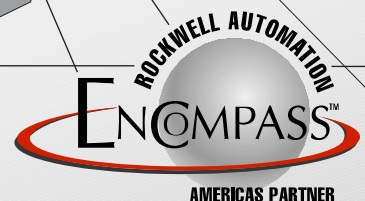


User Manual

1761H Intelligent Resolver Interface Module



AMCI
Allen-Bradley
1771 I/O
Module



Manual: 940-57061

General Information

Important User Information

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Introduction

There are now a variety of 1700 Series Intelligent Resolver Interface Modules for Allen-Bradley 1771 I/O to fit your application. These modules accept one, two, three, or four resolver inputs and convert the resolvers analog signals into digital position and tachometer data that is transmitted to the processor over the backplane. The series are broken down into the 1730 modules that are 10-bit, single turn, resolver interface modules; the 1740 modules that are 13-bit, single turn, resolver interface modules; and the 1760 modules that are multi-turn resolver interface modules which offer 12-bit resolution per turn.

This manual explains the operation, installation, programming, and servicing of the 1761H module. The factory can send you, upon request, manuals for the other modules in this series.

It is strongly recommended that you read the following instructions. Please call the factory if there are any unanswered questions after reading this manual. An applications engineer will be available to assist you.

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Revision Record

The following is the revision history for this manual. In addition to the information listed here, revisions will fix any known typographical errors and clarification notes may be added.

This manual, 940-57061, is the first release of the electronic manual and corresponds to the printed manual 940-07061. The table of contents is removed from this file and incorporated as bookmarks in the PDF file. This revision incorporates the latest transducer drawing for the HTT-20-(x) and the HTT-400-180. The manual corresponds to software revision 1, checksum DCCA for the 1761H. The software can only be used on revision H and higher of the main PC board. The software adds backplane programmability, Autotech compatibility, to the module and incorporates several features into the 1761H that were only available as options before. These new features are described in chapter 1: *1761H Introduction*.

About This Manual

Notes

This chapter serves as an introduction to the 1761H module. It highlights potential applications, compatible transducers, and all of the modules' features, including those added since the last revision.

Overview

The 1761H module is the Allen Bradley 1771 I/O compliant card that converts resolver signals to digital multi-turn position and tachometer data that can be reported over the backplane using either block or single transfers. This module eliminates the separate resolver decoder box, PLC input card, and associated wiring needed to bring the digital data into a PLC.

Like an absolute optical encoder, a resolver is a single turn absolute sensor that converts an angle into electrical signals. However, this is where the similarities end. The resolver is an analog device that does not contain sensitive components such as optics and electronics that may be damaged by severe environmental conditions. Also, the position resolution of a resolver is limited only by the electronics that decode its signals. The module can produce an absolute 20 bit multi-turn position value with a maximum 12 bits (4,096 counts) per turn when an AMCI transducer is connected to it.

The transducer that connects to the 1761H contains two resolvers. These resolvers are geared together in a vernier arrangement. The module decodes the separate resolvers and combines their positions into an absolute multi-turn position. The 1761H accepts a single dual-resolver transducer.

A 1761H application generally falls into one of two categories.

- **Rotary Application** - The resolver position directly correlates to an angular position on the machine. One example is monitoring a rotary table by attaching a multi-turn monitor and control such functions as motor braking to stop the table at its stations.
- **Linear Application** - The resolver position correlates to a physical length. One example is a packaging machine where the transducer completes multiple turns for each product. Here the transducer position is used to control when glue is applied or when the package is cut to length. Another example of a multi-turn application is monitoring the position of a load on either a track or ball screw such as a press shut height monitor. In this type of application, linear position is translated to rotary position through either a wheel or gearing. The transducer completes several rotations in order to travel the complete distance.

AMCI also has a line of cable reel transducers for use in some linear applications. A cable reel transducer has a stranded stainless steel cable wrapped around a spring loaded drum. As the cable is pulled out of the transducer, the drum rotates, which in turn rotates the internal resolvers. The cable is retracted by the force of the drums' spring. Distances of up to forty-five feet can be measured with these transducers.



Figure 1.1 1761H Module

Chapter 1 Introduction

Overview (continued)

The module has Setup Parameters that allow you to scale and adjust the position and tachometer data. Additional parameters allow you to define the type of attached transducer and the digital format of the position data. To maintain compatibility with past versions of the module, some of these parameters can be set with jumpers. Most of the parameters can be programmed over the backplane using block transfers. Using single transfers, a limited number of parameters can be programmed over the backplane.

Since revision H of the PC board, the 1761H module directly supports Autotech transducers. The module does this by automatically adjusting the reference voltage to the Autotech level when the *Resolver Type* parameter is changed from the backplane.

Brushless Resolver Description

The brushless resolver is unsurpassed by any other type of rotary position transducer in its ability to withstand the harsh industrial environment. An analog sensor that is absolute over a single turn, the resolver was originally developed for military applications and has benefited from more than 50 years of continuous use and development.

