

SERIES 1400

INTELLIGENT ABSOLUTE RESOLVER INTERFACE MODULE

USER'S MANUAL

Catalog Number 1400-293M



General Information

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.

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

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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.

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1.0 OBJECTIVE

The objective of this manual is to explain the installation, operation, programming, and servicing of the Series 1400 Absolute Resolver Encoder Modules for the Square D Sy/Max Series I/O Chassis. It is strongly recommended that you read through the following instructions. If there are any unanswered questions after reading this manual, contact the factory. An applications engineer will be available to assist you.

2.0 INTRODUCTION

The Series 1400 Absolute Resolver Encoder Modules are single or multi-axes modules that plug directly into any Square D Sy/Max Register slot. Each module occupies only one slot in the chassis. Since the Absolute Resolver Encoder Module plugs into the chassis, no external wiring is needed to interface the module to the PC. The only wiring necessary for the operation of the module is the wiring needed to connect the transducer to the module.

On the front panel, a six digit LED display and sealed keyboard allows the monitoring of transducer position and speed. Scale Factor, Offsets, and Tachometer Response are programmable from the keyboard. Each module is equipped with hardware fault and broken wire indication. Position and Tachometer information for all of the module's axes is available to the programmable controller.

3.0 SERIES 1400 FAMILY

The following table lists the model numbers of the ten different Absolute Resolver Encoder Modules presently available in the Series 1400 Family as well as a brief description of each module.

1431	10 bit, one axis, single turn encoder
1432	10 bit, two axes, single turn encoder
1433	10 bit, three axes, single turn encoder
1434	10 bit, four axes, single turn encoder
1441	13 bit, one axis, single turn encoder
1442	13 bit, two axes, single turn encoder
1443	13 bit, three axes, single turn encoder
1444	13 bit, four axes, single turn encoder
1461	18 bit, one axis, multi-turn encoder
1462	18 bit, two axes, multi-turn encoder

This manual will deal with the programming and operation of the 143x and 144x modules. For instructions on the other modules, refer to the Series 1461/2 User's Manual.

4.0 INSTALLATION

4.1 POWER REQUIREMENTS

A Series 1400 Absolute Resolver Encoder Module draws its systems power from the I/O chassis backplane. The power that is drawn from the I/O chassis backplane is 850 mAmps from the +5 Vdc Supply (4.25 W total). Add this to the power requirements of all other cards in the chassis to avoid exceeding backplane or supply capacity.

4.2 INSTALLING THE MODULE

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

CAUTION: The Grounding Screw on the bottom of the module must be must be screwed into the chassis tightly in order to insure safe and proper operation.

The Series 1400 Modules can be installed in any available Register Slot in a Square D I/O Rack. These I/O Racks are the Square D register rack (8030 RRK except the first slot) or the register slot of the Square D digital I/O racks (8030 CRK, DRK, GRK, or HRK). The number of registers that must be assigned to the slot is dependent on the type of module that is installed. Refer to Section 9 Addressing the 1400 Module for more information.

The following Keying Pins should be installed in the register slot connector that the Series 1400 Module will reside in. This will insure that only an AMCI Series 1400 Module can be plugged into the slot.

Keying Pin 1: Between slot (03-04) and slot (05-06)
Keying Pin 2: Between slot (29-30) and slot (31-32)
Keying Pin 3: Between slot (91-92) and slot (93-94)

Keying Pins 1 and 3 are standard pins that are used to insure that only register modules can be plugged into the connector. Keying Pin 2 is the pin that keys the connector to accept a Series 1400 Module only.

4.3 INSTALLING THE TRANSDUCER CABLE

The transducer cable is used to carry the low-power position signals from the transducer to the module. Because these signals are low-power, they are sensitive to EMI Noise that can be generated by high power lines and devices. If Noise is injected into the Transducer Cable from outside devices, the module's transducer fault detection may be tripped. To prevent EMI Noise from being induced into the cable, the cable must be placed in a shielded conduit away from any high power lines or devices and the cable itself must incorporate a shield. If you are manufacturing your own transducer cable, the prints given at the end of this manual must be followed. Note that the cable shield is connected at the module's end and not at the transducer connectors. This is to avoid ground loops that may cause damage to the module.

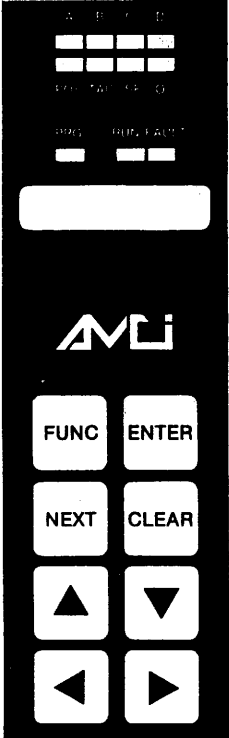
5.0 FUNCTIONAL DESCRIPTION

The following sections describe the functions and programmable parameters available on the Series 1400 Modules. For information on programming the parameters, please refer to Section 8.0 "PROGRAMMING THE 1400 ABSOLUTE RESOLVER ENCODER MODULE".

5.1 FRONT PANEL DESCRIPTION:

STATUS DISPLAY

The three LED's show the status of the module including:
 PROGRAM Mode.
 RUN Mode.
 FAULT Indication.



FUNCTION DISPLAY

The eight LEDs above the display are the FUNCTION INDICATORS. A blinking digit on the display denotes the CURSOR.

KEYBOARD

Used to display or modify the 1400 functions and parameters.

5.2 FUNCTION INDICATORS

Above the digital display are eight LED indicators that define the function showing on the display.

	LEDs ON	FUNCTION or PARAMETER
#	POS	Transducer's Shaft Position.
#	TAC	Tachometer. (speed of rotation in RPM)
*	TAC + A	Tachometer Response Time in mSecs.
*	SF	Scale Factor. (counts per revolution)
*	OF + A	Circular Position Offset.
*	OF + B	Linear Position Offset

The Position and Tachometer data is available to the PC.
 * These are programmable parameters.

5.0 FUNCTIONAL DESCRIPTION (cont'd)

5.3 FUNCTION AND PARAMETER DESCRIPTIONS

This section describes the functions and parameters available with the 1400 Modules. For programming information, refer to Section 8.0: "PROGRAMMING THE 1400 ABSOLUTE RESOLVER ENCODER MODULE".

5.3.1 POSITION FUNCTION

This function shows the current position of the transducer's shaft. This display is affected by three programmable parameters: Scale Factor, Circular Offset, and Linear Offset. The Position data is available to the programmable controller.

5.3.2 TACHOMETER FUNCTION

The Tachometer Function shows the operator the speed of rotation of the transducer's shaft in RPM, Revolutions Per Minute. 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 programmable controller.

5.3.3 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 to 1 RPM or to 0.1 RPM. With the other three update periods the only resolution available is to 1 RPM.

The maximum speed that can be displayed by the module or sent to the PC depends on the chosen tachometer response and resolution. When the Tachometer Response is set to 240 mSecs, and 0.1 RPM resolution, the maximum speed that can be displayed is 999.9 RPM. When the Tachometer Response is set to 240 mSecs, and 1 RPM resolution, the maximum speed that can be displayed is 1000 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 PC.

5.0 FUNCTIONAL DESCRIPTION (cont'd)

5.3 FUNCTION AND PARAMETER DESCRIPTIONS (cont'd)

5.3.4 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 10 bit resolution modules and between 2 and 8192 for the 13 bit Modules. With the Scale Factor programmed to 360 the module will display the position data, and send it to the PC, in degrees. With the Scale Factor programmed to 1024 the module will display the position data, and send it to the programmable controller, with 10 bit resolution.

