

**SERIES 2800** 

**INTELLIGENT PROGRAMMABLE LIMIT SWITCH MODULE**

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**USER'S MANUAL**

Catalog Number 2800-293M

 **ADVANCED  
MICRO CONTROLS INC.**

# General Information

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## *Important User Information*

The products and application data described in this manual are useful in a wide variety of different applications. Therefore, the user and others responsible for applying these products described herein are responsible for determining the acceptability for each application. While efforts have been made to provide accurate information within this manual, AMCI assumes no responsibility for the application or the completeness of the information contained herein.

UNDER NO CIRCUMSTANCES WILL ADVANCED MICRO CONTROLS, INC. BE RESPONSIBLE OR LIABLE FOR ANY DAMAGES OR LOSSES, INCLUDING INDIRECT OR CONSEQUENTIAL DAMAGES OR LOSSES, ARISING FROM THE USE OF ANY INFORMATION CONTAINED WITHIN THIS MANUAL, OR THE USE OF ANY PRODUCTS OR SERVICES REFERENCED HEREIN.

Throughout this manual the following two notices are used to highlight important points.



**WARNINGS** tell you when people may be hurt or equipment may be damaged if the procedure is not followed properly.



**CAUTIONS** tell you when equipment may be damaged if the procedure is not followed properly.

No patent liability is assumed by AMCI, with respect to use of information, circuits, equipment, or software described in this manual.

The information contained within this manual is subject to change without notice.

## *Standard Warranty*

ADVANCED MICRO CONTROLS, INC. warrants that all equipment manufactured by it will be free from defects, under normal use, in materials and workmanship for a period of [1] year. Within this warranty period, AMCI shall, at its option, repair or replace, free of charge, any equipment covered by this warranty which is returned, shipping charges prepaid, within one year from date of invoice, and which upon examination proves to be defective in material or workmanship and not caused by accident, misuse, neglect, alteration, improper installation or improper testing.

The provisions of the "STANDARD WARRANTY" are the sole obligations of AMCI and excludes all other warranties expressed or implied. In no event shall AMCI be liable for incidental or consequential damages or for delay in performance of this warranty.

## *Returns Policy*

All equipment being returned to AMCI for repair or replacement, regardless of warranty status, must have a Return Merchandise Authorization number issued by AMCI. Call (203) 585-1254 with the model number and serial number (if applicable) along with a description of the problem. A "RMA" number will be issued. Equipment must be shipped to AMCI with transportation charges prepaid. Title and risk of loss or damage remains with the customer until shipment is received by AMCI.

## *24 Hour Technical Support Number*

24 Hour technical support is available on this product.

For technical support, call (203) 583-7271.

## ABOUT THIS MANUAL

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This manual is written to explain the installation, operation, programming, and servicing of the Series 2800 Programmable Limit Switch Modules for the Modicon 800 Series I/O Housing. It is strongly recommended that you read through the following instructions. Some familiarity with the operation and programming of Modicon programmable controllers is assumed and essential. If there are any unanswered questions after reading this manual, call the factory. An applications engineer will be available to assist you.

Throughout this manual the following two notices are used to highlight important points.



Cautions tell you when equipment may be damaged if the procedure is not followed properly.



Warnings tell you when people may be hurt or equipment may be damaged if the procedure is not followed properly.

### 1.0 Introduction to the 2800 Programmable Limit Switch Module

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The Series 2800 Programmable Limit Switch Modules (LSM's) are the next step in the evolution of the electronic limit switch. The Series 2800 Modules are a family of intelligent, single slot, absolute position modules that are fully compatible with Modicon 800 Series I/O. The Series 2800 Modules have features that cannot be found in any other electronic limit switch product on the market today.

- Resolver based transducers are used because of their ability to withstand the harsh conditions of the industrial environment.
- A patented resolver to digital conversion technology (U.S. Patent 4,989,001) and a 16 bit Intel 80C196 microcomputer provide the modules with state of the art performance.
- Integral to the module are eight high current opto-isolated DC outputs that require only an external power supply for use.
- Modules can automatically advance the ON and OFF Setpoints of an output independently, based on the velocity of the transducer's shaft and programmable time delays, to compensate for fixed delays in the loads connected to the outputs.
- Extensive fault detection routines continuously monitor the integrity of the electronics, transducer, and transducer cabling.
- Series 800 I/O compatibility allow you to use registers to program the 2800 Modules from the processor.
- Series 800 I/O compatibility allow you to use registers to monitor the transducer's shaft position and velocity, Limit outputs ON/OFF status, and fault diagnostic data.

## 1.0 Intro. to the 2800 Programmable Limit Switch Module (cont'd)

### Series 2800 Family Members

The following modules make up the Series 2800 Programmable Limit Switch Module line. Potential future members of the family will have inputs for two transducers, a higher number of outputs, 13 bit (8192 count) position resolution, or compatibility with different types of transducers.

- 2831 Single Transducer LSM with 10 bit position resolution.
- 2841 Single Transducer LSM with 12 bit position resolution.

All of the modules of the Series 2800 Family have 13 bit accuracy when determining the ON/OFF Status of the Limit Outputs.

### Brushless Resolver Description

The brushless resolver is unsurpassed by any other type of rotary position transducer in it's ability to withstand the harsh industrial environment. Originally developed for military applications, the resolver has benefited from more than 40 years of continuous use and development.

The resolver is essentially a variable rotary transformer, with one primary winding, the Reference Winding, located in the rotor and two secondary windings, the SIN and COS Windings, located in the stator. The two secondary windings are mechanically displaced 90 degrees from each other. (See Fig. 1.1).

In general, the rotor winding is excited by an AC voltage called the Reference Voltage ( $V_r$ ). (See Fig. 1.2). In a brushless resolver, the Reference Voltage, ( $V_r$ ), is supplied to the rotor without the use of brushes and slip rings by using a second rotary transformer on the input. The induced voltages in the stator windings are proportional to the product of the SIN or COS of their angle with the rotor winding and the instantaneous value of the Reference Voltage. If you consider the ratio of the stator voltages, ( $SIN / COS$ ), it is obvious that it is proportional to the angular displacement from the reference winding. Thus, the resolver can provide a set of voltages with their ratio representing the absolute position of the shaft. Because it is the ratio of the SIN and COS windings that is considered, any change in the resolver's characteristics, such as those caused by aging or a change in temperature, are ignored.

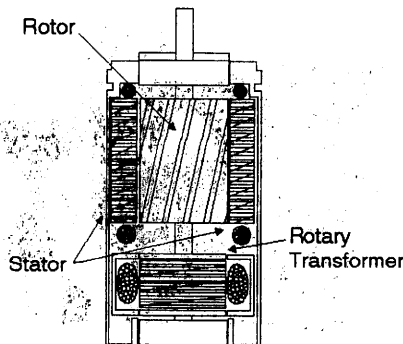


Fig. 1.1 Resolver Cut-away View

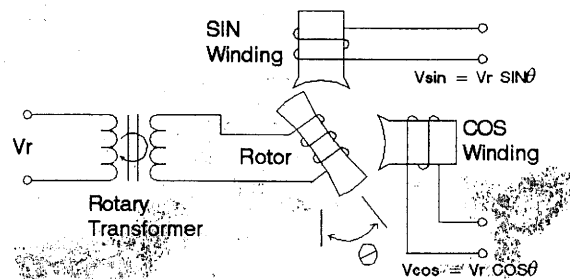


Fig. 1.2 Resolver Schematic

## 1.0 Intro. to the 2800 Programmable Limit Switch Module (cont'd)

### *Resolver Based Position Transducers*

Mechanically connected to the shaft of the controlled machine, the transducer is subjected to severe environmental conditions such as continuous mechanical shock and vibration, extreme temperature and humidity variations, and exposure to contaminants such as oil mist, coolants, and solvents. AMCI manufactures three different types of rugged, brushless resolver transducers for use with the Series 2800 Family of LSM's to meet the challenges of this harsh environment. Every transducer manufactured by AMCI have the following features in common.

- Sealed Shaft Bearing.
- MIL Spec Connectors for the transducer cable. Every Connector is potted to prevent the resolver wires from breaking off due to any vibration that the transducer is subjected to.
- Flexible Coupler between transducer shaft and resolver on the HT-20 family of transducers protects the Resolver from both Radial and Axial shaft loading and high shaft acceleration that sometimes occurs when a motor is first turned on.
- Entire Transducer is sealed to keep out liquid and airborne contaminants.
- Simple 6 wire cabling to Module's transducer input connector.

### *Compatible Position Transducers*

The following resolver based transducers manufactured by AMCI can be used with any Series 2800 module.

For Single Turn applications:

HT-20	Heavy Duty Position Transducer (DWG. B1001)
H25FE	Size 25 Flange Mount Position Transducer (DWG. B1041)
H25SE	Size 25 Servo Mount Position Transducer (DWG. B1041)

For Multi-turn applications:

HT-20-(x)	Multi-turn Position Transducer (DWG. B1051)
	( (x) = Number of Turns)

### Definition of Terms

The following terms are used throughout this manual to describe the 2800 Modules. Please take the time to familiarize yourself with these terms before you continue.

**ANGULAR POSITION** - Several times within the manual we will be referring to the actual position of the transducers shaft with respect to it's mechanical zero, not the value of the Position Function that is read on the display. In order to avoid confusion, the actual position of the transducer's shaft is called the Angular Position.

**FUNCTIONS** - Functions are the outputs of the module. The 2800's have three basic functions. These functions are:

- Position Function: Gives you information on the position of the transducer's shaft relative to a zero point.
- Tachometer Function: Gives you information on the angular velocity of the transducer's shaft in RPM.
- Limit Outputs: 8 DC outputs for use in your control application.

Each function is defined by one or more inputs. One input is the AMCI resolver based transducer. The other inputs are programmable from the keyboard or processor. These programmable inputs are called Parameters.

