 DRIVES LOOP



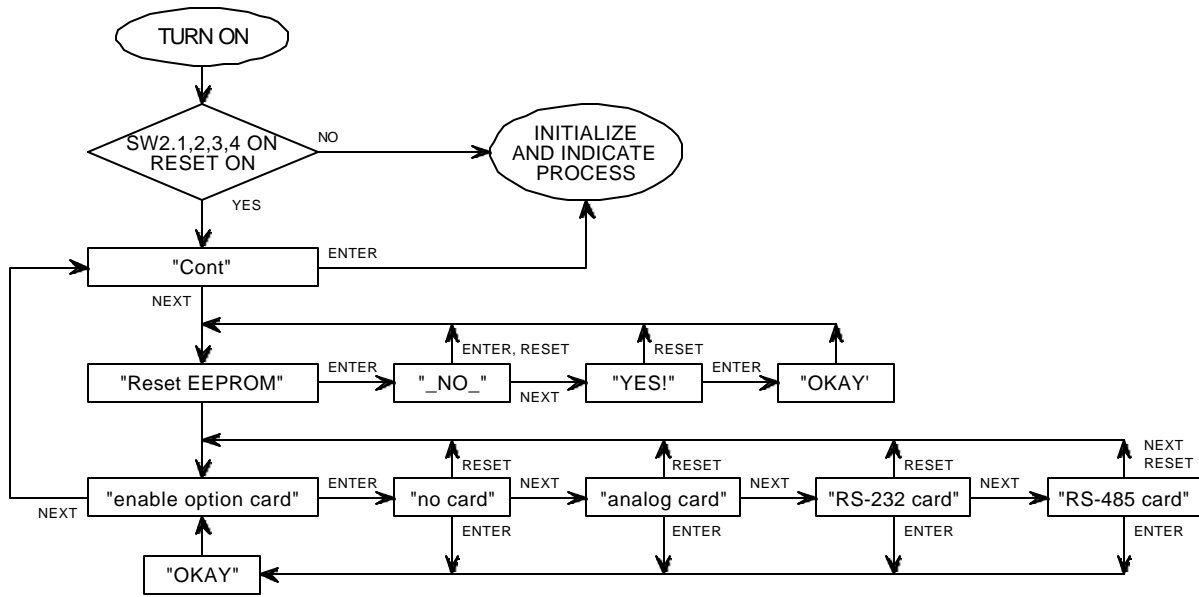
This Drawing is the sole property of DEVAR Inc., and is submitted on the understanding that the contents hereof are not published and are not to be disclosed to third persons without prior permission.

UNSPECIFIED DIMENSION TOLERANCE	CONTRACT NO.
DECIMAL DIMENSION	SMIL
ANGLE	CHECKED
	MECH
	ELEC
	DESIGN
	APPROVED
	APPROVED

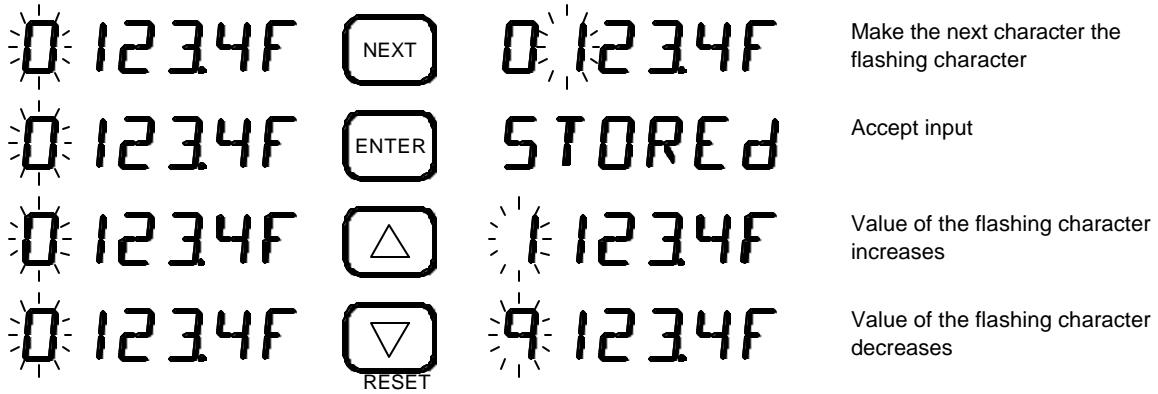
DEVAR Inc. 706 Bostwick Avenue, Bridgeport, Conn. 06605 TEL: (203) 369-6781 FAX: (203) 369-3747	
GENERAL DIMENSIONS AND WIRING 3015 TC / RTD/ mV INDICATOR - CONTROLLER	
SIZE	DRAWING NO.
B	516395
SCALE	WT
FULL	1 OF 1