The resolver is essentially a rotary transformer with one important distinction. The energy coupled through a rotary transformer is not affected by shaft position whereas the magnitude of energy coupled through a resolver varies sinusoidally as the shaft rotates. A resolver has one primary winding, the Reference Winding, and two secondary windings, the SIN and COS Windings (See figure 1.2, Resolver Cut Away View). The Reference Winding is located in the rotor of the resolver, the SIN and COS Windings in the stator. The SIN and COS Windings are mechanically displaced 90 degrees from each other. In a brushless resolver, energy is supplied from the Reference Winding to the rotor by a rotary transformer. This eliminates brushes and slip rings in the resolver and the reliability problems associated with them.

In general, the Reference Winding is excited by an AC voltage called the Reference Voltage (V_R). (See figure 1.3, Resolver Schematic). The induced voltages in the SIN and COS Windings are equal to the value of the Reference Voltage multiplied by the SIN or COS of the angle of the input shaft from a fixed zero point. Thus, the resolver provides two voltages whose ratio represents the absolute position of the input shaft ($\text{SIN } \theta / \text{COS } \theta = \text{TAN } \theta$, where θ = shaft angle). Because the ratio of the SIN and COS voltages is considered, any changes in the resolvers' characteristics, such as those caused by aging or a change in temperature are ignored.

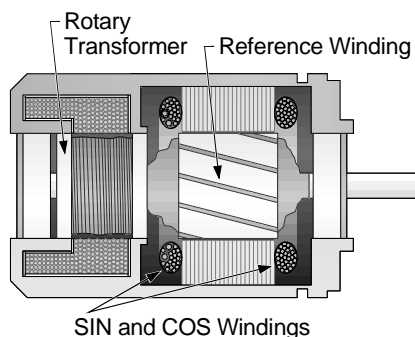


Figure 1.2 Resolver Cut away View

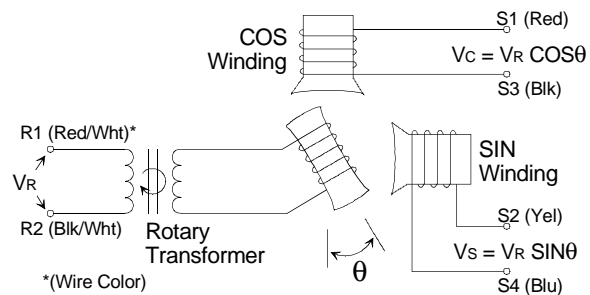


Figure 1.3 Resolver Schematic

AMCI Compatible Transducers

Table 1.2 lists the AMCI transducers compatible with the 1761H module.

Model	Shaft	Mount	Turns	Comments
HTT-20-100	0.625"	Front	100	NEMA 13 heavy duty transducer
HTT-20-180	0.625"	Front	180	NEMA 13 heavy duty transducer
HTT-20-1000	0.625"	Front	1,000	HTT-20-100 w/ additional 10:1 gearing on input shaft.
HTT-20-1800	0.625"	Front	1,800	HTT-20-180 w/ additional 10:1 gearing on input shaft.
HTT425-Ann-100†	0.250"	Motor	100	A-B Series 1326 motor mount transducer. "nn" in part number defines connector style.
HTT425-Mnn-100†	10 mm	Motor	100	Universal motor mount. Requires adapter plate. "nn" in part number defines connector style.
HTT425-Fnn-100†	0.625"	Front	100	NEMA 4X, HTT-20-100 w/ Viton® shaft seal. "nn" in part number defines connector style.
HTT425-Tnn-100†	0.625"	Foot	100	NEMA 4X, HTT-20-100 w/ Viton shaft seal. "nn" in part number defines connector style.
HTT400-180	0.625"	Front	180	NEMA 4, HTT-20-180. Bolt-in replacement for Autotech RL210 transducers.
HTTCR-9n-100	0.047" Cable	Foot	540"	Cable Reel Transducer, 540" span, 0.003" max. resolution, 45 ft stranded stainless cable standard.

† A 1,000 turn version is also available.

Table 1.1 Compatible AMCI Transducers

Each transducer contains two resolvers. The first resolver, called the fine resolver, is attached directly to the input shaft with a flexible coupler. The second resolver, called the course resolver, is geared to the fine. This gear ratio, either 99:100 or 179:180 determines the total number of turns the transducer can encode.

At the mechanical zero of the transducer the electrical zeros of the two resolvers are aligned. See Figure 1.4A. After one complete rotation, the zero of the course resolver lags behind the zero of the fine by one tooth, either 1/100 or 1/180 of a turn. After two rotations the lag is 2/100 or 2/180. See Figures 1.4B and 1.4C. After 100 or 180 turns, the electrical zeros of the resolvers are realigned and the multi-turn cycle begins again.