**PARAMETERS** - Parameters are used, along with the transducer input, to determine the value of the 2800's Functions. All of the parameters are programmable. The parameters are:

- Scale Factor: Sets the resolution to which the position of the transducer shaft is determined.
- Position Offset: Changes the reading of the transducer's shaft position without mechanically rotating the shaft.
- Tach Response: Sets the resolution and update time of the modules' built in tachometer.
- ON/OFF Setpoints: Eight pairs of ON/OFF Setpoints are available per Output.
- ON/OFF Setpoint Advances: Compensates for fixed delays in the loads connected to the outputs. The ON Setpoints and OFF Setpoints on each limit output can be compensated for separate delays.
- Limit Output Mask: Turns limit outputs off regardless of the programming of the ON/OFF Setpoints. Each output can be masked independent of the others. (Programmable from PC only.)

## 2.0 SERIES 2800 MODULE DESCRIPTION

### Definition of Terms (cont'd)

**OPERATING MODE** - There are four different Operating Modes for the 2831/41 Modules. Each Mode defines the following:

- 1) If the Limit Output Drivers are enabled or disabled.
- 2) If the module is programmable from the processor, the keyboard, or both.
- 3) What information the module reports back to the processor.

#### Mode 1 - Fully Programmable Mode

- 1) Limit Output Drivers are disabled.
- 2) The module is programmable from both the processor and the keyboard.
- 3) The module reports the last program instruction or Fault Status information back to the processor.

#### Mode 2 - Processor Programmable Mode

- 1) Limit Output Drivers are disabled.
- 2) The module is programmable from the processor only.
- 3) The module reports the last program instruction or Fault Status information back to the processor.

#### Mode 3 - Keyboard Programmable Mode

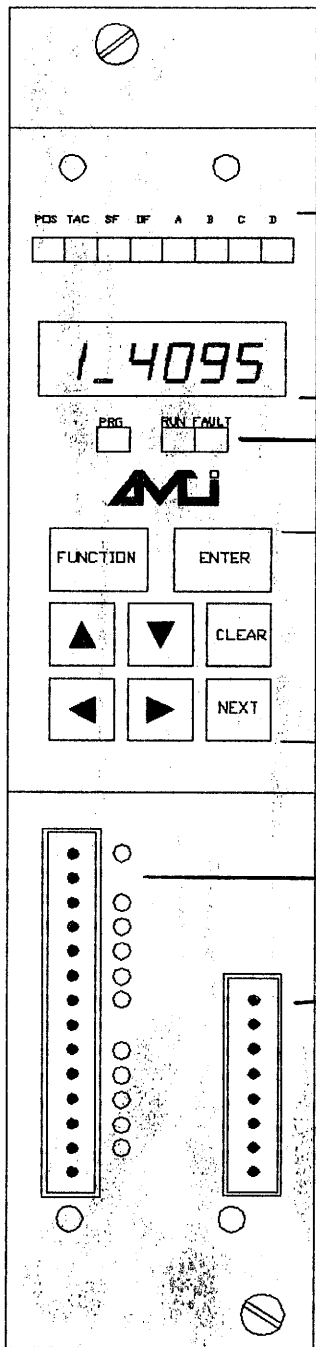
- 1) Limit Output Drivers are enabled.
- 2) The module is programmable from the keyboard only.
- 3) The module reports the values of the Position and Tachometer Functions as well as Limit ON/OFF Status and Fault Diagnostic data.

#### Mode 4 - Run Mode

- 1) Limit Output Drivers are enabled.
- 2) The module is not programmable.
- 3) The module reports the values of the Position and Tachometer functions as well as Limit ON/OFF Status and Fault Diagnostic data.

Refer to Chapter 4 "Configuring a Series 2800 Module" for more information on 2800 Operating Modes

Front Panel Description



**Function Display** - Used to display the functions and parameters of the 2800 Module. The eight LED indicators designate what is showing on the alpha-numeric display. When you are in Program Mode, a blinking digit on the alpha-numeric display shows the position of the Cursor.

**Status Display** - Indicates the operating conditions of the module.

**PRG** - Yellow light is ON when the Module is in Program Mode.

**RUN** - Green light is blinking when the module is operating but not communicating with the processor. The light is ON when the module is communicating with the processor.

**FAULT** - Red light is ON when there is a fault condition. The nature of the error is shown on the alpha-numeric display.

**Keyboard** - Used to examine or change the functions and parameters of the module.

**Limit Output Connector** - Connector for the 8 high current DC outputs.

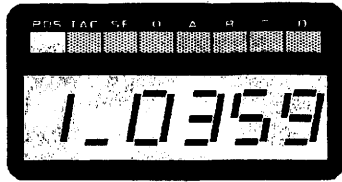
**Transducer Input Connector** - Connector for the position sensing AMCI resolver based Transducer.



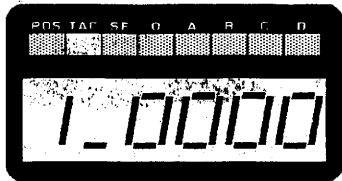
## 2.0 SERIES 2800 MODULE DESCRIPTION (cont'd)

### Function and Parameter Displays

The following displays are available on the Series 2800 Modules. A full description of the Function or Parameter is given to the right of the display. Unless noted, each of the displays is available on all of the 2800 Modules. Please note that a shaded LED indicator is not lit on the display.



**Position Function** - This display shows the current position of the transducer's shaft. It's value varies from 0 to (Scale Factor - 1). This function is affected by two programmable Parameters; the Scale Factor and the Position Offset. The Position data is available the processor.



**Tachometer Function** - This display shows the speed of rotation of the transducer's shaft in Revolutions Per Minute (RPM). The time between updates, which is the time it takes to determine a new speed and show it on the display, and the resolution of the Tachometer are programmable through the tachometer response parameter. The Tachometer data is available to the processor.



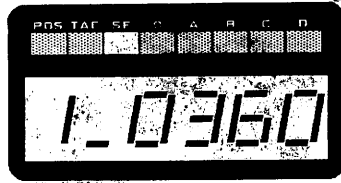
**Tachometer Response Parameter** - The tachometer response can be programmed to any one of four update periods, (time between tachometer updates), and one of two resolutions. This allows the user to tailor the tach's response to the systems needs.

The four tachometer update periods are 32 mSecs, 60 mSecs, 120 mSecs, and 240 mSecs. The two resolutions, available with a 240 mSec update time only, are 1 RPM or 0.1 RPM. With the other three update periods the only resolution available is 1 RPM.

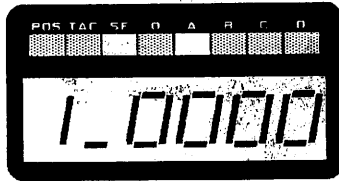
The maximum speed that can be displayed by the module or sent to the PC depends on the chosen resolution and the update time. When the Tachometer Response is set to 240 mSecs, the maximum speed that can be displayed is 999.9 RPM if the resolution is 0.1 RPM or 1000 RPM if the resolution is set to 1.0 RPM. When the Tachometer Response is set to 120 mSecs or faster, the maximum speed that can be displayed is 2000 RPM. Exceeding these speeds will cause the module to display and send erroneous data to the processor.

## 2.0 SERIES 2800 MODULE DESCRIPTION (cont'd)

### Function and Parameter Displays (cont'd)



**Scale Factor Parameter** - The Scale Factor parameter is used to set the resolution with which the module determines the position of the transducer's shaft. The Scale Factor can be programmed between 2 and 1024 for the 2831 module and between 2 and 8192 for the 2841 module. With the Scale Factor programmed to 360 the module will display the position data, and send it to the processor in degrees. With the Scale Factor programmed to 1024 the module will display the position data, and send it to the processor, with 10 bit resolution.



**Position Offset Parameter** - The Position Offset parameter allows you to change the displayed position of the transducer's shaft without changing the RANGE of values that the unit displays and sends to the processor. This offset is most commonly used to force the position to the correct count after the machine has been aligned. For example: One rotation of the transducer's shaft produces counts between 000 and 720. (SF = 720) When the machine is aligned to mechanical zero the Position Function should read 0000. However, when the machine is aligned, the Position Function reads a value of 0000. An Offset can be programmed in to force the position to 0000. The formula for determining the Position Offset is as follows:

$$\begin{array}{rcccccc} \text{Scale Factor} & - & \text{Actual Position} & + & \text{Desired Position} & = & \text{OFFSET} \\ 720 & & 695 & & 0000 & & 25 \end{array}$$

The maximum value of the Offset is: (Scale Factor - 1).

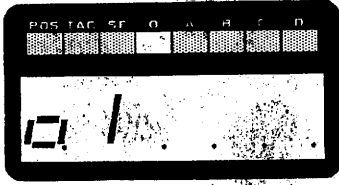
If the Calculated Offset is greater than the Scale Factor, the Actual Offset equals (Calculated Offset - Scale Factor).

If the user wishes to force the position to zero, the user can use the AUTO ZERO feature. This feature performs all the calculations needed to determine the required offset and stores this value in EEPROM memory. To use the AUTO ZERO feature, the user must be displaying the transducers' position Function (POS LED on). The user then presses the [CLEAR] key and the unit calculates and stores the required offset. The calculated offset can be displayed with the Offset parameter.

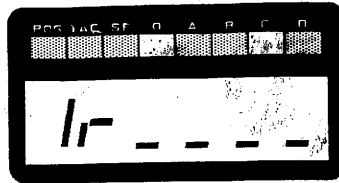
When the user enters a new value for the Scale Factor parameter, the Offset is reset to zero.

## 2.0 SERIES 2800 MODULE DESCRIPTION (cont'd)

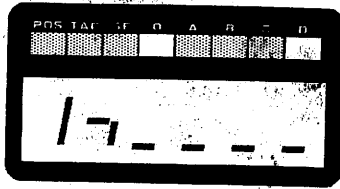
### Function and Parameter Displays (cont'd)



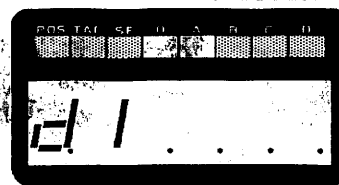
Limit Number Select for Setpoint Modification - This display is used to select which limits' setpoints you wish to modify. Use the [NEXT] Key to change the Limit Number. Use the [ENTER] Key to go to the ON Setpoint Parameter display.