5.3.5 CIRCULAR OFFSET PARAMETER

The Circular 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 programmable controller. 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 transducers position should equal 45. However, when the machine is aligned, the module reads a position of 695. An Offset must be programmed in to force the position to 45. The formula for determining the Offset is:

$$\begin{array}{rcccccc} \text{Scale Factor} & - & \text{Actual Position} & + & \text{Desired Position} & = & \text{OFFSET} \\ 720 & & - & 695 & + & 45 & = & 70 \end{array}$$

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 function. This function performs all the calculations needed to determine the required offset and stores this value in EEPROM memory. To use the AUTO ZERO Function, the user must be displaying the transducers position value (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.

5.0 FUNCTIONAL DESCRIPTION (cont'd)

5.3 FUNCTION AND PARAMETER DESCRIPTIONS (cont'd)

5.3.6 LINEAR OFFSET PARAMETER

The Linear Offset Parameter is used to change the RANGE of position values that the unit displays and sends to the programmable controller. This offset is most commonly used when the transducer is measuring linear distances such as with a X-Y table application. For example: The encoder is used to measure a total distance of 5.00 inches with a 0.01 inch resolution. This means that the total counts over full scale is 500, (5.00 inches * 100 counts/inch), and the user programs the Scale Factor to this value. The 5.00 inches that the encoder measures is in the range of 7.50 to 12.50 inches on the machine. The user decides to use the Linear Offset to force the module to send its position data to the programmable controller in the correct format instead of using the programmable controller to add an offset to the position value from the module. The formula for the Linear Offset is as follows:

$$\begin{array}{rclcl} \text{Minimum Desired Value} & * & \text{Resolution} & = & \text{LINEAR OFFSET.} \\ 7.50 \text{ inches} & * & 100 \text{ counts/inch} & = & 750 \end{array}$$

The maximum position value that can be displayed is 9999. Therefore the maximum value of the Linear Offset is 9999 - (SF-1).

The Linear Offset is reset to zero when the Scale Factor is changed.

5.4 FAULT DIAGNOSTICS

Three single LED indicators below the digital display are used for Status indicators.

RUN: A blinking green LED indicates that the module is powered and functioning.

FAULT: A red LED lights when one of the following faults is detected:

Transducer Fault is indicated by "X_Err.1" on the digital display, if the selected function is POS or TAC. The "X" is the number of the axis that has the fault. A broken or improperly wired transducer cable or a damaged transducer will cause this fault. Another potential cause of this fault is excessive amounts of EMI Noise that is induced into the transducer cable by an external source. A flashing "X_Err.1" on the digital display indicated that the fault can be cleared by using the [CLEAR] key on the keyboard.

5.0 FUNCTIONAL DESCRIPTION (cont'd)

5.4 FAULT DIAGNOSTICS (cont'd)

EEPROM Memory Fault is indicated by "Err2" on the digital display. This message is displayed regardless of the function selected. This fault, indicating corrupted data stored in the Users Program, means that the programmed parameters may be incorrect. The user can recover from this fault by pressing the [CLEAR] key. All parameters will be set to their default values. If the "Err.2" message remains on the display after the [CLEAR] Key has been pressed, this indicates a program storage failure and the module must be returned for repairs.

PRG: A lit yellow LED indicates that the module is in Program Mode. While in Program Mode, all of the Programmable Parameters can be inspected and altered.

6.0 PROGRAM MODE

WARNING: Remove the system power before removing or installing a module in the I/O chassis. Failure to observe this warning can result in damage to the module's circuitry and/or undesired operation with possible injury to personnel. Please refer to Section 4.0 INSTALLATION for additional information.

A slide switch (SW1) is located on the upper part of the module's PC Board behind the display. Placing the switch in the "ON" position, (pushed towards the front of the unit), will put the 1400 Module in Program Mode and light the yellow LED. Removing the two pin header that is next to SW1 will disable Program Mode regardless of the position of SW1. While in Program Mode all of the Programmable Parameters can be changed.

The Programmable Parameters are:

- Tachometer Response.
- Scale Factor.
- Circular Offset
- Linear Offset.

The uses of these parameters and the keystrokes needed to program these parameters are explained in Section 8.0 "PROGRAMMING THE 1400 ABSOLUTE RESOLVER ENCODER MODULE".

7.0 KEYBOARD DESCRIPTION

7.1 DISPLAY MODE of operation:

The Program Mode Switch (SW1) in the "off" position.
(Pushed towards the back of the unit.)

This Mode of operation allows the user to inspect all of the present values in the parameters but does not allow the changing of programmed values.

KEY	COMMENTS
[FUNCTION], [◀], [▶]	These keys are used to select the function shown on the digital display. The function displayed is determined by the Function Indicators. See Section 5.1 FUNCTION INDICATORS.
[NEXT]	This key is used to switch between axes on a multi-axes module.
[CLEAR]	This key is used to recover from fault conditions. The nature of the error is determined by the message on the display See Section 5.3 FAULT DIAGNOSTICS.
[ENTER], [▲], [▼]	These keys are not used in Display Mode.

7.0 KEYBOARD DESCRIPTION (cont'd)

7.2 PROGRAM MODE of operation:

The Program Mode Switch, SW1, in the "on" position.
(Pushed towards the front of the unit.)

This mode of operation allows the user to inspect and change all of the programmable parameters.

KEY	COMMENTS
[FUNCTION]	This key is used to select the function shown on the digital display. The function displayed is determined by the Function Indicators. See Section 5.1 FUNCTION INDICATORS.
[CLEAR]	1) This key is used to recover from fault conditions. See Section 5.3 FAULT DIAGNOSTICS. 2) If the POS function is displayed, pressing this Key will AUTO ZERO the transducer. The unit will automatically calculate and store the required offset to make the Position value equal to zero.
[ENTER]	1) When pressed, this key will store the displayed data in EEPROM Memory. Only data that is displayed with a blinking cursor can be stored. When the Scale Factor is changed, the Offset will be reset to zero.
[NEXT]	This key is used to switch between axes on a multi-axes module.
[▲], [▼]	These keys are used to increment, [▲], or decrement, [▼], the number under the blinking cursor.
[◀], [▶]	1) If the blinking cursor is active, these keys move the blinking cursor to the left or the right of the display. 2) If the blinking cursor is not active, pressing these keys selects a new function.

8.0 PROGRAMMING THE 1400 ABSOLUTE RESOLVER ENCODER MODULE

The following steps explain the programming of the 1400 Absolute Resolver Encoder Module. In all of the following examples the Module must be in the Program Mode before the keystrokes can be entered in the given sequence. Please refer to Section 6.0 PROGRAM MODE for more information.

The following conventions are used when describing the Keystrokes used to program the different functions.

[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 function. 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.

IND1 + IND2: Indicator LEDs that indicate the parameter or function being programmed or displayed.

The following keystroke 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.

8.1 TACHOMETER RESPONSE:

The user's machine will be running at 1500 RPM. Because of this, 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 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.

8.0 PROGRAMMING THE 1400 ABSOLUTE RESOLVER ENCODER MODULE (cont'd)

8.2 SCALE FACTOR:

You want to program a Scale Factor of 720, which is a resolution of one count per every half of a degree rotation, for the second transducer on a 1433. Presently, the default Scale Factor of 360 is programmed in.

PRESS	IND. LEDS	DISPLAY	COMMENTS
*[FUNCTION]	SF	"1_xxxx"	Transducer 1 Scale Factor
[NEXT]	SF	"2_0360"	Transducer 2 Scale Factor
[▶], [▼]X4 [▶], [▲]X4	SF	"2_0720"	Desired Scale Factor
[ENTER]	SF	"2_0720"	Value stored in EEPROM Blinking cursor removed.

8.3 CIRCULAR OFFSET

You want to program in a Circular Offset of 70 counts. The default value of 0000 is presently in memory.

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

8.4 AUTO ZERO:

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

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

8.0 PROGRAMMING THE 1400 ABSOLUTE RESOLVER ENCODER MODULE (cont'd)

8.5 LINEAR OFFSET

You want to program in a Linear Offset of 1000 counts for the third transducer of a 1444. The default value of 0000 is presently in memory.