PANEL CUTOUT
92 +0.8 X 45 +0.8 mm
3.622 +0.032 X 1.772 +0.032 INCHES
92 -0.5 X 45 -0.5 mm
3.622 -0.018 X 1.772 -0.018 INCHES

## SYSTEM INITIALIZATION ROUTINE

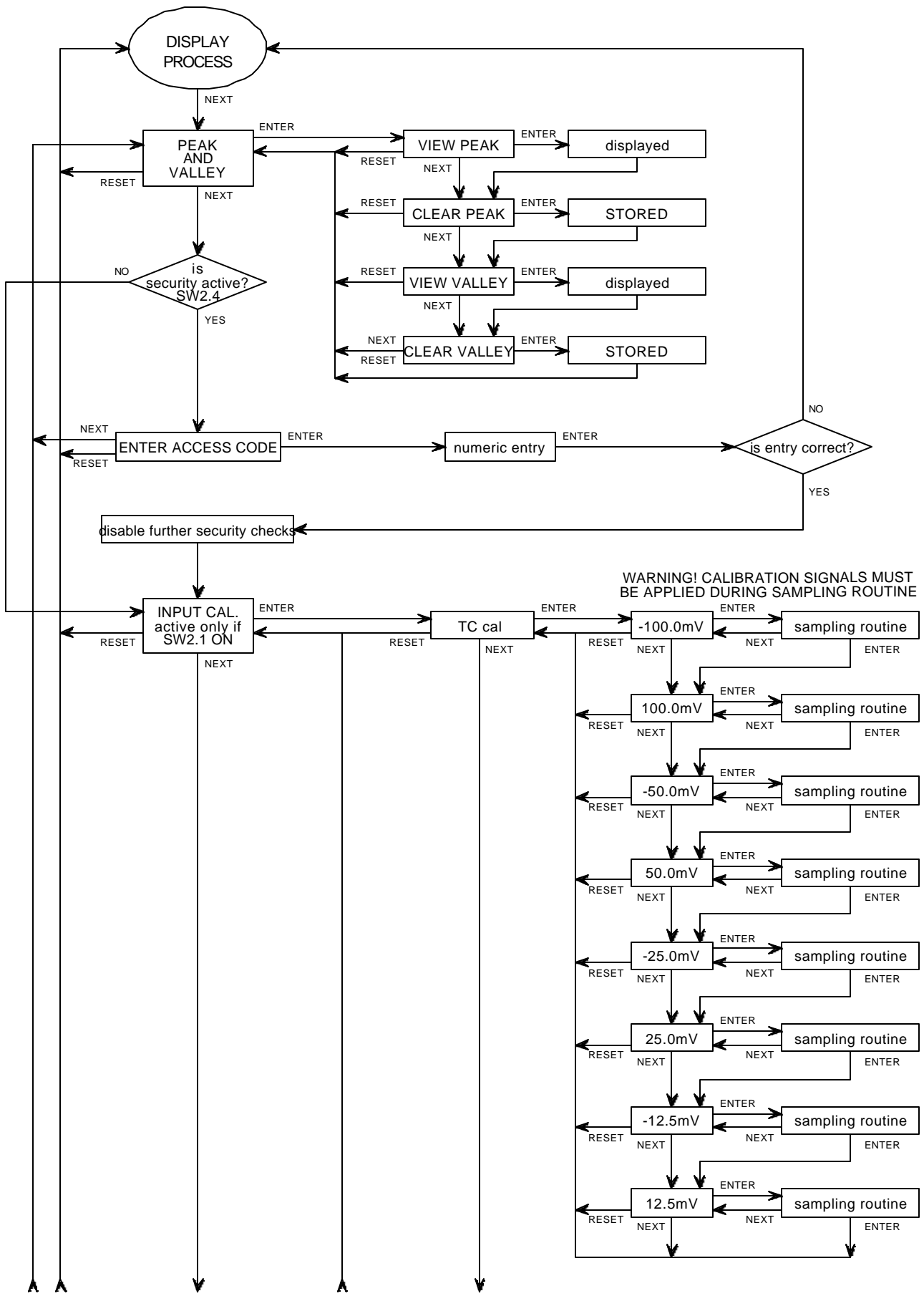