ON Setpoint Parameter - The ON Setpoint is used by the Module to determine when an output should be on. When an output is on, the output will source current to the attached load. Each ON Setpoint has a corresponding OFF Setpoint. Each Limit has 8 pairs of Setpoints. The valid range of values for the ON Setpoint parameter is from 0 to (Scale Factor - 1). The figure to the right shows an ON Setpoint parameter for Limit 1 without a value programmed into it.



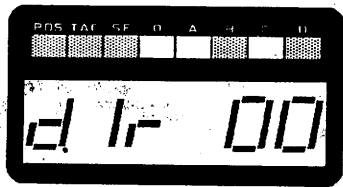
OFF Setpoint Parameter - The OFF Setpoint is used by the Module to determine when an output should be off. When an output is off, the output will not source current to the attached load. Each OFF Setpoint has a corresponding ON Setpoint. Each Limit has 8 pairs of Setpoints. The valid range of values for the OFF Setpoint parameter is from 0 to (Scale Factor - 1). The figure to the right shows an OFF Setpoint parameter for Limit 1 without a value programmed into it.



Limit Number Select for Advance Modification - This display is used to select which limits' automatic advance parameters you wish to modify. Use the [NEXT] Key to change the Limit Number. Use the [ENTER] Key to go to the ON Advance Parameter display. Automatic Advances are available on limits 1 through 5 on the 2831/41.

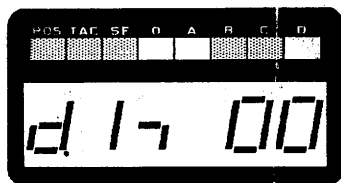
## 2.0 SERIES 2800 MODULE DESCRIPTION (cont'd)

### Function and Parameter Displays (cont'd)



**ON Advance Parameter** - The ON Advance parameter is used by the module to cancel any turn on delay in the load that is attached to the Limit Output. The ON Advance Parameter is programmed in mSec and has a valid range of 0 to 99 mSec. Note that a limit's ON Advance must be greater than the limit's OFF Advance. The figure on the right shows the default ON Advance of 0 mSec on Limit 1.

A typical example is a solenoid that mechanically pulls 10 mSec after power is applied to it's terminals. Let's assume that you want the solenoid to mechanically pull when the machine is at 90°. If the ON Advance is not used, at 100 RPM the limit will turn on at 90° but the solenoid will mechanically pull when the machine is at 96°. At 200 RPM, the limit will again turn on at 100° but the solenoid will mechanically pull at 102°. If the ON Advance is programmed to 10 mSec, the module will turn the limit ON before the 90° point so that the solenoid will mechanically pull at 90°. With the ON advance programmed in and the machine running at 100 RPM, the limit output will turn on when the machine is at 84°. At 200 RPM, the limit output will turn on at 78°. In both cases the solenoid will mechanically pull at 90°



**OFF Advance Parameter** - The OFF Advance parameter is used by the module to cancel any turn off delays in the load that is attached to the Limit Output. The OFF Advance Parameter is programmed in mSec and has a valid range of 0 to 99 mSec. Note that a limit's OFF advance must be less than the limit's ON advance. The figure on the right shows the default OFF Advance of 0 mSec on Limit 1.

A typical example is a solenoid that mechanically releases 5 mSec after power is removed from it's terminals. Let's assume that you want the solenoid to mechanically release when the machine is at 180°. If the OFF Advance is not used, at 100 RPM the limit will turn off at 180° but the solenoid will mechanically release when the machine is at 183°. At 200 RPM, the limit will again turn off at 180° but the solenoid will mechanically release at 186°. If the OFF Advance is programmed to 5 mSec, the module will turn the limit OFF before the 180° point so that the solenoid will mechanically release at 180°. With the OFF advance programmed in and the machine running at 100 RPM, the limit output will turn off when the machine is at 177°. At 200 RPM, the limit output will turn on at 174°. In both cases the solenoid will mechanically release at 180°

## 2.0 SERIES 2800 MODULE DESCRIPTION (cont'd)

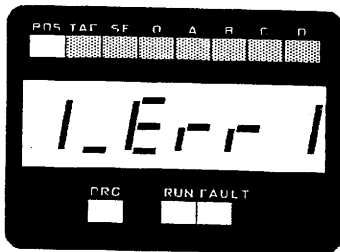
### Status Indicators

There are three single indicators below the function display that show the operating status of the module.

The first light is the PRG Indicator. This yellow light is on when the module is in Mode 1 Fully Programmable Mode, or Mode 3 Keyboard Programmable Mode. When the module is in one of these two Modes all of the parameters can be changed from the keyboard.

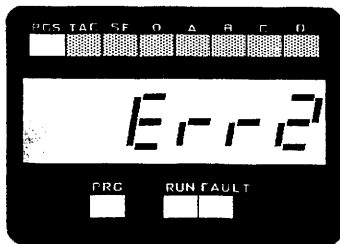
The second light is the RUN Indicator. This green light is blinking when the module is powered and operational but not communicating with the processor. The RUN light is on all the time when the module is communicating with the processor.

The third light is the FAULT Indicator. When this light is on, the module recognizes that a fault condition exists. The type of fault is shown on the alpha-numeric display. The Series 2800 modules recognizes three types of faults.

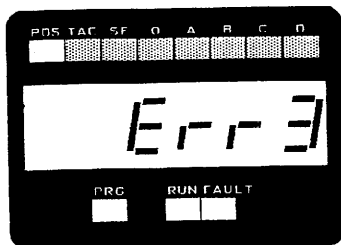


**Error Class 1: Transducer Fault** - This message is shown only when the module is displaying the Position or Tachometer Functions. The parameters will be displayed normally. There are four major causes of this fault.

- Broken Transducer Cable.
- Improper wiring of the Transducer Cable.
- Non-compatible Transducer.
- Faulty Transducer.

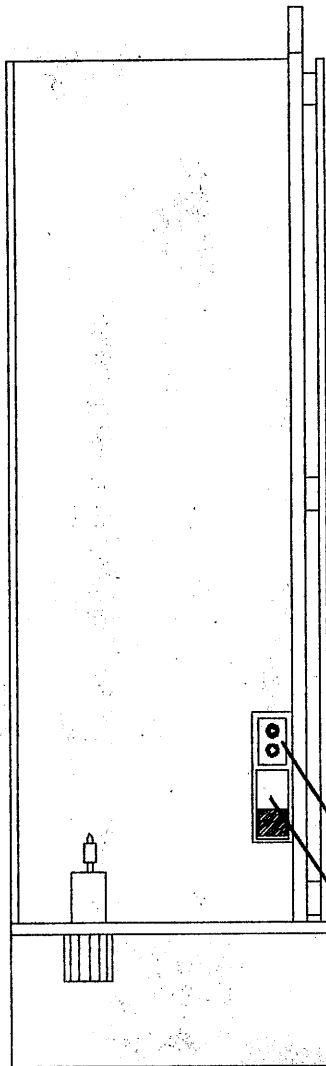


**Error Class 2: EEPROM Fault** - This message is displayed at all times. The module recognizes that the program data (Scale Factor, Limit Setpoints, Advances, etc.) is incorrect. This error can be cleared by pressing the [CLEAR] Key. If the "Err 2" message remains after pressing the [CLEAR] Key, the EEPROM Memory is damaged and the module must be returned for repairs. Please call the factory for assistance.



**Error Class 3: RAM Fault** - This message is displayed at all times. The module recognizes that the RAM has not stored data correctly. If this message is displayed, cycle power to the module. If the message remains on power up, the RAM is damaged and the module must be returned for repairs. Please call the factory for assistance.

### Keyboard Program Switch



The Keyboard Program Switch is used to enable or disable the programming of the 2800 from the Keyboard. The 2800 is always programmable from the processor. The module is in Modes 1 or 3 (Fully or Keyboard Programmable, PRG light ON) when the switch is pushed towards the back of the unit. The module is in Modes 2 or 4 (Processor Programmable or Run: PRG Light OFF) when the switch is pushed to the front of the unit. With the unit in Modes 2 or 4, the parameters can be examined from the keyboard but they cannot be changed.

**WARNING:** Remove the system power before removing or installing a module in the I/O housing. Failure to observe this warning can result in damage to the module's circuitry and/or undesired operation with possible injury to personnel.

There are two ways to disable the Keyboard Program Switch. The first is by removing the jumper on the two pin header. The second is by issuing a "Disable Keyboard Programming" command from the processor. If the "Disable Keyboard Programming" command is issued by the processor, the module can be programmed from the keyboard at a later time by first issuing the "Enable Keyboard Programming" command or by cycling power to the module.

Two Pin Header (shown with Jumper installed)







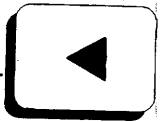

Program Switch (shown in Modes 2 or 4 Position)

## 2.0 SERIES 2800 MODULE DESCRIPTION (cont'd)

### Keyboard Description

The following table describes what the keys do when you are in Modes 2 or 4 and Modes 1 or 3. Remember, when you are in Modes 1 or 3 you can program the module from the keyboard.

When in the Modes 1 or 3, a parameter that you show on the alpha-numeric display can be changed if one of the digits on the display is blinking. The blinking digit shows the Cursor.

KEY	MODES 2 or 4	MODES 1 or 3
	This key is used to select the function or parameter that you wish to show on the display.	Same for all Modes.
	Not used in these Modes.	If a parameter is shown with a Cursor, pressing this key will store the displayed value in the User's Program Memory.
	This Key is used to recover from fault conditions. The exact nature of the fault is shown in the display. See "Status Indicators" Pg. 11.	1) Same as Modes 2 and 4. 2) If the Position function is shown on the display, pressing this key will AUTO ZERO the Position Function.
	This key is not used with the 2831 or 2841.	This key is not used with the 2831 or 2841.
	Not used in these Modes.	If the Cursor is shown on the display, pressing this key will increment the number under it.
	Not used in these Modes.	If the Cursor is shown on the display, pressing this key will decrement the number under it.
	This key can be used to select the function of parameter that you wish to show on the display.	1) Same as Modes 2 and 4. 2) If the Cursor is shown on the display, this key will shift the Cursor one place to the left.
	This key can be used to select the function or parameter that you wish to show on the display.	1) Same as Modes 2 and 4. 2) If the Cursor is shown on the display, this key will shift the Cursor one place to the right.