PRESS	IND. LEDS	DISPLAY	COMMENTS
*[FUNCTION]	OF + B	"1_xxxx"	Transducer 1 Linear Offset
[NEXT]	OF + B	"2_xxxx"	Transducer 2 Linear Offset
[NEXT]	OF + B	"3_0000"	Transducer 3 Linear Offset
[▲], [ENTER]	OF + B	"3_1000"	Value Stored in EEPROM. Blinking Cursor removed.

9.0 ADDRESSING THE 1400 MODULE

Before a Series 1400 Module can communicate with a Square D programmable controller, you must assign register numbers to the slot that the module is plugged into. The number of registers that must be assigned to the slot is dependent on the type of 1400 Module. The following table lists the ten 1400 Modules and the required number of registers.

Module Number	# of Registers
1431/41	2
1432/42	4
1433/43	6
1434/44	8
1461	3
1462	6

The process of assigning register numbers to the slots is called RACK ADDRESSING. Rack Addressing is accomplished from your CRT Programmer. The actual steps involved in Rack Addressing are different for each model of Square D processors. Please refer to the appropriate instruction bulletin for each type of SY/MAX programmer.

The Series 1400 Modules appear as Input modules to the SY/MAX controller. When the Rack addresses are specified on the CRT Programmer, using the CPU or REMOTE RACK ADDRESS ASSIGNMENT Displays, the "MODULE INFO" comment should read "IN D5" if the module is operating correctly. "D5" is the hexadecimal code specified by Square D for third party Input Modules.

10.0 1400 MODULE REGISTER DATA FORMAT

Up to eight registers are used by the Series 1400 Modules for communication with the SY/MAX Processor. The 16 Data Bits are used to either store the Position and Tachometer values or report error diagnostic information. The format of the data in the 16 Data Bits for the single turn 1400 Modules is shown below. All Position and Tachometer values are in Binary. 1431/41 Modules will only use the first two registers listed. 1432/42 Modules will use the first four registers listed. 1433/43 modules will use the first six registers listed and 1434/44 Modules will use all eight registers listed.

BIT	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	
REG. 1	E*	0	0	13 or 10 BIT POSITION VALUE											TRANS. 1		
REG. 2	E*	0	0	0	0	11 BIT TACHOMETER VALUE											TRANS. 1
REG. 3	E*	0	0	13 or 10 BIT POSITION VALUE											TRANS. 2		
REG. 4	E*	0	0	0	0	11 BIT TACHOMETER VALUE											TRANS. 2
REG. 5	E*	0	0	13 or 10 BIT POSITION VALUE											TRANS. 3		
REG. 6	E*	0	0	0	0	11 BIT TACHOMETER VALUE											TRANS. 3
REG. 7	E*	0	0	13 or 10 BIT POSITION VALUE											TRANS. 4		
REG. 8	E*	0	0	0	0	11 BIT TACHOMETER VALUE											TRANS. 4

Because both the Position and Tachometer values are less than 16 bits in length, both have preceding zero's to complete the 16 bit register.

When a transducer fault is detected, the module will transmit 8000h (Bit 16 set) in the words of the effected channel. For example, if channel 3 has a fault, 8000h will be transmitted in words 5 and 6. When a E²PROM error is detected, 8000h (Bit 16 set) will be transmitted in all of the words sent to the processor. For more information on Fault conditions, refer to 5.3 FAULT DIAGNOSTICS, PGS 6-7.

11.0 SPECIFICATION

Module Location

Any SY/MAX[®] Register Slot

Position Transducer

AMCI Brushless Resolver

Transducer Input

Transformer Isolated

Position Resolution

143x: Programmable to 1 part in 1024

144x: Programmable to 1 part in 8192

1461/2: Programmable to 1 part in 1024 per turn

1463: Programmable to 1 part in 1024 per turn (10,000,000 Counts max.)

New Position Throughput Time

400 uSec: 1431, 32, 41, 42, 61

800 uSec: 1433, 34, 43, 44, 62, 63

Programmable Parameters

Scale Factor (Full Scale Counts)

Number of Turns (146x only)

Decimal Point Position (146x only)

Circular Offset

Linear Offset

Tachometer Response time (143x/4x only)

Tachometer Resolution (143x/4x only)

Number of Turns (146x only)

1461/2:

100 Turn Transducer:

1, 2, 4, 5, 10, 20, 25, 50, or 100 turns

180 Turn Transducer:

1, 2, 3, 4, 5, 6, 9, 10, 12, 15, 18, 20, 30, 36, 45, 60, 90, or 180 turns

1463:

10,000 Turn Transducer:

200, 400, 500, 1000, 2000, 2500, 5000, or 10000 turns

Position Offset

Circular Offset programmable from 0 to Full Scale Count

Linear Offset programmable from 0 to:
(9999 - Full Scale Count) 143x, 144x
(999999 - Full Scale Count) 1461/2
(9999999 - Full Scale Count) 1463

Programmable Tachometer Response Time

32, 60, 120, or 240 mSec: (143x/4x only)

Set to 32 mSec: (146x)

Tachometer Resolution

1 RPM at 32, 60, or 120 mSec response times

Programmable to 1 RPM or 0.1 RPM at 240 mSec response time

Tachometer Range

1 to 2000 RPM at 32, 60, and 120 mSec response time

1 to 1000 or 0.1 to 999.9 at 240 mSec response time

Data Available to Processor

Transducer's Shaft Position, Shaft Velocity, and Fault Diagnostics

Program Input

Module's self-contained keyboard and display

Program Storage

EEPROM Memory

DC Supply Voltage from Backplane

+ 5 Volts @ 0.95A max. (4 axis Module)

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.

Connector Keying

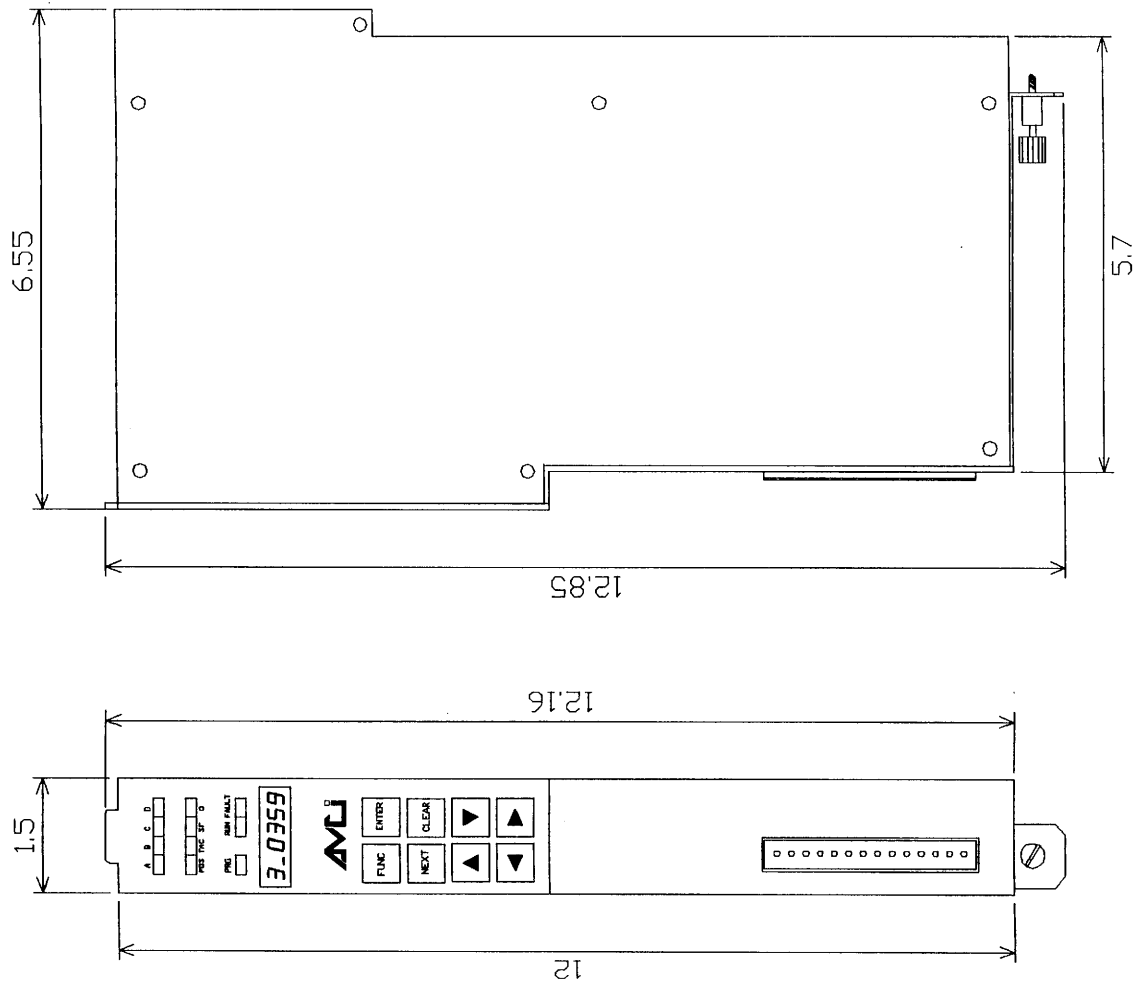
Pin 1: Between slot (03 - 04) and slot (05 - 06)