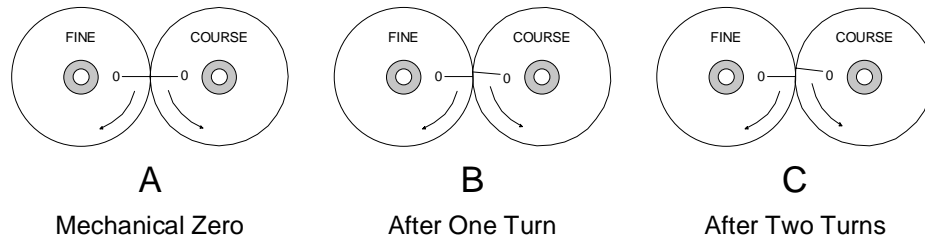


Figure 1.4 Resolver Alignment in Multi-turn Transducers

The fine resolver yields the absolute position within the turn directly. Using a proprietary algorithm, the module determines the number of turns completed by the difference in positions of the two resolvers. The absolute Multi-turn position is then calculated as ((number of turns completed * counts per turn) + fine resolver position).

The 1,000 and 1,800 turn transducers have a 10:1 gear ratio between the input shaft and the resolvers. Therefore they can encode ten times the number of turns but at a tenth of the resolution.

Chapter 1 Introduction

Other Compatible Transducers

In addition to AMCI transducers, the 1761H module now directly support Autotech multi-turn transducers. The Autotech models supported are:

- All SAC-RL210-G128 Transducers. (Size 40, NEMA 13)

Autotech also manufactures SAC-RL210-G64 transducers. These transducers are not supported by AMCI.

You select between AMCI and Autotech transducers over the backplane from the processor. The module then sets the reference voltage according to your selection. When using Autotech transducers, only 10 bit (1024 counts) per turn resolution is supported. AMCI's HTT400 -180 is a direct bolt-in replacement for the Autotech RL210. AMCI strongly suggests using this transducer instead of the Autotech RL210.

Programmable Number of Turns

The maximum number of turns a transducer can encode is fixed by the gearing inside of it. However, the 1761H has the ability to divide this maximum number of turns into smaller multi-turn cycles. The module does this without loss of absolute position within the smaller cycle. An example of this feature is shown in figure 1.5. It shows how the 180 turn mechanical cycle of an HTT-20-180 can be broken down into three electronic cycles of sixty turns each. The 180 turn cycle could also be broken down into sixty cycles of three turns each.

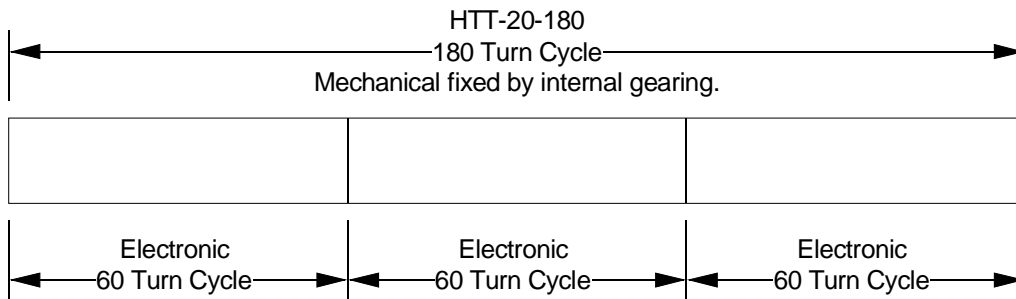


Figure 1.5 Programmable Number of Turns Example

You program the number of turns you want the module to decode over the backplane.

- When using a 100 turn transducer, the number of turns is programmable to 1, 2, 4, 5, 10, 20, 25, 50, or 100.
- When using a 180 turn transducer, the number of turns is programmable to 1, 2, 3, 4, 5, 6, 9, 10, 12, 15, 18, 20, 30, 36, 45, 60, 90, or 180.
- When using a SAC-RL210-G128, the number of turns is programmable to 1, 2, 4, 8, 16, 32, 64, or 128.

NOTE

To the 1761H, the HTT-20-1,000 and HTT-20-1,800 transducers appear to be HTT-20-100 and HTT-20-180 transducers. Therefore, when using the 1,000 or 1,800 transducers, program the Number of Turns using the 100 or 180 turn values above. The actual Number of Turns that must be completed will be *ten times* (10x) the programmed value.

The remainder of this chapter introduces the many programmable features of the 1761H module. It also introduces backplane programming concepts that allows you to control the module from the processor.

Programmable Parameters

Programmable parameters are stored in the modules nonvolatile memory. Therefore, you do not have to configure the module after every power up. Prior to hardware revision H of the module, the nonvolatile memory was EEPROM. This technology has the advantage of retaining programmed values for over 100 years. Its disadvantage is its limited number of write cycles, approximately ten thousand, before the memory will begin to fail.

With revision H, the nonvolatile memory has been changed to battery backed, non-volatile, static RAM (nvRAM). The battery in the nvRAM is rated for ten years but the nvRAM has an unlimited number of write cycles. The nvRAM has the additional advantage of significantly decreasing the time needed to store new parameter values.

Count Direction

This new parameter sets the direction of transducer shaft rotation to increase the position count. *If the transducer cable is wired as specified in this manual* and the count direction is set to *positive*, the position count will increase with clockwise rotation (looking at the shaft). If the count direction is set to *negative*, the position count will increase with counter-clockwise rotation.

- The Count Direction default value is *positive*.