## USER AND NUMERIC INPUT KEYS





# CONFIGURATION MENU FLOWCHART

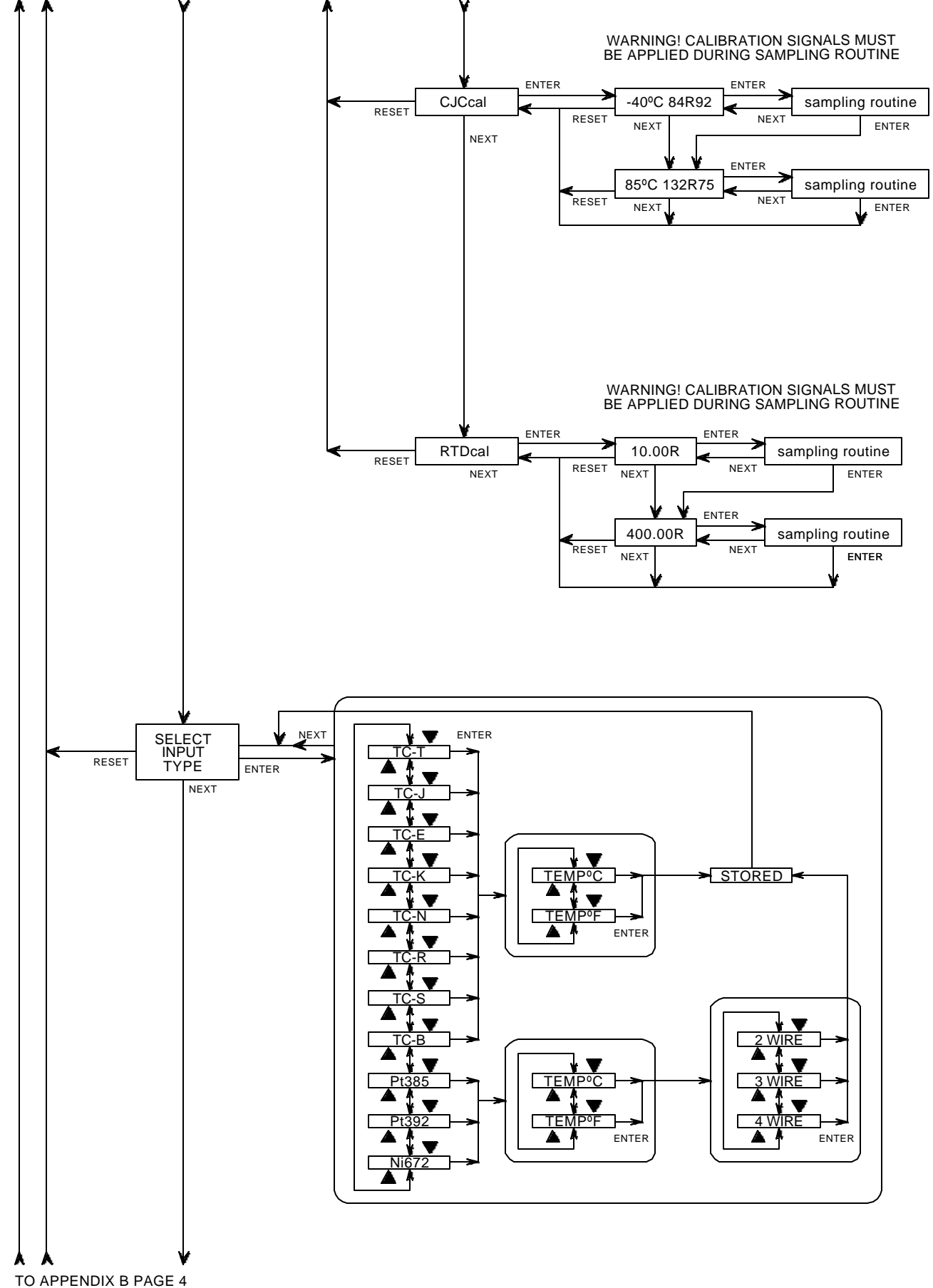


TO APPENDIX B PAGE 3

TO APPENDIX B PAGE 3 ( INPUT CAL CONTINUED )