Pin 2: Between slot (29 - 30) and slot (31 - 32)

Pin 3: Between slot (91 - 92) and slot (93 - 94)

NOTES

DATE	BY	REVISION RECORD	AUTH.	DR.	CHK.

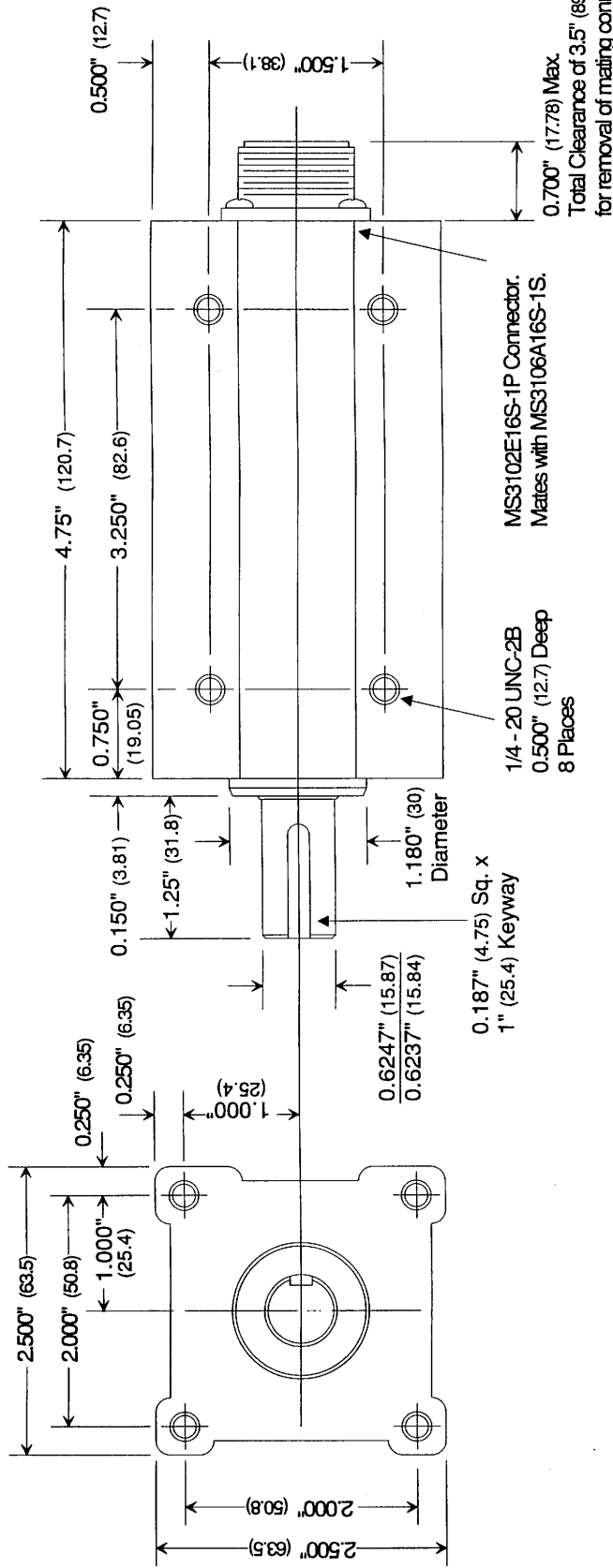


TOLERANCES (EXCEPT AS NOTED)		AMJ ADVANCED MICRO CONTROLS INC.	
DECIMAL	±	SERIES 1400	SCALE NONE
FRACTIONAL	±	DRAWN BY <i>JMN</i>	
ANGULAR	±	APPROVED BY	
TITLE		OUTLINE DRAWING	
DATE		DRAWING NUMBER	
5/30/91		B1153	

MADE IN U.S.A.

K&E ALBANY, N.Y. 12004
ENGINEERS' STANDARD FORM

DATE	SYN	REVISION RECORD	AUTH	DR	CK
1/83	A	Added Connector Removal Dimensions.	DWN		



() = Dimensions in millimeters

MECHANICAL SPECIFICATIONS

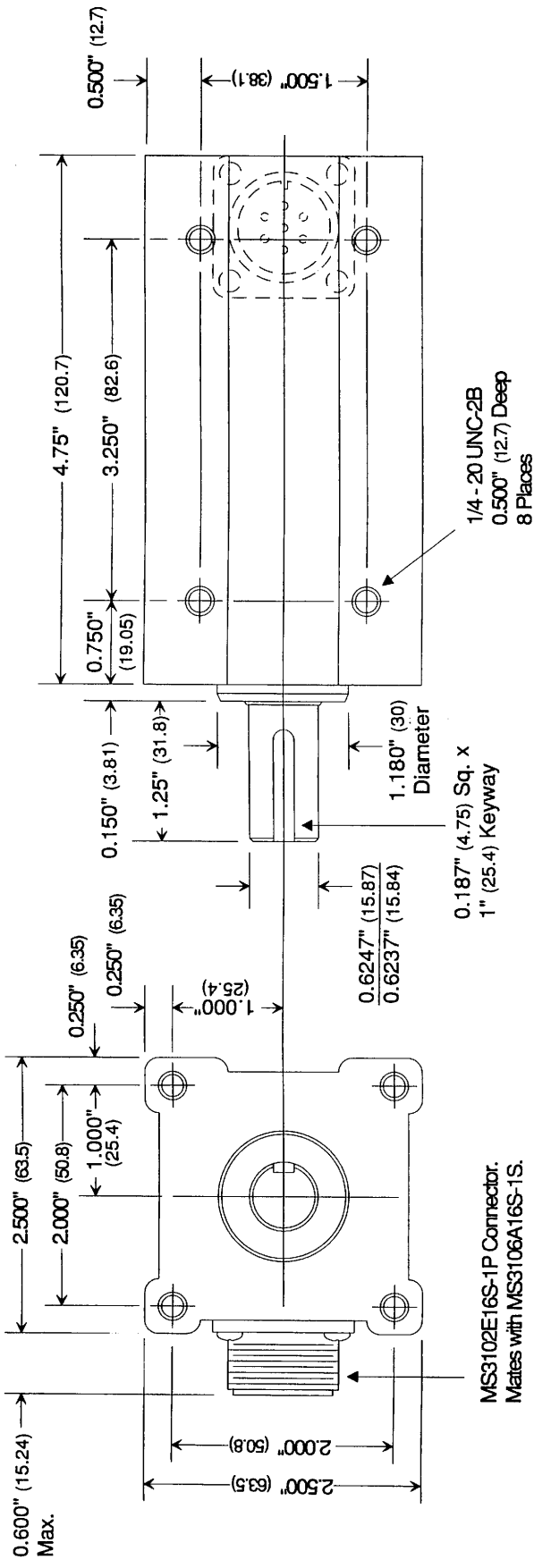
Max. Starting Torque @ 25°C 8 oz.in.
 Moment of Inertia 20 oz-in-sec²
 Max. Shaft Loading:
 Radial 400 lbs.
 Axial 200 lbs.
 Weight 4 lbs.