NOTE

It is also possible to reverse the count direction by reversing four wires in the transducer cable. If you are installing this module either as a replacement for an older module or on a machine that is a copy installation of a previous system, you will probably not need to set this parameter. Once the machine is setup, you can easily change this parameter if the position is increasing in the wrong direction.

Resolver Type

The Resolver Type parameter is programmable from the backplane and makes Autotech 128 turn transducers compatible with the 1761H module.

- The Resolver Type default value is AMCI. The module can then be programmed to use Autotech transducers.

Transducer Type

This parameter specifies the type of transducer attached to the input channel. The module needs this information in order to combine the positions of the two resolvers inside the transducer into one multi-turn position. This parameter is selected by the J2 jumper on the circuit board and is not programmable from the processor.

When the *Resolver Type bit* is set to *AMCI*, the Transducer Type parameter can be set to:

- 100/1,000 Turn transducer (default value)
- 180/1,800 Turn transducer

When the *Resolver Type bit* is set to *Autotech*, the Transducer Type parameter is fixed. It specifies a 128 turn transducer only. The 64 turn transducers are not supported by AMCI.

Chapter 1 Introduction

Programmable Parameters (continued)

Number of Turns

The Number of Turns parameter sets the number of turns needed to complete one multi-turn cycle. The values that can be programmed into this parameter is dependent on the value of the Transducer Type parameter.

- ▶ When using a 100 turn transducer, the number of turns is programmable to 1, 2, 4, 5, 10, 20, 25, 50, or 100.
- ▶ When using a 180 turn transducer, the number of turns is programmable to 1, 2, 3, 4, 5, 6, 9, 10, 12, 15, 18, 20, 30, 36, 45, 60, 90, or 180.
- ▶ When using a SAC-RL210-G128, the number of turns is programmable to 1, 2, 4, 8, 16, 32, 64, or 128.

NOTE

To the 1761H, the HTT-20-1,000 and HTT-20-1,800 transducers appear to be HTT-20-100 and HTT-20-180 transducers. Therefore, when using the 1,000 or 1,800 transducers, program the Number of Turns using the 100 or 180 turn values above. The actual Number of Turns that must be completed will be *ten times* (10x) the programmed value.

The default value of this parameter is equal to the value of the Transducer Type Parameter. Changing the Transducer Type parameter resets the Number of Turns to its default value.

Full Scale Count

The Full Scale Count parameter specifies the number of counts over the programmed number of turns.

AMCI Transducers

- ▶ Default value is (Number of Turns * 4096) if 100 or 180 turn transducer
- ▶ Range is 2 to (Default Value)

Autotech Transducers

- ▶ Default value is (Number of Turns * 1024)
- ▶ Range is 2 to (Default Value)

NOTE

To the 1761H, the HTT-20-1,000 and HTT-20-1,800 transducers appear to be HTT-20-100 and HTT-20-180 transducers. Therefore, when using the 1,000 or 1,800 transducers, note that the actual Number of Counts per turn is *one tenth* (1/10th) the programmed value.

Changing the Transducer Type parameter resets the Full Scale Count to its default value.

Backplane Programming

When a 1761H module is configured to use block transfers, it is programmed using data sent to it with block transfer writes. All block transfer writes are four words long. The first word of the block transfer write is called the *Command Word*. The four least significant bits of this word define what programming data is being transferred to the module .

This chapter gives information on installing AMCI transducers. This includes information on transducer mounting, shaft loading, and cable installation. Information on interfacing Autotech transducers is also included.

Power Requirements

The 1761H module draws power from the I/O chassis +5Vdc supply. The maximum current draw is dependent on the number of transducer channels and is given in the table below. Add this to the power requirements of all other modules in the chassis when sizing the chassis power supply.

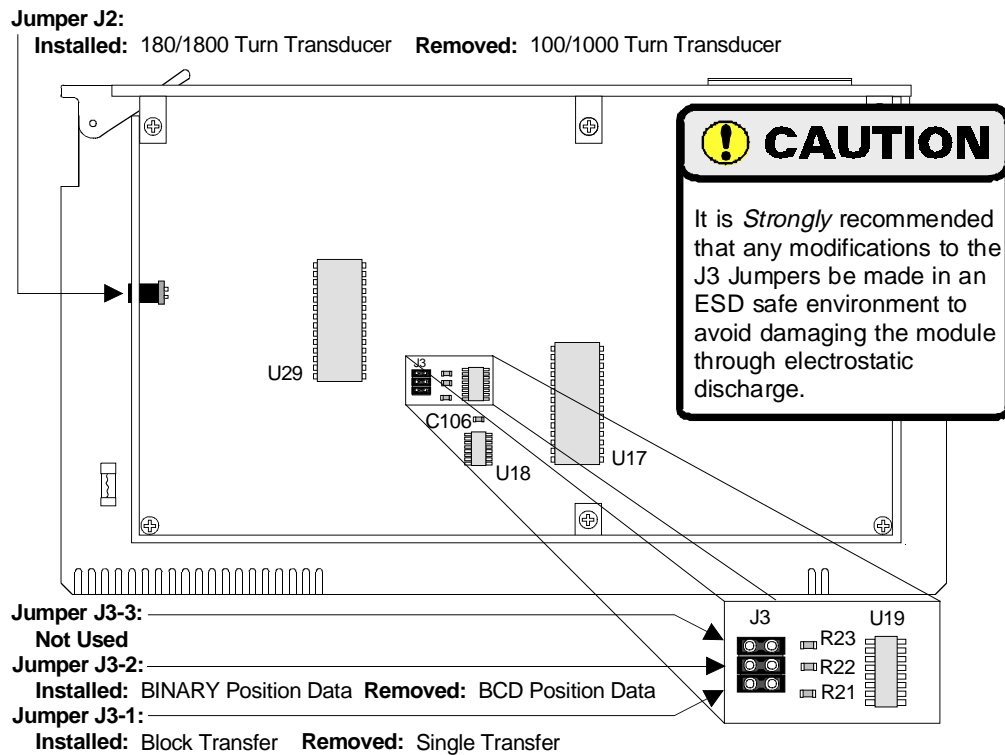
Model Number	1761H
Maximum Current Draw	350 mA