## 2.0 SERIES 2800 MODULE DESCRIPTION (cont'd)

### Transducer Input Connector

The Transducer Input Connector has eight contacts and accepts the following mating connectors:

AMCI Part Number: MS8  
Phoenix Contact Part Number: MSTB1.5/8-ST-5.08

Drawing Number B1110 found at the back of this manual gives the pinout for the cable.

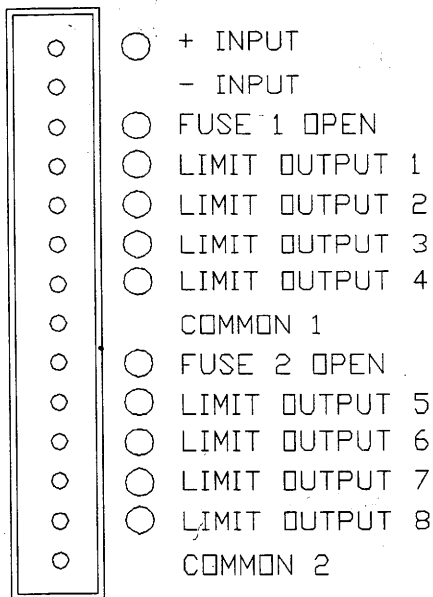
When the cable length is less than 100 feet, Belden 9873 Cable or an exact equivalent should be used. When the cable length exceeds 100 feet, Belden 9730 Cable or an exact equivalent should be used.

### Limit Output Connector

The Limit Output Connector has fourteen contacts and accepts the following mating connectors:

AMCI Part Number: MS14  
Phoenix Contact Part Number: MSTB1.5/14-ST-5.08

### Connector Pinout



Drawing Number B1162 found at the back of the manual gives the hook-up information on the Limit Output Connector.

The Input on pins 13 and 14 are not used by the 2831 or 2841.

The Limit Output drivers are protected by two fuses. Fuse 1 protects outputs 1 through 4. Fuse 2 protects outputs 5 through 8. When the fuse is blown, the Fuse LED will turn on.



## 2.0 SERIES 2800 MODULE DESCRIPTION (cont'd)

### Limit Output Fuse Replacement

If a Limit Output Fuse fails, the module must be opened before the Fuse can be replaced. The factory installed fuses are 7A Fast Blow, Littelfuse Inc. Part Number 225007. A fuse kit of 5 fuses is available from AMCI. The part number is SFK-4.

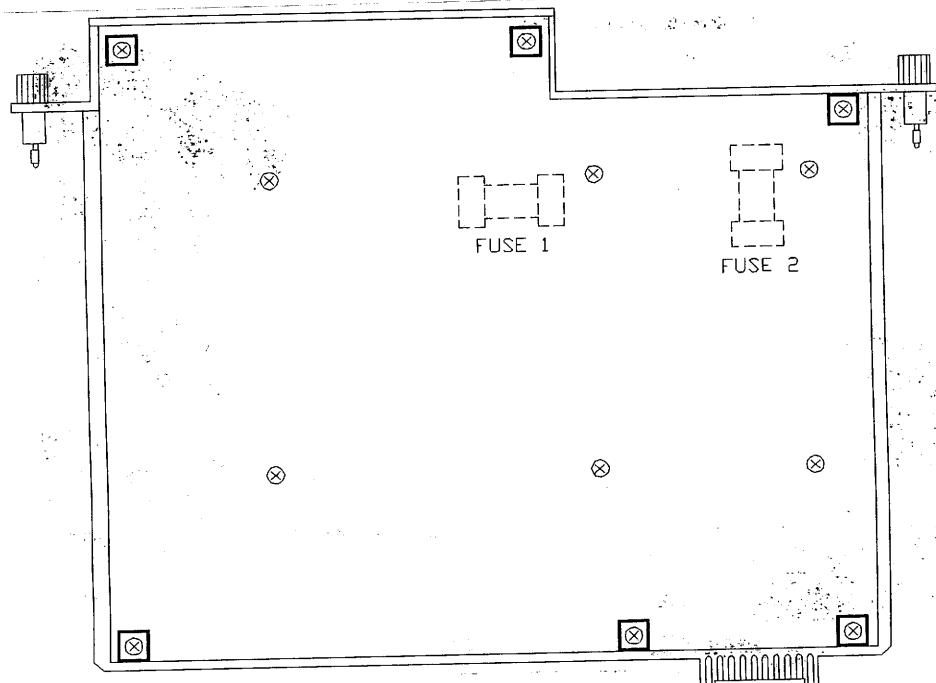
**CAUTION:** To insure continued and adequate protection, any replacement fuses must have a rating of 7A Fast Blow. Using any higher ampere rating or slow blow fuses may not protect the module from damage if the fault conditions are again applied to the module.

Refer to the picture at the bottom of this page when replacing the fuses.

- 1) Remove the module from the housing and lay it on a table so that it is orientated the same way as it is in the picture.

**WARNING:** Remove the system power before removing or installing a module in the I/O housing. Failure to observe this warning can result in damage to the module's circuitry and/or undesired operation with possible injury to personnel.

- 2) Remove each screw that has a square around it in the picture below.
- 3) Gently open the module like a book, with the bottom of the panel going to the left.
- 4) Replace the fuse. Fuse 1 is closest to Pin 14 of the connector. Fuse 2 is closest to Pin 6.
- 5) Reposition the side panel onto the unit making sure that the ribbon cable is not pinched between the panel and the rest of the unit. Replace the screws.



## 3.0 INSTALLING THE SERIES 2800 MODULE

---

### *Power Requirements*

A Series 2800 Programmable Limit Switch Module draws its systems power from the I/O housing backplane. The power that is drawn from the I/O housing backplane is 800 mAmps from the +5 Vdc Supply (4.00 W total). Add this to the power requirements of all other cards in the housing to avoid exceeding backplane or supply capacity.

### *Installing the Module*

**WARNING:** Remove the system power before removing or installing a module in the I/O housing. Failure to observe this warning can result in damage to the module's circuitry and/or undesired operation with possible injury to personnel.

To insert a module into the I/O housing:

1. Remove power from the I/O housing before inserting the module.
2. Insert the module into the designated slot.
3. Firmly press on the front of the module to seat the module into the backplane connector. **CAUTION:** Do not force the module into the backplane connector. If you cannot seat it with firm pressure, check the alignment. You can damage the connector or the module if you force the module into the connector.
4. Secure the module with the module's thumb screws.

To remove the module do the following:

1. Remove power from the I/O housing before removing the module.
2. Loosen the module's thumb screws so that they are not securing the module to the housing.
3. Remove the module from the housing by pulling it from the center.

When the unit is powered up, the module will be in either Fully Programmable Mode (Mode 1) or Processor Programmable Mode (Mode 2). In both of these Modes, the Limit Output Drivers are disabled. The "RUN" Command must be issued from the processor before the modules' Limit Outputs will function. See Chapter 4 "Configuring a Series 2800 Module" for more information.

### 3.0 INSTALLING THE SERIES 2800 MODULE (cont'd)

#### INSTALLING THE TRANSDUCER CABLE

The transducer cable consists of twisted pairs of individually shielded wire. When the cable length is less than 100 feet, Belden 9873 Cable or an exact equivalent should be used. When the cable length exceeds 100 feet Belden 9730 Cable or an exact equivalent should be used. Advanced Micro Controls Inc. supplies Transducer cables with the following part numbers:

- CLT - xx for the 2831 Module.
- xx is the length of the cable in feet.

Drawing number B1110 found at the back of this manual gives the pinout for the cable.

The user must route the cable as far as possible from any power cables, including the cables coming from the Limit Output Connector, to minimize the effect of the EMI generated by them. In addition, it is recommend that all Power Switching Devices residing in the same control panel as the 800 I/O Housing have surge-suppressing devices installed at their terminals.

#### LIMIT OUTPUT CONNECTOR HOOKUP

Drawing number B1162 found at the back of this manual give the pinout for connecting loads to the Limit Output Connector.

All cabling from the Limit Output Connector must be routed away from the transducer cable. This is to limit the effects of EMI on the transducer cable that may be generated by the loads. In addition, all inductive loads (motors, solenoids, etc) connected to the limit outputs should have surge suppressors installed on their power terminals.

## 4.0 CONFIGURING A SERIES 2800 MODULE

---

The Operating Mode is defined by two inputs. The first input is the Keyboard Program Switch. The second input is the last command sent to the module by the processor. The table below lists the four Modes and the states of the inputs.

	Program Switch	Last Command
Mode 1	ON	Power Up condition or any command other than the "RUN" command
2	OFF	
3	ON	"RUN" Command
4	OFF	

### Mode 1 - Fully Programmable Mode

- 1) Limit Output Drivers are disabled.
- 2) The module is programmable from both the processor and the keyboard.
- 3) The module reports the last program instruction or Fault Status information back to the processor.

### Mode 2 - Processor Programmable Mode

- 1) Limit Output Drivers are disabled.
- 2) The module is programmable from the processor only.
- 3) The module reports the last program instruction or Fault Status information back to the processor.

### Mode 3 - Keyboard Programmable Mode

- 1) Limit Output Drivers are enabled.
- 2) The module is programmable from the keyboard only.
- 3) The module reports the values of the Position and Tachometer Functions as well as Limit ON/OFF Status and Fault Diagnostic data.

### Mode 4 - Run Mode

- 1) Limit Output Drivers are enabled.
- 2) The module is not programmable.
- 3) The module reports the values of the Position and Tachometer functions as well as Limit ON/OFF Status and Fault Diagnostic data.