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature -20 to 125°C.
 Shock 50 G's for 11 mSec.
 Vibration 5 to 2000 Hz @ 20 G's
 Nema Rating Nema 13

TOLERANCES (EXCEPT AS NOTED)	AMC ADVANCED MICRO CONTROLS INC.	
DECIMAL	HT-20	SCALE 1:1
FRACTIONAL		DRAWN BY DWN
ANGULAR		APPROVED BY WXE
	TITLE OUTLINE DRAWING	
	DATE 3/9/90	DRAWING NUMBER B1001 REV. A

DATE	BY	REVISION RECORD	AUTH	DR	CK
1/29/91	A	Added Height Dimension.	DWIN		
1/28/91	B	Added Connector Removal Dimensions.	DWIN		



Total Clearance of 3.5" (89) needed for removal of mating connector.

MECHANICAL SPECIFICATIONS

Max. Starting Torque @ 25°C 8 oz.in.
 Moment of Inertia 20 oz-in-sec²
 Max. Shaft Loading:
 Radial 400 lbs.
 Axial 200 lbs.
 Weight 4 lbs.

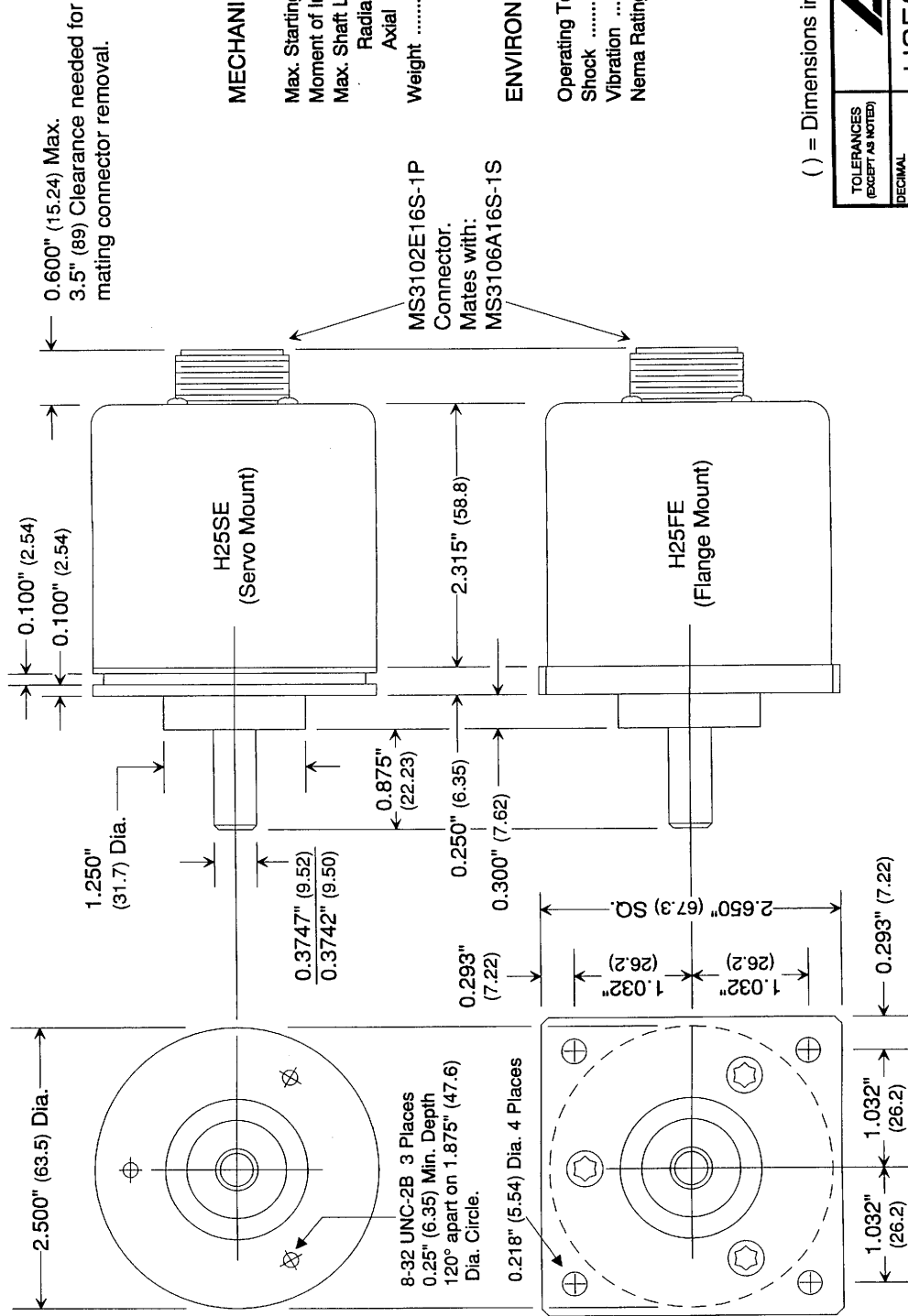
ENVIRONMENTAL SPECIFICATIONS

Operating Temperature -20 to 125°C.
 Shock 50 G's for 11 mSec.
 Vibration 5 to 2000 Hz @ 20 G's
 Nema Rating Nema 13

() = Dimensions in millimeters

TOLERANCES (EXCEPT AS NOTED)	AMC ADVANCED MICRO CONTROLS INC.	
DECIMAL	SCALE 1:1	DRAWN BY DWIN
FRACTIONAL	APPROVED BY W X E	
ANGULAR	TITLE OUTLINE DRAWING	
	DATE 5/1/90	DRAWING NUMBER B1115 REV. B

DATE	SYM	REVISION RECORD	AUTH	DR	CK
8/91	A	Changed Mounting Holes (SE)	W/XE		
9/91	B	Added 1.875" Circle (SE)	D/W/N		
1/93	C	Changed Can Length, Flange Width, Added Specifications	D/W/N		



MECHANICAL SPECIFICATIONS

Max. Starting Torque @ 25°C 1.5 oz.in.
 Moment of Inertia 4 oz-in-sec²
 Max. Shaft Loading:
 Radial 40 lbs.
 Axial 20 lbs.
 Weight 1 lb.