Table 2.1 Backplane Current Draw

Module Configuration

Figure 2.1 shows the location of the configuration jumpers on the 1761H module. When shipped from the factory, all jumpers are installed. In order to access the J3-1 and J3-2 jumpers, you must remove the left side panel. Jumper J3-3 is not used in this module. It is strongly recommended that any modification to the J3 jumpers be made in a ESD safe environment. The default configuration is: 180/1,800 Turn Transducer, Binary Position Data, Block Transfer.

Figure 2.1 Jumper Locations



Chapter 2 Installation

Installing the Module



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

Keying Bands

Plastic keying bands can be inserted into the top backplane connector to prevent the insertion of other modules.

- Pins 28 and 30
- Pins 32 and 34.

Transducer Specifications

HTT-20, HTT-400, HTT425-F, HTT425-T Transducers		HTT425 Motor Mount Transducers
Shaft Diameter 0.625"		Shaft Diameter 0.250" or 10mm
Shaft Loading Radial: 400 lbs. max. Axial: 200 lbs. max.		Shaft Loading Radial: 40 lbs. max. Axial: 20 lbs. max.
Starting Torque 8 oz.in. @ 25° C		Starting Torque 1.5 oz.in. @ 25° C
Moment of Inertia ... 20 oz-in-sec ²		Moment of Inertia ... 4 oz-in-sec ²
Enclosure HTT-20: NEMA 13 HTT400:NEMA 4 HTT425: NEMA 4X		Enclosure NEMA 4 When properly installed
Environmental (All Transducers)		
Operating Temp -20 to 125°C	Shock 50G's for 11 mSec	Vibration 5 to 2000 Hz @ 20 G's

Table 2.2 Transducer Specifications

Transducer Mounting

All AMCI resolver based transducers are designed to operate in the industrial environment and therefore require little attention. However, there are some general guidelines that should be observed to ensure long life.

- Limit transducer shaft loading to the following maximums:

	Radial Load	Axial Load
All 0.625" Shafts	100 lbs. (445 N)	50 lbs. (222.4 N)
All other Shafts	30 lbs. (133 N)	15 lbs. (66.7 N)

Table 2.3 Transducer Bearing Loads

- Minimize shaft misalignment when direct coupling shafts. Even small misalignments produce large loading effects on front bearings. It is recommended that you use a flexible coupler whenever possible.

Transducer Outline Drawings

The appropriate outline drawing is included with the transducer when shipped. The outline drawings of the HTT-20-(x) and HTT-400-180 transducers are also shown below.

HTT-20-(x): Anodized/Painted Aluminum Body, 1070 Carbon Steel Shaft, NEMA 4 (x) = 100, 180, 1,000, or 1,800