#### 4.0 CONFIGURING A SERIES 2800 MODULE (cont'd)

- NOTES:
- 1) The module will power up in Mode 1 or 2. The exact configuration depends on the position of the Keyboard Program Switch.
  - 2) When the module is in Modes 1 or 2, (programmable from the processor), the Limit Output Drivers are disabled. Please Note: The limits are disabled on power up.
  - 3) The processor can issue a "Disable Keyboard Programming" command to the module that will disable the Keyboard Program Switch. This will disable Modes 1 and 3. For most applications, this is recommended to keep someone from inadvertently changing the parameters of the module from the keyboard and will allow the programmer to force the module into a known mode.
  - 4) Mode 4 (RUN Mode) is the recommended Operating Mode for the module when the system is running.

## 5.0 KEYBOARD PROGRAMMING OF THE 2800 MODULE

---

Before any of the 2800's parameters can be changed from the keyboard the module must be in Modes 1 or 3. When the module is in one of these two Modes, the yellow PRG light on the front panel is lit. For more information on entering Modes 1 or 3, refer to the section "Keyboard Program Switch" found on page 12 and Chapter 4 "Configuring the 2800 Module".

The following conventions are used when describing the keystrokes used to program the different parameters.

[KEY]: Used to show the key pressed on the module. The key's name will be inside the brackets. If an asterisk appears before a key, (Example: \*[FUNCTION]), the key must be pressed until the display is showing the proper parameter. If a "X" and a number follow a key, (Example: [▲]X3), the key must be pressed the shown number of times. (In this example, the [▲] key would be pressed 3 times.

"Display": Information shown on the 6 digit display. A blinking cursor is shown by a underline.

IND. LEDS: Indicator LEDS that indicate the function or parameter being displayed or programmed.

An underlined number (Example "8") shows the position of the Cursor.

The following examples use the least number of keystrokes. However, any series of keystrokes is valid as long as the data is correct before the [ENTER] key is pressed.

### TACHOMETER RESPONSE

You want the tachometer to update every 32 mSecs.

The tachometer response is presently at it's default value of 240 mSecs with a 1.0 RPM resolution.

PRESS	IND. LEDS	DISPLAY	COMMENTS
*[FUNCTION]	TAC + A	"1_0240"	Present Value.
[▲]	TAC + A	"1_240.0"	240 mSec, .1 RPM resolution
[▲]	TAC + A	"1_0032"	Desired Value.
[ENTER]	TAC + A	"1_0032"	Value stored in EEPROM Blinking cursor removed.

## 5.0 KEYBOARD PROGRAMMING OF THE 2800 MODULE (cont'd)

### SCALE FACTOR

You wish to program a Scale Factor of 720, which is a resolution of one count per every half of a degree rotation. Presently, the default Scale Factor of 360 is programmed in.

PRESS	IND. LEADS	DISPLAY	COMMENTS
*[FUNCTION]	SF	"1_0360"	Present Scale Factor
[▶], [▲]X4 [▶], [▼]X4 [▶]	SF	"1_0720"	Desired Scale Factor
[ENTER]	SF	"1_0720"	Value stored in EEPROM Blinking cursor removed.

### POSITION OFFSET

You need to program in an offset of 70 counts. The default value of 0000 is presently in memory.

PRESS	IND. LEADS	DISPLAY	COMMENTS
*[FUNCTION]	SF + A	"1_0000"	Present Offset.
[▶]X2, [▼]X3	SF + A	"1_0070"	Desired Offset.
[ENTER]	SF + A	"1_0070"	Value stored in EEPROM Blinking cursor removed.

### AUTO ZERO FEATURE

The machine is set to mechanical zero. You want to preset the transducers position to 0000. Instead of calculating the required offset, you can use the Auto Zero feature.

PRESS	IND. LEADS	DISPLAY	COMMENTS
*[FUNCTION]	POS	"1_xxxx"	xxxx = Present Position.
[CLEAR]	POS	"1_0000"	Position reset to zero.
*[FUNCTION]	SF + A	"1_yyyy"	yyyy = Calculated Offset.

5.0 KEYBOARD PROGRAMMING OF THE 2800 MODULE (cont'd)

LIMIT SETPOINT PROGRAMMING

Programming with no existing setpoints in memory.

You wish to program the following setpoints into memory.  
There are presently no setpoints in memory.

Limit 1: 45 to 135 and 225 to 315  
Limit 2: 90 to 180  
Limit 8: 225 to 100

PRESS	IND. LEDS	DISPLAY	COMMENTS
*[FUNCTION]	O	"o1...."	Limit Select Display. Cursor blinking.
[ENTER]	O + C	"1 ____"	Limit 1 ON Setpoint.
[▲], [▶], [▲], [▶], [▲]X5, [▶], [▲]X6	O + C	"1 0045"	Desired Value.
[ENTER]	O + C	"1 0045"	Value Stored in EEPROM. Blinking Cursor removed.
[NEXT]	O + D	"1 ____"	Limit 1 OFF Setpoint.
[▲], [▶], [▲]X2, [▶], [▲]X4, [▶], [▲]X6, [ENTER]	O + D	"1 0135"	Value Stored in EEPROM.
[NEXT]	O + C	"1 ____"	Limit 1 ON Setpoint.
[▲], [▶], [▲]X3, [▶], [▲]X3, [▶], [▲]X6, [ENTER]	O + C	"1 0225"	Value Stored in EEPROM.
[NEXT]	O + D	"1 ____"	Limit 1 OFF Setpoint.
[▲], [▶], [▲]X4, [▶], [▲]X2, [▶], [▲]X6, [ENTER]	O + D	"1 0315"	Value Stored in EEPROM.
[NEXT]	O	"1 ____"	Limit 1 ON Setpoint
[NEXT]	O	"o2...."	Limit Select Display.
[ENTER]	O + C	"2 ____"	Limit 7 ON Setpoint.



5.0 KEYBOARD PROGRAMMING OF THE 2800 MODULE (cont'd)

LIMIT SETPOINT PROGRAMMING (cont'd)

Programming with no existing setpoints in memory. (cont'd)

PRESS	IND. LEDES	DISPLAY	COMMENTS
[▲], [▶], [▲], [▶], [▼]X2, [▶], [▲], [ENTER]	O + C	"2 0090"	Value Stored in EEPROM.
[NEXT]	O + D	"2 ____"	Limit 7 OFF Setpoint.
[▲], [▶], [▲]X2, [▶], [▼]X3, [▶], [▲], [ENTER]	O + D	"2 0180"	Value Stored in EEPROM.
[FUNCTION]	O + C	"o2...."	Limit Select Display.
[NEXT]X6	O	"o8...."	Program Display: Limit 8
[ENTER]	O + C	"8 ____"	Limit 8 ON Setpoint.
[▲], [▶], [▲]X3, [▶], [▲]X3, [▶], [▲]X6, [ENTER]	O + C	"8 0225"	Value Stored in EEPROM.
[NEXT]	O + D	"8 ____"	Limit 8 OFF Setpoint.
[▲], [▶], [▲]X2, [▶], [▲], [▶], [▲], [ENTER]	O + D	"8 0100"	Value Stored in EEPROM.
[FUNCTION]	O	"o8...."	Limit Select Display.
[FUNCTION]	O	"o1...."	Inspection Display for Limit 1. Cursor not blinking.

## 5.0 KEYBOARD PROGRAMMING OF THE 2800 MODULE (cont'd)

### LIMIT SETPOINT PROGRAMMING (cont'd)

#### Clearing a Limit's Setpoints

Limit Setpoints can be cleared (erased) by using the [CLEAR] key. Both ON and OFF Setpoints are cleared. The setpoints are cleared by displaying either the ON or the OFF setpoint and pressing the [CLEAR] Key. In the following example, you erase both sets of setpoints that were programmed on Limit 1 in the last example.

PRESS	IND. LEDS	DISPLAY	COMMENTS
*[FUNCTION]	O	"L1...."	Limit 1 Program Display.
[ENTER]	O + C	"1 0045"	Limit 1 ON Setpoint.
[CLEAR]	O	"1_____"	A set of ON/OFF setpoints cleared. Because the unit stays with limit 1, at least one group of setpoints remain.
[NEXT]	O	"L1...."	Limit 1 Program Display.
[ENTER]	O + C	"1 0225"	Limit 1 ON Setpoint.
[CLEAR]	O	"2_____"	Limit 1 setpoints Cleared. Module goes to Limit 2.
[FUNCTION]	O	"L2...."	Limit 2 Program Display
[FUNCTION]	O	"L1...."	Inspection Display for Limit 1. Cursor not blinking.

#### Changing existing Setpoints

The existing setpoints can be changed by two methods. The first is by clearing the old limit setpoints (see above) and entering new setpoints. The second method is by changing the old setpoints to the values and pressing the [ENTER] Key. If the second method is used, both the ON and the OFF setpoints must be displayed and the [ENTER] Key must be pressed for each, even if only one setpoint is being changed.

**CAUTION:** Do not program overlapping pairs of ON/OFF Setpoints on the same limit. (Examples 10 - 50 and 40 - 60 OR 10 - 50 and 20 - 30). If one of the pairs is removed or altered the section of the remaining limit that was overlapped will be cleared. (If the 20 - 30 limit was erased from the example above, there would be an OFF window inside the 10 - 50 limit.

5.0 KEYBOARD PROGRAMMING OF THE 2800 MODULE (cont'd)

LIMIT SETPOINT PROGRAMMING (cont'd)

7.5.4 Inspecting Limit Setpoints.

The 2700 Module will allow you to inspect the limit setpoints without being able to program them. This cuts down on the number of keystrokes needed to view the setpoints and avoids the possibility of inadvertently changing them.

This feature is available in both the Display and the Program Mode of operation. It is the only allowed way to view the limit setpoints while in the Display Mode. In Program Mode, this feature can be accessed by pressing the [FUNCTION] Key twice. (See the end of the example in the Section: "Programming from no existing setpoints".)