ENVIRONMENTAL SPECIFICATIONS

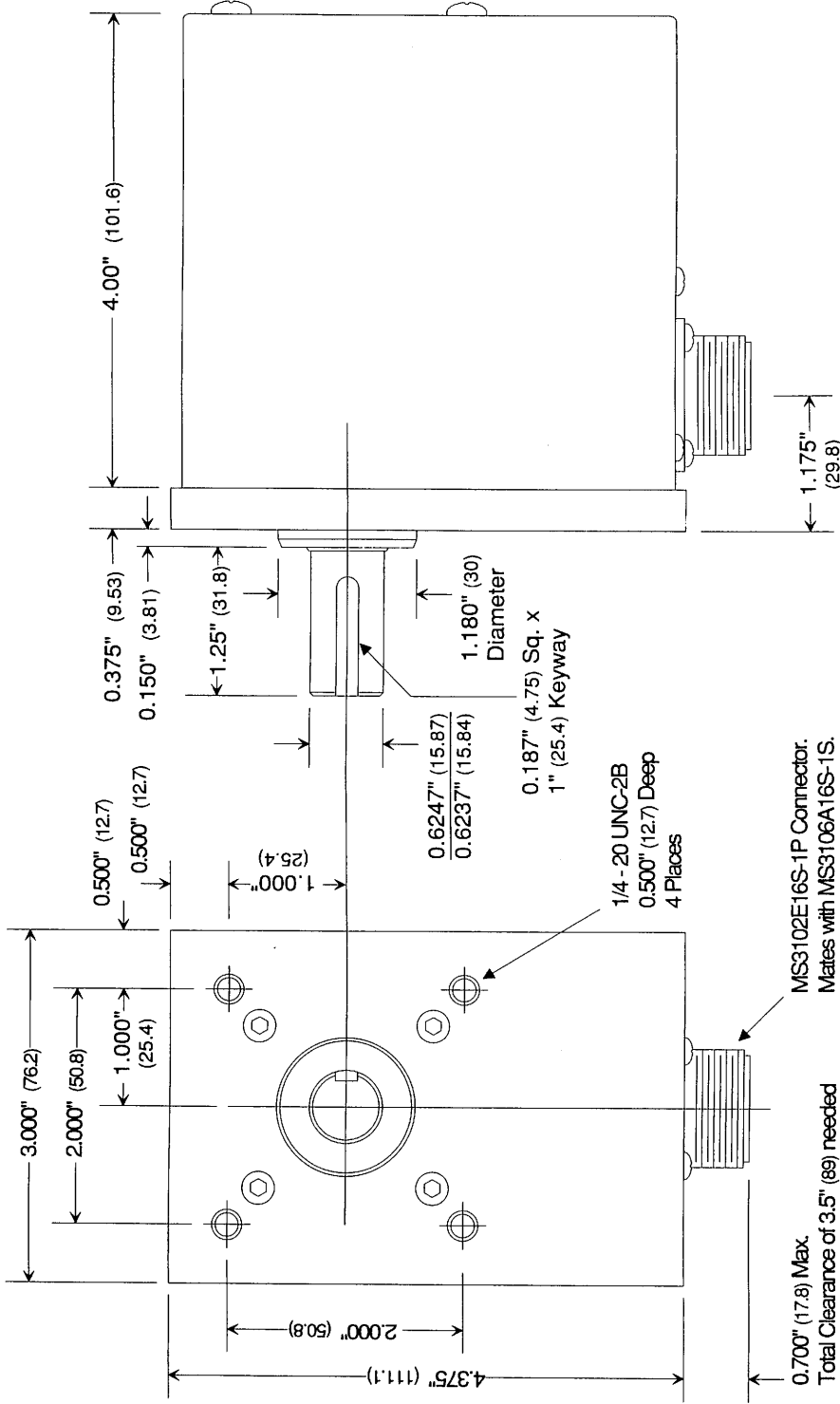
Operating Temperature -20 to 125°C.
 Shock 50 G's for 11 mSec.
 Vibration 5 to 2000 Hz @ 20 G's
 Nema Rating Nema 13

MS3102E16S-1P
 Connector.
 Mates with:
 MS3106A16S-1S

() = Dimensions in millimeters

ADVANCED MICRO CONTROLS INC.	
TOLERANCES (EXCEPT AS NOTED)	SCALE
DECIMAL	1:1
FRACTIONAL	DRAWN BY D/W/N
ANGULAR	APPROVED BY WXE
TITLE	
OUTLINE DRAWING	
DATE	DRAWING NUMBER
1/2/87	B1041 REV. C

DATE	SYM	REVISION RECORD	AUTH	DR	CR
1/83	A	Added Specifications	DMN		



MECHANICAL SPECIFICATIONS

Max. Starting Torque @ 25°C 8 oz.in.
 Moment of Inertia 20 oz-in-sec²
 Max. Shaft Loading:
 Radial 400 lbs.
 Axial 200 lbs.
 Weight 3 lbs.

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature -20 to 125°C.
 Shock 50 G's for 11 mSec.
 Vibration 5 to 2000 Hz @ 20 G's
 Nema Rating Nema 13

TOLERANCES (EXCEPT AS NOTED)	AMJ ADVANCED MICRO CONTROLS INC.	
DECIMAL	SCALE	DRAWN BY
±	1 : 1	DMN
FRACTIONAL	APPROVED BY	
±	W X Z	
ANGULAR	TITLE	
±	DRAWING NUMBER	
	DATE	B1051 REV. A
	6/1/87	

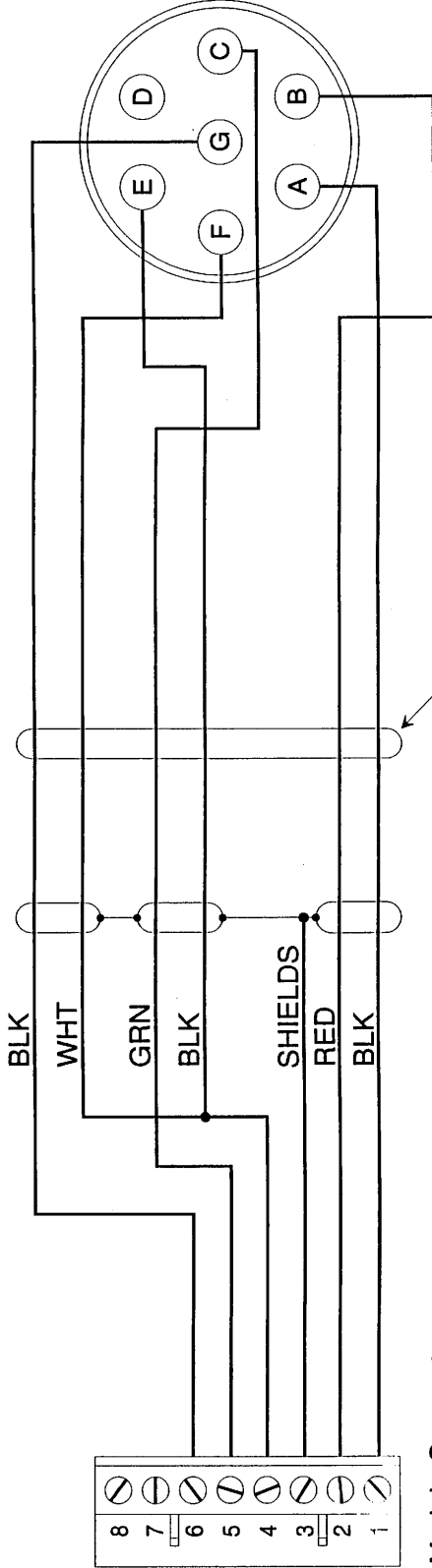
OUTLINE DRAWING

() = Dimensions in millimeters

MS3102E16S-1P Connector.
 Mates with MS3106A16S-1S.

0.700" (17.8) Max.
 Total Clearance of 3.5" (89) needed
 for removal of mating connector.

DATE	SYM	REVISION RECORD	AUTH	DR	CK
2/90	A	Added CW/CCW Note	D/W/N		
6/90	B	Changed "Mates to all..."	D/W/N		
8/91	C	Added 9730 Note	D/W/N		
2/92	D	Added 14/24/19/2900 Note	D/W/N		



Transducer Connector
 Mates with:
 HT-20 B1001
 HT-20/S B1115
 H25F/SE B1041
 HT-20-(X) B1051
 AMCI Part #: MS-16
 Bendix #: MS3106A16S-1S

BELDEN 9873 Cable
 For Cable lengths greater than 100' (30 meters) use BELDEN 9730.

Module Connector
 Mates to all Single Channel Resolver Input and Limit Switch Modules.
 For all iPLC-1 and iPCE-1 Products refer to Print B1013
 AMCI Part #: MS-8
 Phoenix #: MSTB 1.5/8-5.08

Connections are shown for CW increasing readings
 For CCW increasing readings, reverse GRN/BLK Pair. (Pins C&E)

14/24/19/2900 Users:

Pin 1 of the Transducer Input Connector is located towards the top of the module, NOT the bottom as this drawing may imply. Reversing the wires on the Module Connector will not harm the module or the transducer, but the transducer will not operate.