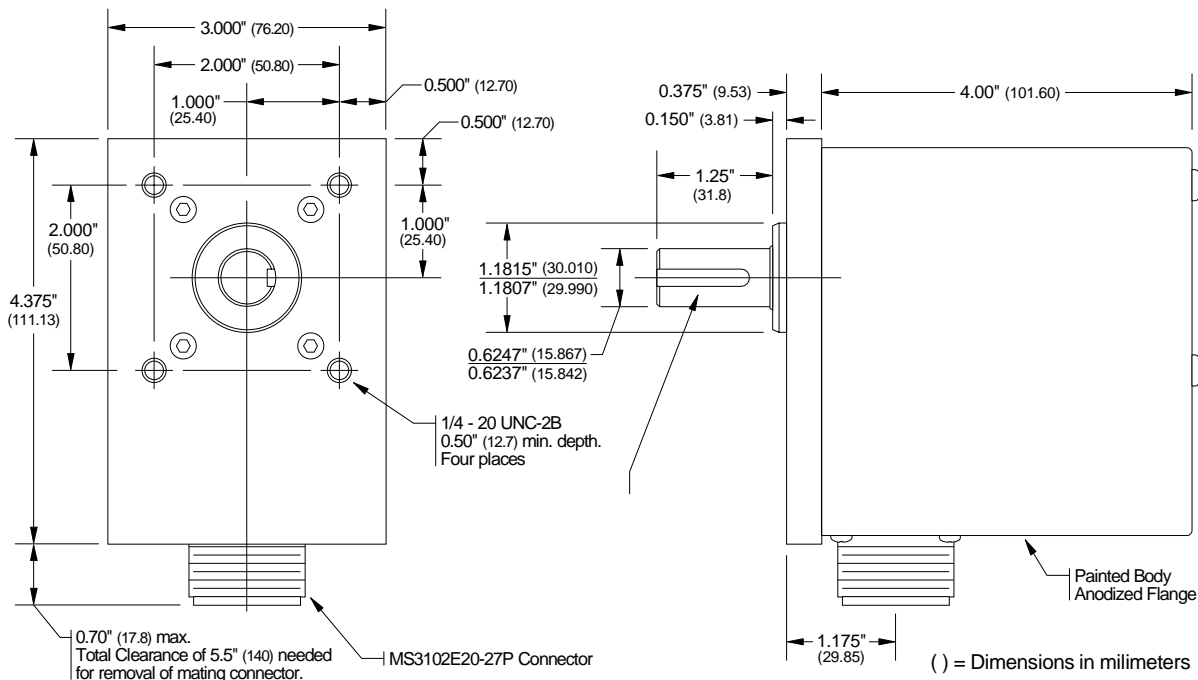


Figure 2.2 HTT-20-(x) Outline Drawing

HTT-400-180: Anodized Aluminum Body, 1070 Carbon Steel Shaft, NEMA 4

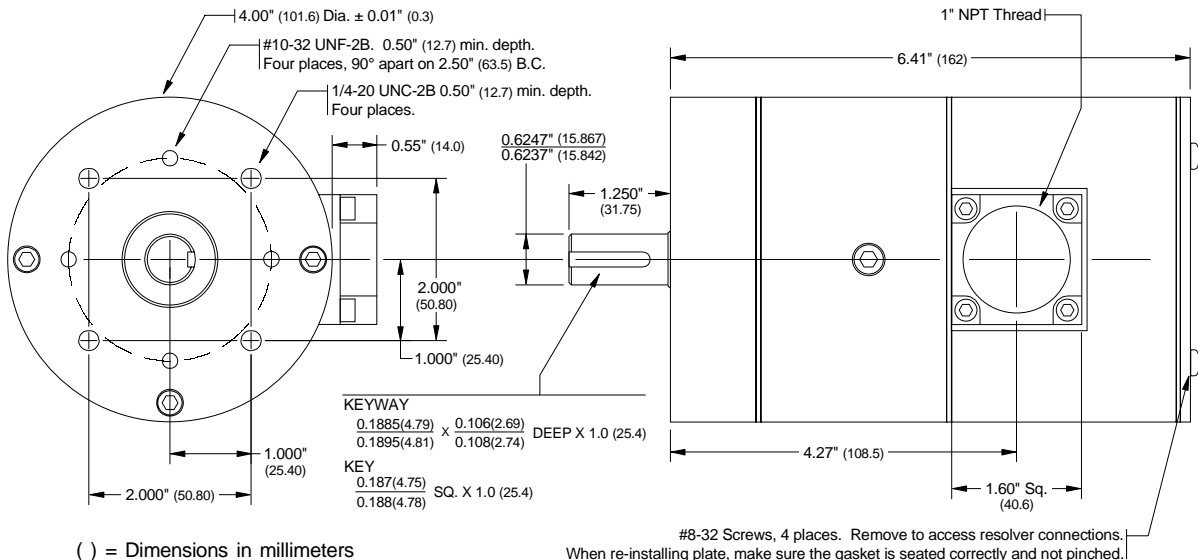


Figure 2.3 HTT-400-180 Outline Drawing

Chapter 2 Installation

Transducer Cable Installation

Use the table below to determine the correct cable and connectors for your application. Cables that have been assembled and tested are available from AMCI under the given part number. If you are making your own cables, cable and connectors can be ordered from AMCI.

Module	AMCI Part #	Belden Cable	Module Connector	Transducer Connector
1761H	CTT - (x)	9731	MS-8	MS-20

Table 2.4 Transducer Cable Numbers

NOTE

- 1) Resolvers are low voltage devices. If you are using A-B guidelines for cabling installation, treat the transducer cable as a Category 2 cable. It can be installed in conduit along with other low power cabling such as communication cables and low power ac/dc I/O lines. It cannot be installed in conduit with ac power lines or high power ac/dc I/O lines. Refer to the *Allen Bradley Programmable Controller Grounding and Wiring Guidelines* manual, Publication number 1770-4.1 for more information.
- 2) The shields of the transducer cable must be grounded at the module *only!* A grounding clamp will connect the shields to chassis ground. When installing the cable, treat the shield as a conductor. Do not connect the shield to ground at any junction box or the transducer. These precautions will minimize the possibility of ground loops that could damage the module or PLC.