PRESS	IND. LEDS	DISPLAY	COMMENTS
*[FUNCTION]	O	"L1...."	Limit 1 Inspection Display.
[ENTER]	O + C	"1 ____"	Limit 1 ON Setpoint, Does not exist.
[NEXT]	O + D	"1 ____"	Limit 1 OFF Setpoint, Does not exist.
[NEXT]	O + C	"2 0090"	Limit 2 ON Setpoint.
[NEXT]	O + D	"2 0180"	Limit 2 OFF Setpoint.
*[NEXT]	O + C	"8 0225"	Limit 8 FROM Setpoint.
[NEXT]	O + D	"8 0100"	Limit 8 TO Setpoint.
[FUNCTION]	O	"o1...."	Inspection Display for Limit 1. Cursor not blinking.

## 5.0 KEYBOARD PROGRAMMING OF THE 2800 MODULE (cont'd)

### AUTOMATIC ADVANCES

Limit Output 2 in the above programming example will be driving a solenoid. You wish to program an ON Advance of 10 mSec and an OFF Advance of 5 mSec to compensate for the mechanical delays in the solenoid.

PRESS	IND. LEADS	DISPLAY	COMMENTS
*[FUNCTION]	OA	"d1...."	Advance Select Display. Limit 1.
[NEXT]	OA	"d2...."	Advance Select Display. Limit 2.
[ENTER]	OA + C	"d2 00"	ON Advance Limit 2.
[ ▲ ], [ENTER]	OA + C	"d2 10"	ON advance set to 10 mSec.
[NEXT]	OA + D	"d2 00"	OFF Advance Limit 2.
[ ► ], [ ▲ ]X5, [ENTER]	OA + D	"d2 05"	OFF Advance set to 5 mSec.
[FUNCTION]	OA	"d1...."	Advance Select Display.

## 6.0 ADDRESSING A SERIES 2800 MODULE

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When setting up a Modicon processor to communicate with a 2831/41 module, the Traffic Cop must be programmed to recognize the module. The Traffic Cop will recognize the 2831/41 when you program the Module Type as B883. The data type will appear as BINARY and the description is "BIDIR 3 REG". The 2831/41 then has 3 input registers and 3 output registers assigned to it. When programming the Traffic Cop, you must supply the starting addresses of the input and output registers. The Traffic Cop will then assign consecutive addresses to the remaining registers. Input registers can have any address between 30000 and 39999. Output registers can have any address between 40000 and 49999. The output registers are used by the processor to program the 2831/41 module. The input registers are used by the 2800 to report status data back to the processor. The Traffic Cop set-up for a typical system is shown in the following figure:

SLOT	MODULE TYPE	REFERENCE NUMBER	DATA TYPE	MODULE DESCRIPTION
101	P8xx	n/a	n/a	Power Supply
102	884A	n/a	n/a	Mainframe CPU
103	884A	n/a	n/a	Mainframe CPU
104	B863	30001 - 30004	BINARY	Reg. Input (4CH)
105	B883	30005 - 30007 40001 - 40003	BINARY	BIDIR 3 REG.
106	B804	00001 - 00016	Disc	115 Vac 16 Output
107	B805	10001 - 10017	Disc	115 Vac 16 Input

The 2831/41 would be installed in slot 105. Input registers 30005 to 30007 would store the information sent from the module to the processor. Output registers 40001 to 40003 would store the commands from the processor to the module.

## 7.0 PROCESSOR PROGRAMMING OF THE 2800 MODULE

---

Programming the module from the processor involves sending the module a set of commands. Each command tells the module to perform a single action. An example of a single action may be storing a new value for a parameter or disabling the Keyboard Program Switch.

The module is programmable from the processor when it is in Modes 1 or 2. (Fully Programmable or Processor Programmable Modes.) The exact Mode (1 or 2) that the module is in depends on the position of the Keyboard Program Switch. Please note that Modes 1 and 2 are identical to the processor. The only difference between the two Modes is your ability to program the unit from the keyboard. The processor programs the module by sending commands through the three Output Registers assigned to the module's slot. The module replies to the program command by sending status information back to the processor through the three Input Registers.

When the module is in Modes 3 or 4 (Keyboard or Run Modes), the module is not being programmed from the processor. The exact Mode (3 or 4) that the module is in depends on the position of the Keyboard Program Switch. Please note that these two Modes are identical to the processor. The only difference between the two Modes is the ability to program the module from the keyboard. When the module is in one of these two Modes the three Output Registers are not used. The three Input Registers are used by the module to send information to the processor. This information is the values of the Position and Tachometer Functions, Limit Output ON/OFF status and Fault Diagnostic data.

The module automatically enters Modes 1 or 2 on power up or when the processor issues any command other than the "RUN" Command. You do not need to have your program send a special command to the module to set the module in Modes 1 or 2.

To enter Modes 3 or 4 your program must send the "RUN" Command to the module. When this command is processed by the unit it will update the values of the programmable parameters and begin its normal operation.

**WARNING!:** When the Module is in Modes 1 or 2, the Limit Output Drivers are disabled. The Output Drivers will not operate until the "RUN" command has been issued from the processor to set the module in Modes 3 or 4.

## 7.0 PROCESSOR PROGRAMMING OF THE 2800 MODULE (cont'd)

### Command Format

Each command that is issued from the processor uses all three of the Output Registers assigned to the 2831/41. Each register is 16 bits in length. Each command has the following format:

	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01
Reg. 1	0				OPCODE											
2	OPERAND 1															
3	OPERAND 2															

**Note:** The Opcode and the two Operands are programmed in BCD Format.

The table below lists the Program Commands in numerical order. A brief description of each command is given after the table.

Command Name	OPCODE	OPERAND 1	OPERAND 2
RUN	0002	0000	0000
PROGRAM	0003	0000	0000
CLEAR ERROR	0004	0000	0000
DISABLE KEYBOARD PROGRAM SWITCH	0005	0000	0000
ENABLE KEYBOARD PROGRAM SWITCH	0006	0000	0000
STORE SCALE FACTOR	0201	0000	New S.F.
STORE POSITION OFFSET	0202	0000	New Offset
STORE TACHOMETER RESPONSE	0203	0000	New T.R.
STORE LIMIT DISABLE MASK	0204	bbbb	bbbb
STORE LIMIT SETPOINTS	040(LS#)	ON Point	OFF Point
ADD LIMIT SETPOINTS	050(LS#)	ON Point	OFF Point
STORE LIMIT ADVANCES	060(LS#)	ON Adv.	OFF Adv.

## 7.0 PROCESSOR PROGRAMMING OF THE 2800 MODULE (cont'd)

### Command Descriptions

- 1) RUN Command - This command sets the module in Modes 3 or 4. When this command is issued, the module stores the new values for the changed parameters and enables the Limit Output Drivers. This should be the last command issued when programming the module from the processor.
- 2) PROGRAM Command - This command sets the module in Modes 1 or 2. When this command is issued, the module disables the Limit Output Drivers and awaits further programming instructions. This command is usually not needed because any command from the PC will force the module into Modes 1 or 2.
- 3) CLEAR ERRORS Command - This command is used to clear an error that the module has detected in programming commands or in transducer connections. The uses of this command are discussed in chapter 8 "READING THE STATUS OF THE 2800 MODULE" found on page 33.
- 4) DISABLE KEYBOARD PROGRAMMING Command - This command disables the Keyboard Program Switch. When this command is issued, the module will not be programmable from the keyboard. This command disables Modes 1 and 3. For most applications, it is recommended that that this command be issued before the normal operation of the machine to ensure that the modules parameters can only be changed through processor control. This command will stay in effect until the processor issues the "ENABLE KEYBOARD PROGRAMMING" Command or until power to the module is cycled.
- 5) ENABLE KEYBOARD PROGRAMMING Command - This command will override a previous "DISABLE KEYBOARD PROGRAMMING" Command. After this command has been issued the module will be programmable from the keyboard. Sending this command to the module when keyboard programming is enabled will have no effect.
- 6) STORE SCALE FACTOR Command - Use this command to write a new Scale Factor Parameter to the module. This command will not take effect until the "RUN" command is issued. The new Scale Factor is programmed as Operand 2. It's legal value is any number from 2 to 1024.





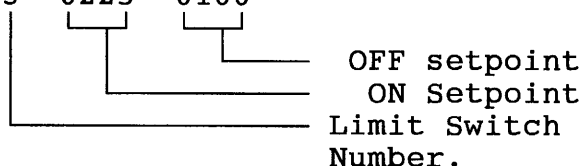
7.0 PROCESSOR PROGRAMMING OF THE 2800 MODULE (cont'd)

Command Descriptions (cont'd)

STORE LIMIT SETPOINTS Command - Use this command to erase all of the existing ON/OFF setpoints on a limit and store the two Operands as the first ON/OFF Setpoint pair. The example below will program the following limit setpoints:

Limit 1: 45 to 135  
 Limit 2: 90 to 180  
 Limit 3: 225 to 100

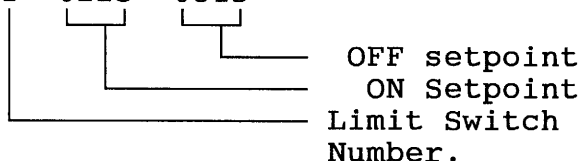
Store Limit 1 Setpoints: "0401 0045 0135"  
 Store Limit 2 Setpoints: "0402 0090 0180"  
 Store Limit 3 Setpoints: "0403 0225 0100"



ADD LIMIT SETPOINTS Command - Use this command to add a pair of ON/OFF Setpoints to a limits' existing setpoints. A total of eight pairs of setpoints can be assigned to each limit. The programming is the same as the programming for the STORE LIMIT SETPOINTS Command. The example below will add the following setpoints to Limit 1.

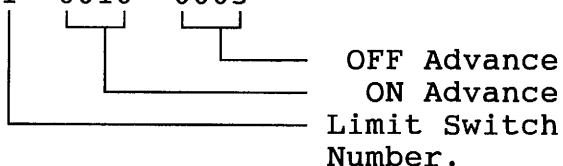
Limit 1: 225 to 315

Add Limit 1 Setpoints: "0501 0225 0315"



STORE LIMIT ADVANCES Command - Use this command to store new ON and OFF Automatic Advances for the Limit Setpoints. Automatic Advances are available on Limits 1 through 5. The values for the Automatic Advances can range from 0 to 99 mSec. The ON Advance must be greater than the OFF Advance. The example below shows an ON Advance of 10 mSec and an OFF Advance of 5 mSec being programmed on Limit 1.