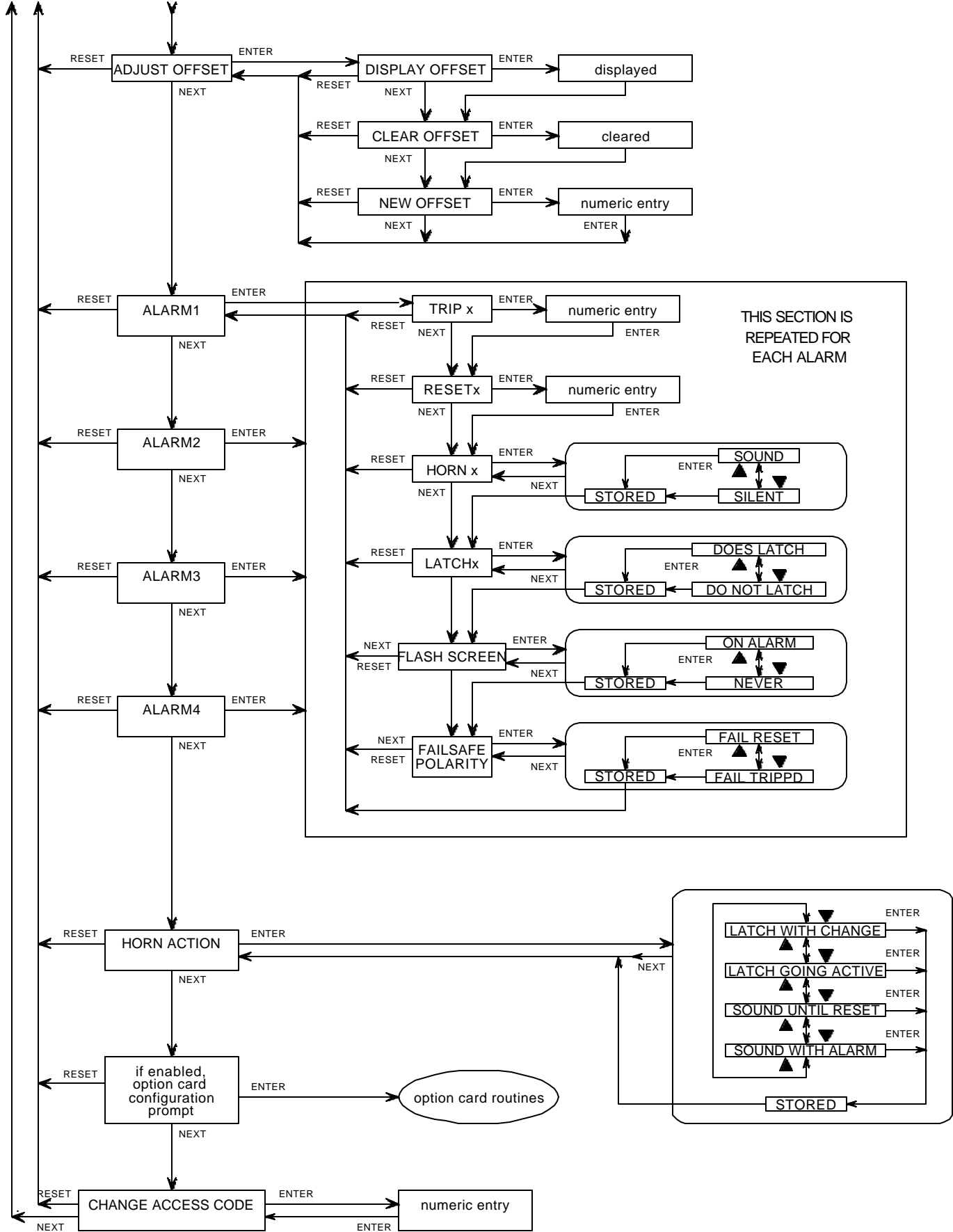
# CONFIGURATION MENU FLOWCHART

FROM APPENDIX B PAGE 2 FROM APPENDIX B PAGE 2 ( INPUT CAL CONTINUED )