Transducer Input Connector

Figure 2.4 shows the transducer input connector which has eight contacts and the pinout to industry standard resolver wire designations. The figure also gives the AMCI and Phoenix Contact part numbers for the mating connector. Cabling information for AMCI and Autotech transducers is given above in *Transducer Cable Installation*.

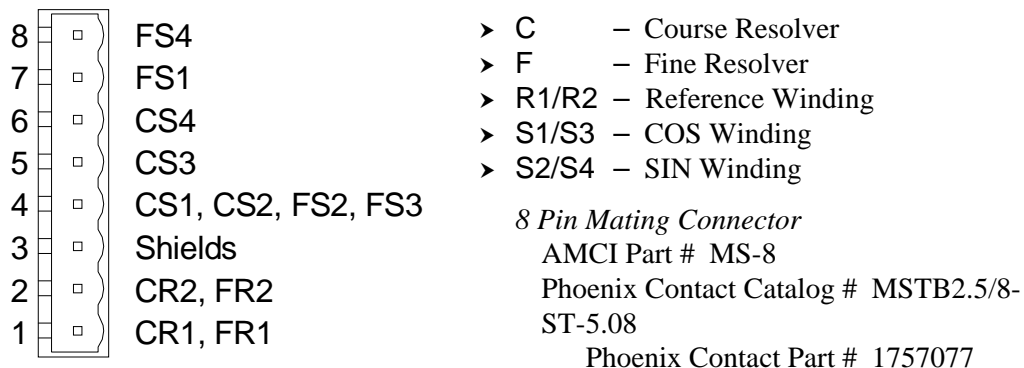


Figure 2.4 Transducer Input Connector

Transducer Cable Wiring Diagrams

CTT-(x) Wiring Diagram (1761H)

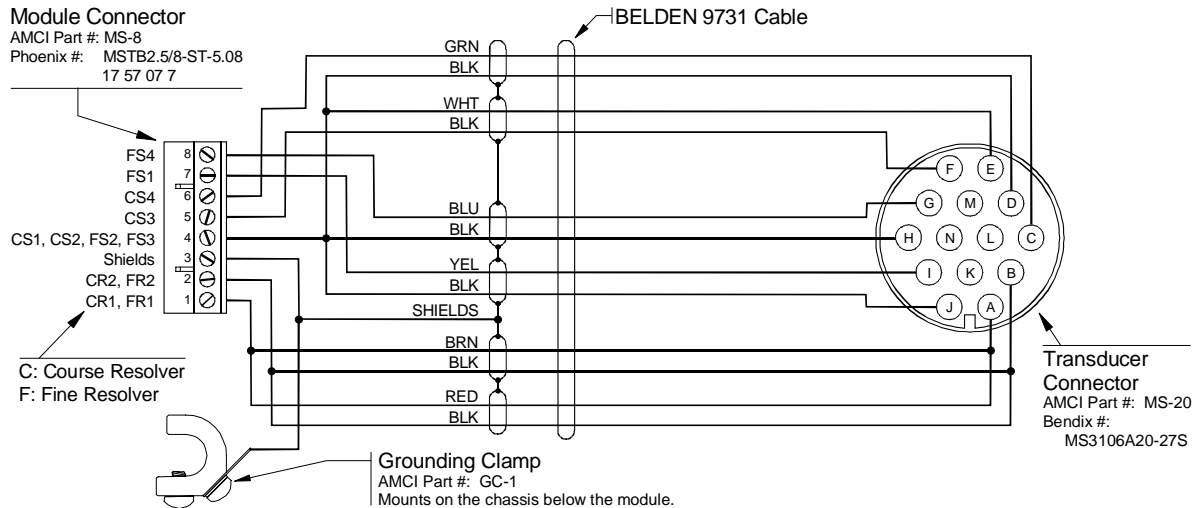
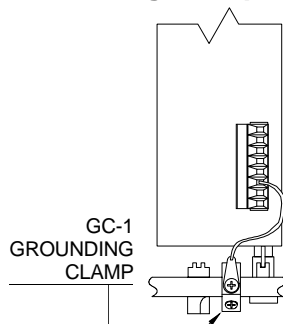


Figure 2.5 CTT-(x) Wiring Diagram

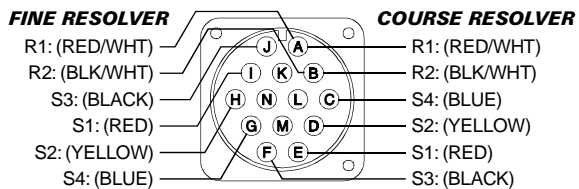
GC-1 Grounding Clamp



The shield of the transducer cable must be attached to the chassis with a grounding clamp (AMCI part number GC-1). This guarantees a low impedance path to ground for any EMI radiation that may be induced into the cable. The drain wire from the grounding clamp must be connected to pin 3 of the MS-8 Transducer Input Connector. The grounding clamp package includes installation instructions. See Figure 2.6.

Figure 2.6 Grounding Clamp

Transducer Connector Pinout



All of the AMCI transducers that are compatible with the 1761H module have the same connector. Figure 2.7 is the connector pinout to the industry standard wire designations.