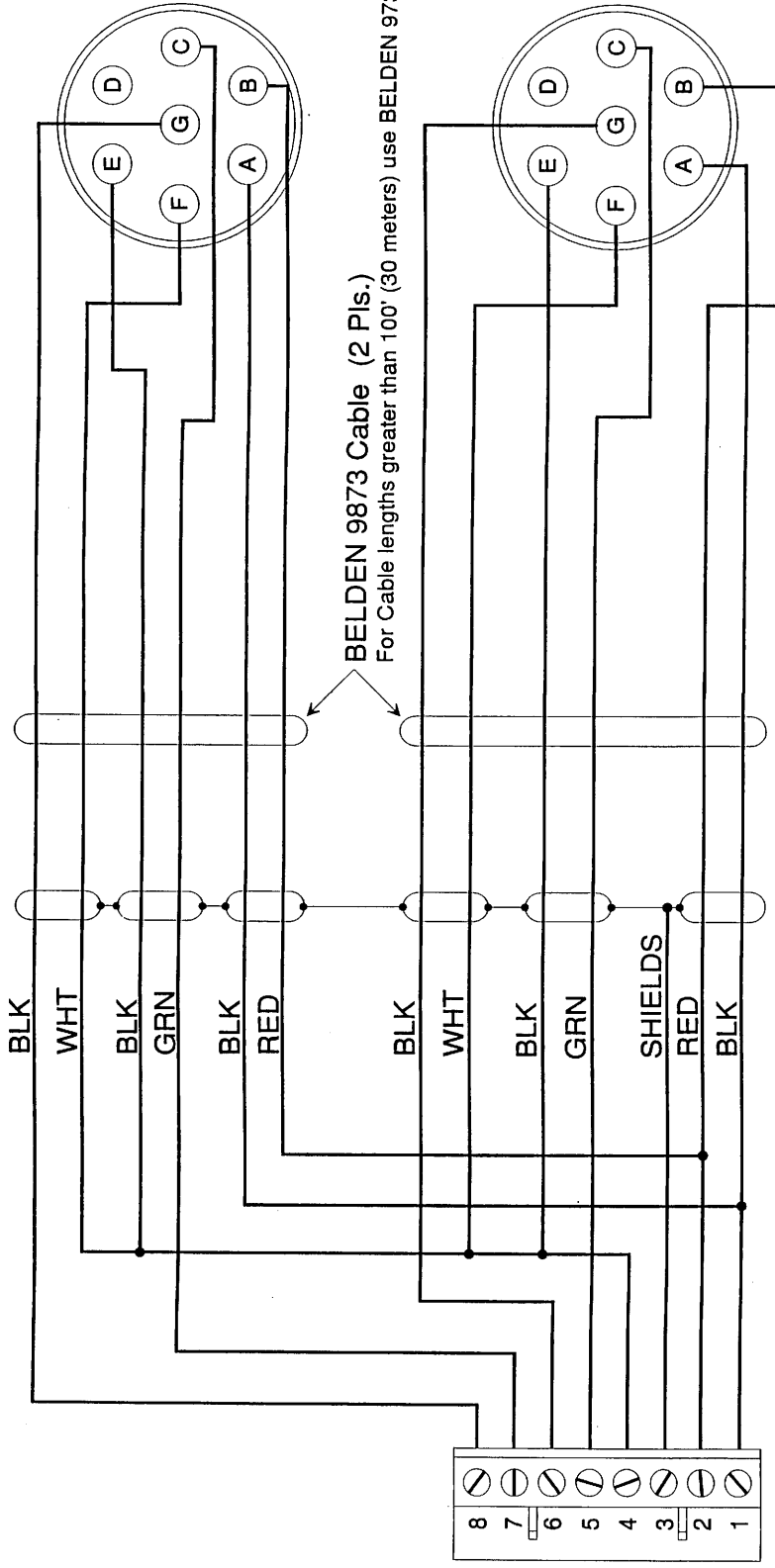
TOLERANCES (EXCEPT AS NOTED)		AMCI ADVANCED MICRO CONTROLS INC.	
DECIMAL	C1T-(X)	SCALE	DRAWN BY D/W/N
FRACTIONAL	(X) = Length in Feet	None	APPROVED BY W X E
ANGULAR			
DATE 1/11/90		DRAWING NUMBER B1110 REV. D	
Transducer Cable Drawing			

14/24/19/2900 Users:

Pin 1 of the Transducer Input Connector is located towards the top of the module, NOT the bottom as this drawing may imply. Reversing the wires on the Module Connector will not harm the module or the transducer, but the transducer will not operate.

Connections are shown for CW increasing readings
For CCW increasing readings, reverse GRN/BLK Pair. (Pins C&E)

DATE	SYM	REVISION RECORD	AUTH	DR	CK
1/90	A	Name Change.	D/W/N		
8/91	B	Added 9730 Note	D/W/N		
2/92	C	Added 14/24/19/2900 Note.	D/W/N		



Transducer B Connector
Mates with:
HT-20 B1001
HT-20/S B1115
H25F/SE B1041
HT-20-(x) B1051
AMCI Part #: MS-16
Bendix #: MS3106A16S-1S

Transducer A Connector
Mates with:
HT-20 B1001
HT-20/S B1115
H25F/SE B1041
HT-20-(x) B1051
AMCI Part #: MS-16
Bendix #: MS3106A16S-1S

Module Connector

Mates with:
Two Channel Resolver Input and Limit Switch Modules.
iPLC-2 Intelligent Programmable Limit Controllers.
iPCE-2 Intelligent Programmable Controller Encoders.
AMCI Part #: MS-8
Phoenix #: MSTB 1.5/8-5.08

TOLERANCES (EXCEPT AS NOTED)	AMCI ADVANCED MICRO CONTROLS INC.	
DECIMAL	C2T-(X)	SCALE DRAWN BY D/W/N
FRACTIONAL	(X) = Length in Feet	APPROVED BY W X E
ANGULAR	TITLE Transducer Cable Drawing	
	DATE 3/10/87	DRAWING NUMBER B1046 REV. C