Store Limit 1 Advances: "0601 0010 0005"



## 8.0 READING THE STATUS OF THE 2800 MODULE

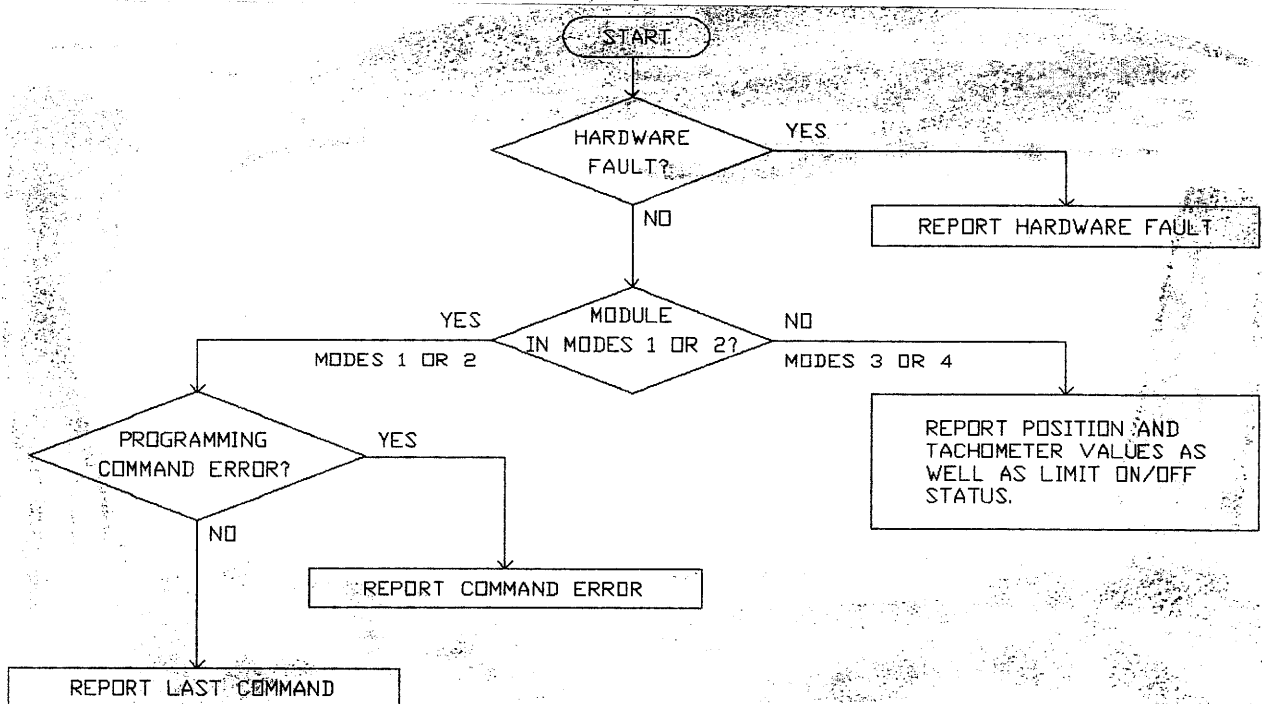
The 2800 Module reports status information back to the processor through the three Input Register assigned to it when the Traffic Cop was configured.

The information that the module sends to the processor is based on two things. The first is the fault status of the module and the second is the Mode that the module is in.

If there is a fault condition, the module will send information on the type of fault. There are two categories of faults. The first is Hardware Faults. These faults are the Transducer Fault, the EEPROM Fault and the RAM Fault. Each fault is explained in the section "Status Indicators" found on page 11. The second category of faults are the Command Faults. These faults are caused by the processor sending an invalid command to the module.

If there are no fault conditions, the information that the module sends to the processor will depend on the Mode that the module is in. If the module is being programmed from the processor, (Modes 1 or 2), the module will echo back the last command sent to it. If the module is not being programmed from the processor, (Modes 3 or 4), the module will send back the information on the ON/OFF status of the limits as well as the values of the Position and Tachometer Functions.

The flowchart below shows the decision making process that the 2800 goes through when determining what message should be sent to the processor.



## 8.0 READING THE STATUS OF THE 2800 MODULE (cont'd)

### Data Format

As you can tell from the flow chart on the preceding page, there are 4 different messages that the module can send to the processor. The format of each message is shown below:

#### 1) HARDWARE FAULT

	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01
Reg. 1	STATUS				0				0				ERROR CODE			
2	0000															
3	0000															

#### 2) COMMAND ERROR

	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01
Reg. 1	STATUS				OPCODE											
2	0000															
3	0				0				ERROR CODE							

#### 3) LAST COMMAND ECHO (MODES 1 OR 2: NO ERRORS)

	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01
Reg. 1	STATUS				OPCODE											
2	OPERAND 1															
3	OPERAND 2															

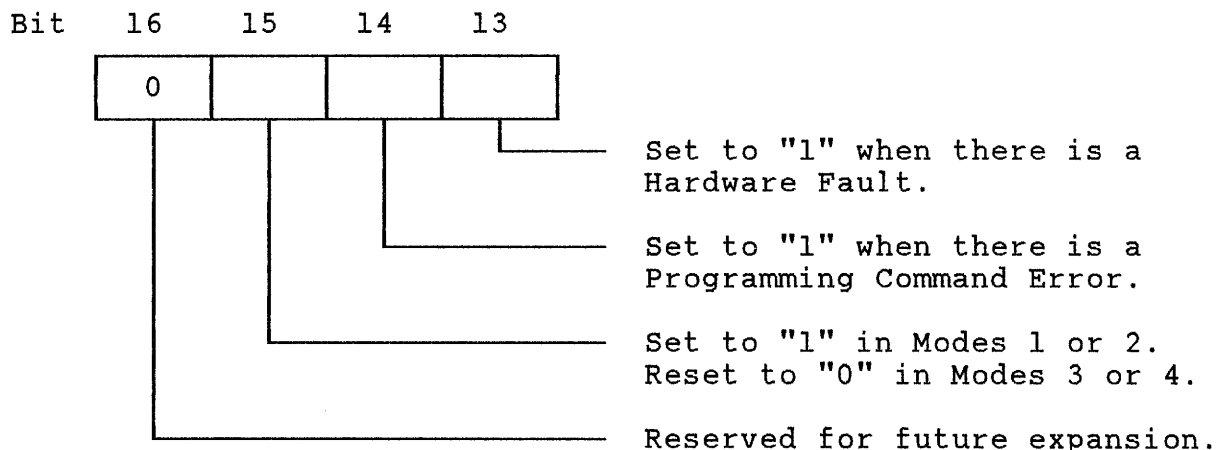
#### 4) POSITION, TACHOMETER VALUES AND ON/OFF LIMIT STATUS

	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01
Reg. 1	STATUS				0				ON/OFF LIMIT STATUS							
2	VALUE OF POSITION FUNCTION															
3	VALUE OF TACHOMETER FUNCTION															

## 8.0 READING THE STATUS OF THE 2800 MODULE (cont'd)

### Status Field

Each message has 4 bits that are used to indicate the status of the module. These bits are bits 13, 14, 15, and 16 of the first register assigned to the module. These bits are labeled "STATUS" in the figures on the preceding page. The format of the Status Field is shown below.

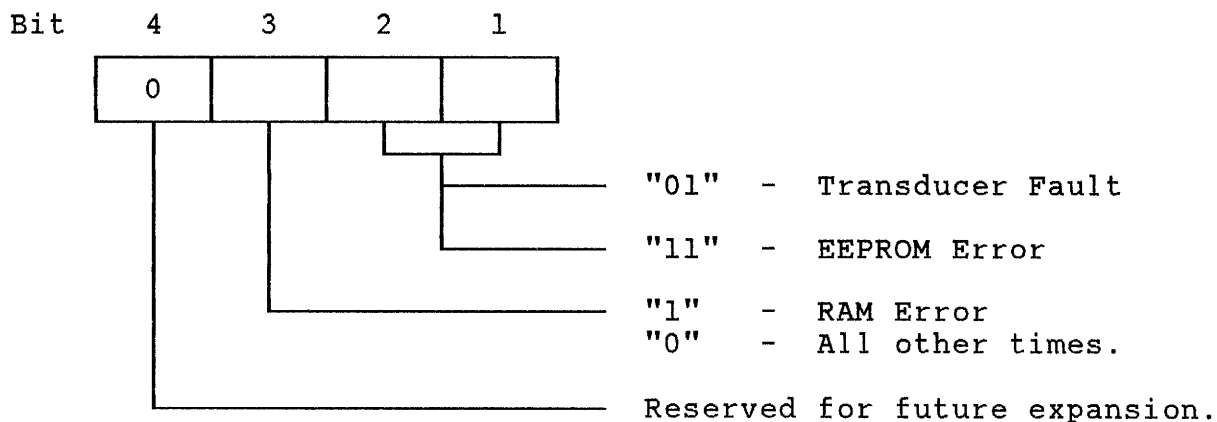


### Error Codes

When there is an error condition the module will set the appropriate bit in the Status Field and send additional information describing the exact nature of the fault. The format of the error information is shown below:

#### HARDWARE FAULTS:

When there is a Hardware Fault the Error Field is located at bits 1, 2, 3, and 4 of the first Input Register assigned to the module. The format of the Error Field is shown below.



The "CLEAR ERRORS" Command can be used to clear the transducer fault. The EEPROM Error can only be cleared from the keyboard.

## 8.0 READING THE STATUS OF THE 2800 MODULE (cont'd)

### Error Codes (cont'd)

#### PROGRAMMING COMMAND ERROR:

When there is a Programming Command Error the Error Field is located at bits 1 through 8 of the third Input Register assigned to the module. If there is also a Hardware Fault, the Programming Command Error bit will be set in the Status Field but the data that is sent to the processor will be the error data for the Hardware Fault. The Programming Command Error data is sent to the processor as two BCD digits. The format of the error data is shown in the following table.