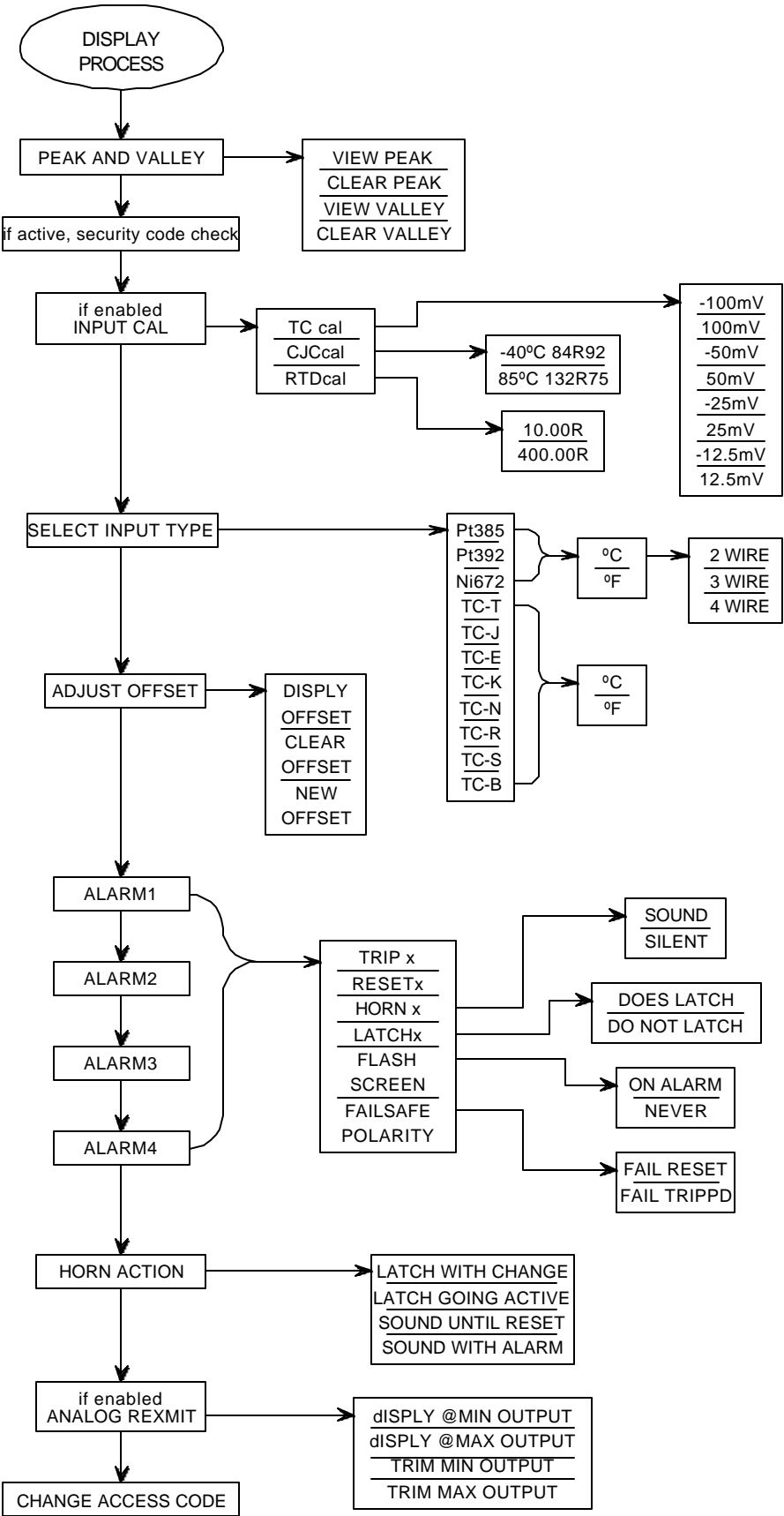


# CONFIGURATION MENU FLOWCHART

FROM APPENDIX B PAGE 3

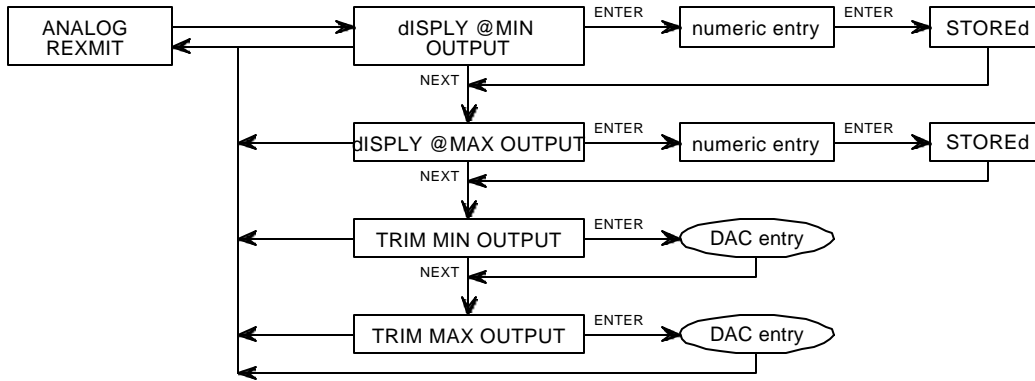


# SIMPLIFIED MENU SYSTEM DIAGRAM

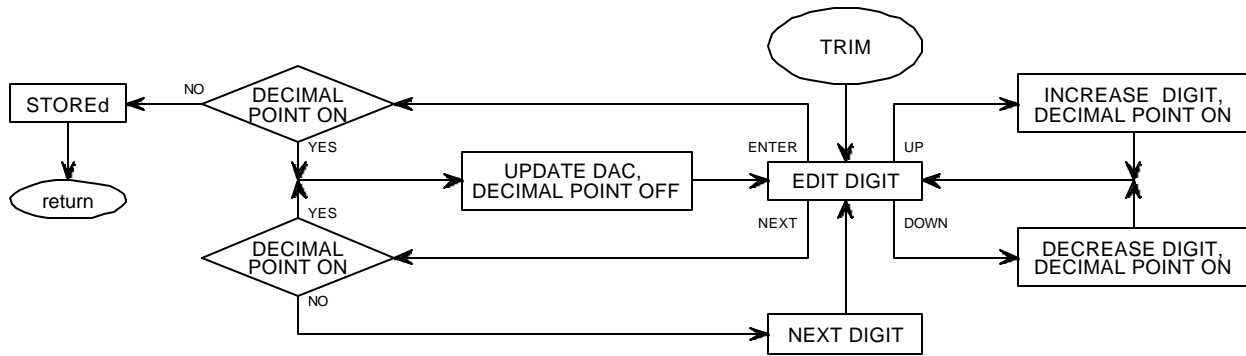


## (optional) ANALOG RETRANSMISSION

### ANALOG RETRANSMISSION CONFIGURATION MENU FLOWCHART

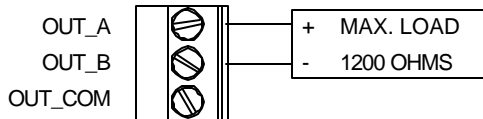


### TRIM ANALOG OUTPUT

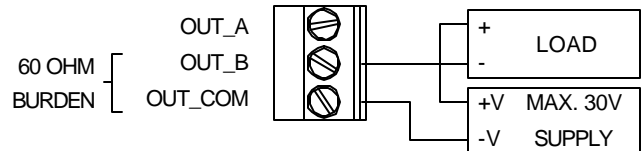


### ANALOG RETRANSMISSION WIRING AND DIP SWITCH SETTING

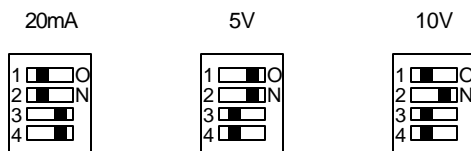
4/20mA OUTPUT  
INTERNAL SUPPLY POWERS LOOP



4/20mA OUTPUT  
EXTERNAL SUPPLY POWERS LOOP



SETTING SW3 ON ANALOG BOARD  
TO SELECT OUTPUT SIGNAL



VOLTAGE OUTPUT