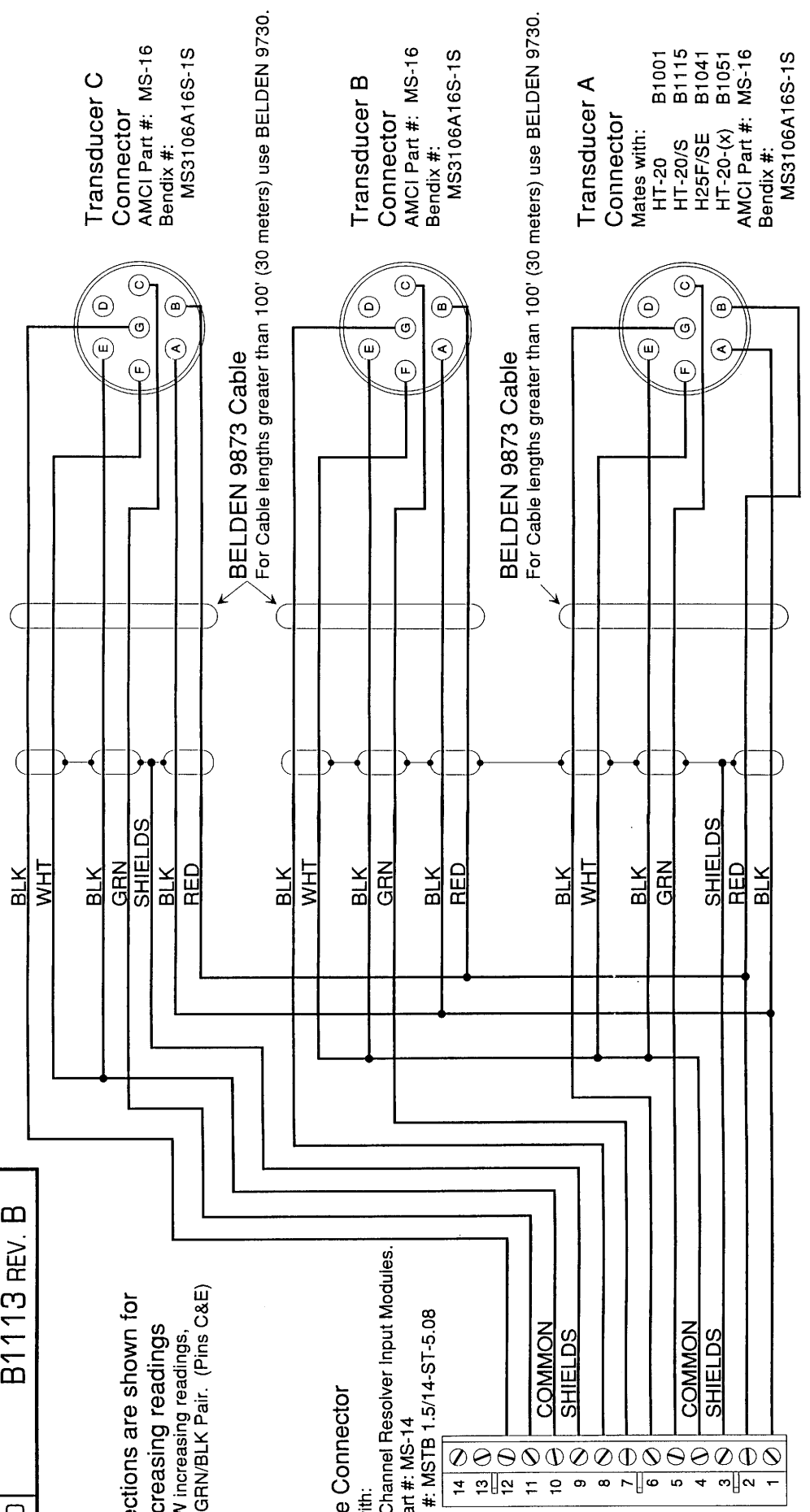
DATE	SYM	REVISION RECORD	AUTH	DR	CK
B/91	A	Added 9730 Note	DWN		
2/92	B	Added 1471900 Note.	DWN		

14/1900 Users:
 Pin 1 of the Transducer Input Connector is located towards the top of the module, NOT the bottom as this drawing may imply. Reversing the wires on the Module Connector will not harm the module or the transducer, but the transducer will not operate.

AMCI ADVANCED MICRO CONTROLS INC.
 DRAWN BY: DWN
 SCALE: None
 APPROVED BY: [Signature]
 DATE: 4/26/90
 DRAWING NUMBER: B1113 REV. B
 TITLE: Transducer Cable Drawing

Connections are shown for CW increasing readings. For CCW increasing readings, reverse GRN/BLK Pair. (Pins C&E)

Module Connector
 Mates with:
 Three Channel Resolver Input Modules.
 AMCI Part #: MS-14
 Phoenix #: MSTB 1.5/14-ST-5.08



Connections are shown for CW increasing readings. For CCW increasing readings, reverse GRN/BLK Pair. (Pins C&E)

Transducer Connectors

- Mate with:
 HT-20 B1001
 HT-20/S B1115
 H25F/SE B1041
 HT-20-(X) B1051

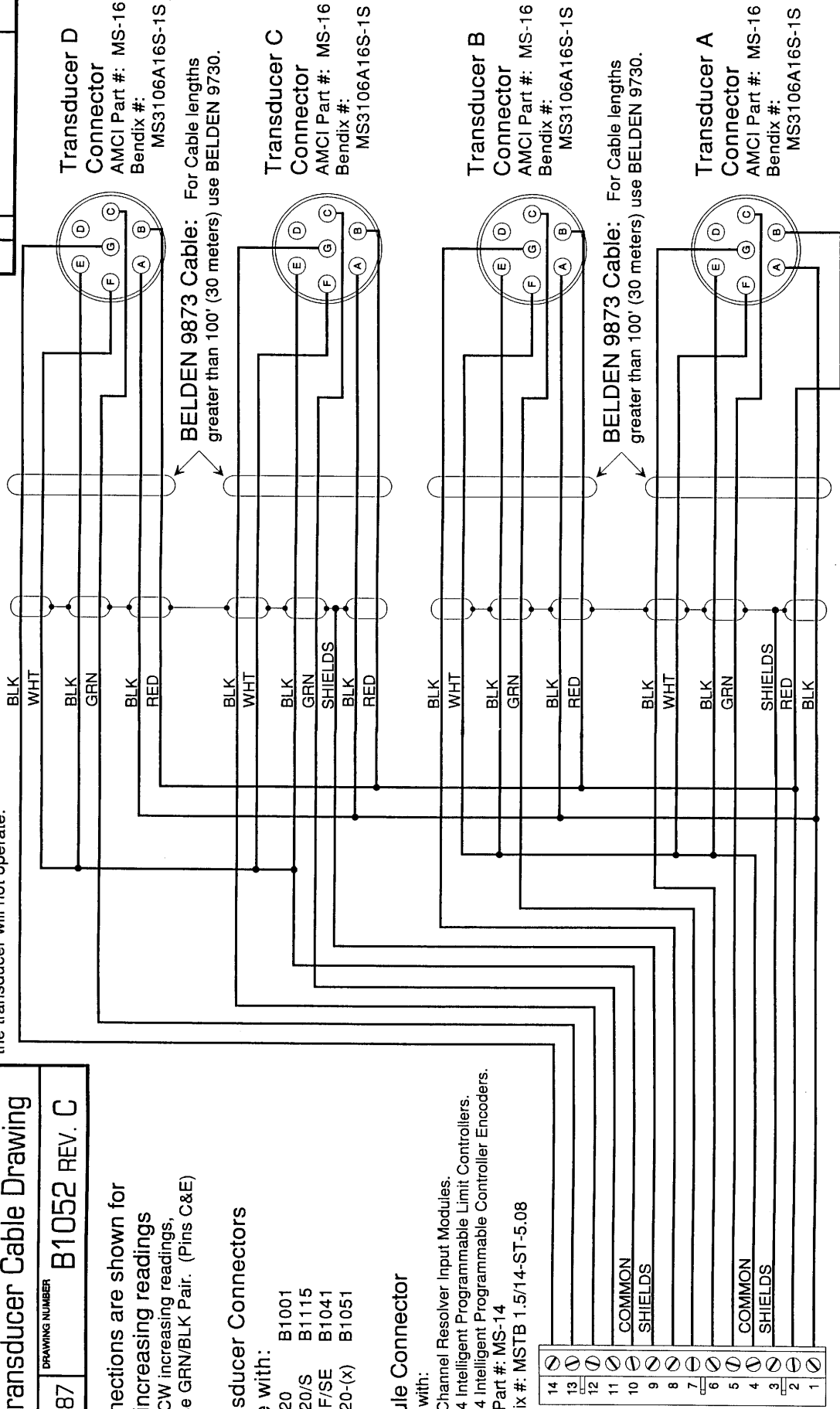
Module Connector

- Mates with:
 Four Channel Resolver Input Modules.
 iPLC-4 Intelligent Programmable Limit Controllers.
 iPCE-4 Intelligent Programmable Controller Encoders.
 AMCI Part #: MS-14
 Phoenix #: MSTB 1.5/14-ST-5.08

14/1900 Users:

Pin 1 of the Transducer Input Connector is located towards the top of the module, NOT the bottom as this drawing may imply. Reversing the wires on the Module Connector will not harm the module or the transducer, but the transducer will not operate.

DATE	SYM	REVISION RECORD	AUTH	DR	CK
1/90	A	Name Change	DWN		
8/91	B	Changed Layout - + 9730 Note	DWN		
2/92	C	Added 14/1900 Note.	DWN		





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