BCD Code	Mnemonic	Cause of Error
11	INVALID COMMAND	Invalid Opcode
12	COMMAND IGNORED	Previous Command Error was not Cleared
13	INVALID OPERAND	Operand that should have been set to 0000 was a different value.
21	INVALID SCALE FACTOR	Scale Factor outside limits of 2 to 1024
22	INVALID OFFSET	Offset parameter greater than (S.F. - 1)
23	INVALID TACH RESPONSE	Tach Response Code greater than 4.
31	INVALID LIMIT #	Limit Switch number greater than 8.
32	INVALID # OF SETPOINTS	Number of Setpoint Pairs assigned to a Limit exceeds eight.
33	INVALID ON SETPOINT	ON Setpoint value greater than (S.F.-1)
34	INVALID OFF SETPOINT	OFF Setpoint value greater than (S.F.-1)
41	INVALID ON ADVANCE	Limit Switch Number greater than 5
42	INVALID OFF ADVANCE	OFF Advance greater than ON Advance

## 9.0 2800 SPECIFICATIONS

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### Module Location

Any Modicon 800 series I/O housing, occupies one slot

### Position Transducer

AMCI Brushless Resolver

### Transducer Input

Transformer Isolated

### Position Resolution

All modules internal to 1 part in 8192  
2831 Module programmable to 1 part in 1024  
2841 Module programmable to 1 part in 4096

### New Position Throughput time

400 uSec: 2831, 2841 Modules

### Programmable Parameters

Scale Factor  
Position Offset  
Tachometer Response Time  
Tachometer Resolution  
Limit Setpoints  
Limit Setpoint Advances  
Limit Output Mask  
(By Processor Instruction only)

### Position Offset

Programmable to Full Scale Count

### Tachometer Response Time

Programmable to 32, 60, 120, or 240 mSec

### Tachometer Resolution

1 RPM at 32, 60, or 120 mSec response time  
Programmable 1 or 0.1 RPM at 240 mSec response time

### Tachometer Range

1 to 2000 RPM at 32, 60, or 120 mSec response time  
1 to 1000 or 0.1 to 999.9 RPM at 240 mSec response time

### Program Input

Module's keyboard or Program Instructions from programmable controller

### Program Storage

EEPROM Memory

### Number of Outputs

8

### Number of Limit ON/OFF Setpoints

8 pairs of ON/OFF Setpoints per Output

### Setpoint Advances

Independent ON and OFF Setpoint Advances programmable from 0 to 99 mSec  
Separate Advances for each Limit Output Available on Limits 1 to 5

### Output Current Rating

2A DC Sourcing per Output  
5A DC Limit per group of 4 Outputs

### Surge Rating

4A DC for 10 mSec

### Output Power Supply

External +12V DC to +40 V DC

### Output Fuses (1 per group of 4 Outputs)

7A Fast Blow (Littelfuse 225007)

### Output Isolation

1500 Vrms Minimum (opto isolated)

### DC Supply from Backplane

+5V DC @ 0.75A max.

### Module's +5V DC Supply Fuse

1.5A Fast Blow (Littelfuse 22501.5)

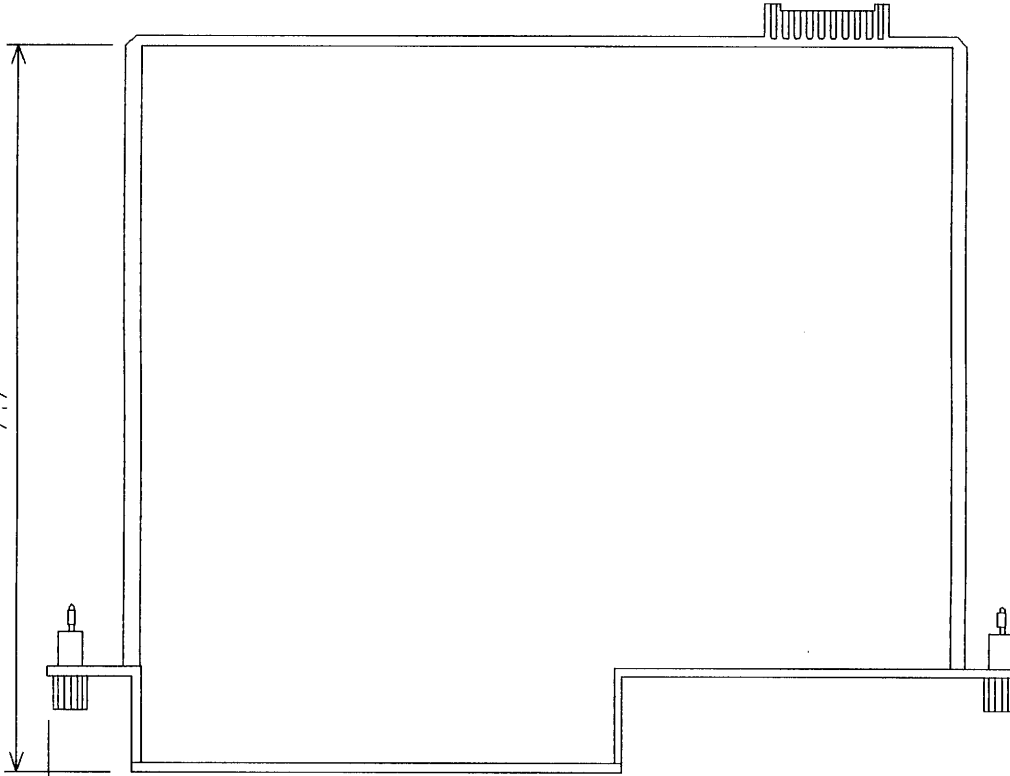
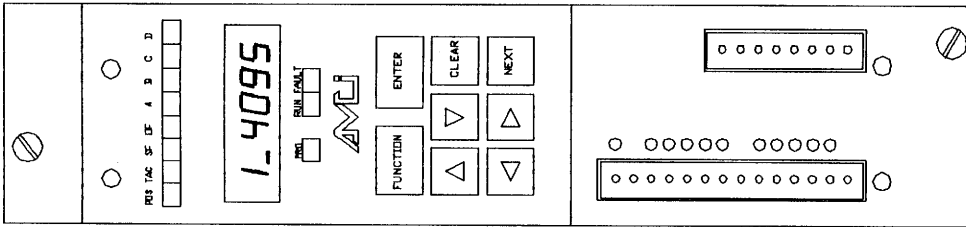
### Environmental Conditions


Operating Temperature: 0 to 60° C  
Relative Humidity: 5 to 95%  
(without condensation)  
Storage Temperature: -40 to 85° C

2.35

7.7

10.5



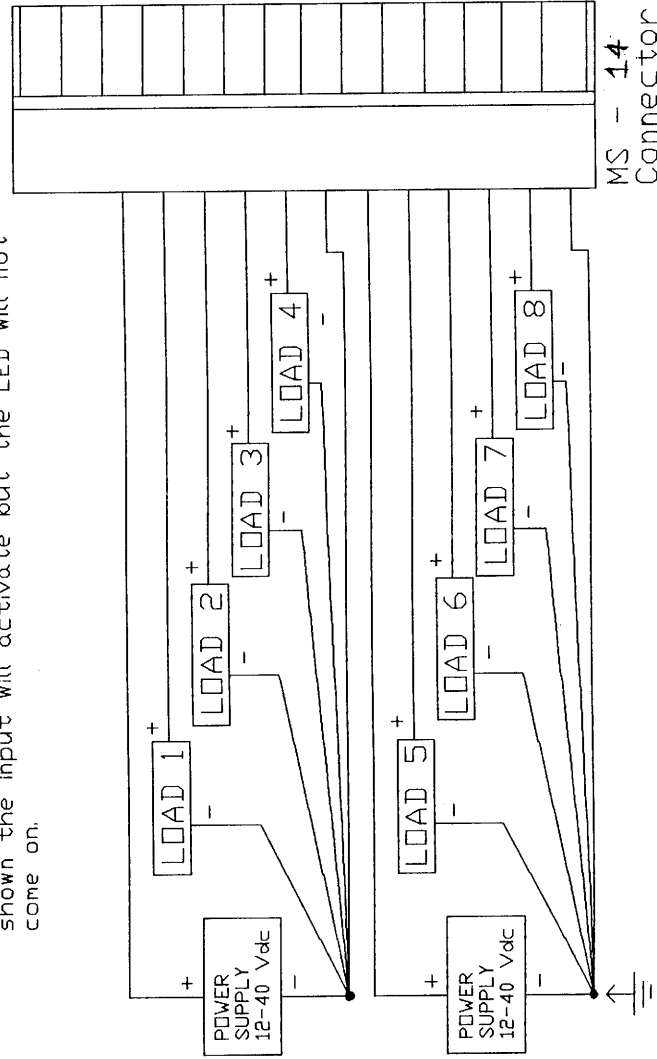
 ADVANCED MICRO CONTROLS, INC.		SCALE	DRAWN BY
2800 SERIES			DWN
TITLE		OUTLINE DRAWING	
DATE	DRAWING NUMBER		
8/5/91	B1163		

All dimensions are in inches. To convert to mm, multiply by 25.4.



# Programmable Limit Switch Module

The Input is not used by standard Programmable Limit Switch Modules. If the Input is used, the input voltage must be between 10 and 24 Vdc/ac. Minimum current to turn the input on is 10 mAmps. If a DC voltage is applied with the opposite polarity then shown the input will activate but the LED will not come on.



All return connections from the loads must be as close to the Power Supply as possible.


If the power supply is to be connected to earth ground, the connection must be made as close to the supply as possible.

Maximum current draw per output is 2A dc.

Surge Rating per output is 4A dc for 10 mSec.

Maximum current draw per group of 4 outputs is 5A dc.

All inductive loads should have surge suppression devices installed on their terminals.

 ADVANCED MICRO CONTROLS, INC.		
PROGRAMMABLE LSM'S	SCALE NONE	DRAWN BY D.W.Y.
TITLE LIMIT OUTPUT CONNECTOR		
DATE 7/26/91	DRAWING NUMBER B1162	