Figure 2.7 Transducer Connector Pinout

Chapter 2 Installation

Autotech Transducer Installation

Transducer Mounting

The 1761H module directly support Autotech SAC-RL210-G128 transducers. The Autotech SAC-RL210-G64 transducers are not supported by AMCI. Refer to Autotech literature for dimensional drawings and mounting recommendations.

Transducer Wiring

Table 3.5 is a wiring table for all supported Autotech transducers. The table cross references resolver designations, AMCI wire color, Autotech terminal and connector pin-outs, and Transducer Input Connector pin-out.

NOTE

- 1) Autotech CBL-10T22 cable is not supported. Belden 9731 or exact equivalent must be used.
- 2) Cable drawings for connecting Autotech transducers are available. If you want a cable drawing instead of using the table, contact AMCI. A drawing will be faxed to you upon request.

9731 Wire Color	Resolver Designation	SAC-RL210 Terminals	SAC-RL210 MS Connector	1761H Connector
RED	R1	1	A	1
BLK/RED ¹	R2	2	B	2
BRN	R1	1	A	1
BLK/BRN ¹	R2	2	B	2
WHT	CS1	3	C	6
BLK/WHT ¹	CS3	5	E	4
BLK/GRN ¹	CS2	4	D	5
GRN	CS4	6	F	4
YEL	FS1	7	H	4
BLK/YEL ¹	FS3	9	L	8
BLK/BLU ¹	FS2	8	K	4
BLU	FS4	10	M	7

1: Denotes black wire of black and colored wire pair.

Table 2.5 Autotech Transducer Wiring

CAUTION

Do not, *under any circumstances*, connect the shields of the transducer cable to the earth ground connection of the transducer. This connection could form a ground loop that may damage the 1761H module or PLC. The earth ground connection on the MS style connectors is pin G. The earth ground connection on the screw terminal transducers is the green screw.

Indicator LED Patterns

Two LED's on the front panel show the operating status of the module as shown in table 2.6.

<i>GREEN LED</i>	<i>RED LED</i>	<i>INDICATION</i>
On	Off	<p>MODULE OK</p> <p>Module and transducer are operating properly.</p>
On	Flashing	<p>TRANSDUCER FAULT</p> <p>Transducer not operating properly. There are 6 major causes of this fault.11</p> <ul style="list-style-type: none"> ▶ Broken or intermittent transducer cable ▶ Non-compatible transducer ▶ Improper wiring of the transducer cable ▶ Improper installation of the transducer cable ▶ Faulty transducer ▶ Faulty module <p>Transducer faults are self clearing. If a fault is caused by a burst of electrical noise or an intermittent connection, the fault will clear itself.</p>
Off	On	<p>MODULE FAULT</p> <p>The parameters in nvRAM are corrupted. Cycle power to the module. If the fault clears, parameters will be set to default values. If the fault does not clear then module must be returned to AMCI for repair.</p> <p>Note: If parameters are reset to their defaults on every power up, the battery in the module may be discharged. If this is the case, the module must be returned to AMCI for repair.</p>
Off	Flashing	<p>REFERENCE ERROR</p> <p>The module stores constants in nvRAM to automatically adjust the reference voltage. This display occurs if these constants are corrupted. Attaching a working transducer should clear the fault. If it does not, or the reference error occurs at every power up, the module must be returned to AMCI for repair.</p>
Flashing	Off	<p>ADJUSTING REFERENCE VOLTAGE</p> <p>This display occurs while the module is recalculating the reference voltage constants (see Reference Error above). Once the constants are recalculated the module's LED pattern will display MODULE OK or REFERENCE ERROR. If this display does not appear when a working transducer is attached to clear a Reference Error, the module must be returned to AMCI for repair.</p>

Table 2.6 Indicator LED Patterns

Chapter 2 Installation

Notes

Block Transfer Definition

Block Transfers are used by most intelligent I/O cards. Block Transfers move a block of up to sixty-four words over the backplane at one time. This transfer will occur only when the rung containing the Block Transfer instruction in your ladder logic program becomes true. Block Transfer Read instructions transfer data from the module to the processor. Block Transfer Write instructions transfer data from the processor to the module. The advantage of Block Transfers is that both the position and tachometer data are transferred at one time.

Block Transfer Read Format

The PLC accepts four 16 bit words from the module when a Block Transfer Read instruction accesses the module. The order and format of the words is shown in Figure 3.1.

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Word 0	T	0	0	0	0	0	0	0	0	0	0	0	R	M	C	N
Word 1	T	0	0	0	Upper 3 Digits Position Data											
Word 2	T	0	0	0	Lower 3 Digits Position Data											
Word 3	T	0	0	0	0	11 Bit Tachometer Data										

Figure 3.1 Block Transfer Read Format

The position data is divided into two words. For example if the position is 38,864 counts, the first three digits (038) are in Word 1, the last three digits (864) are in Word 2. Tachometer data is always transferred in binary format in Word 3.

Fault Bits

- T - Transducer Fault, Bit 15 - When these four bits (MSB in word 0 - 3) are set, a transducer fault has occurred and is indicated with a blinking red LED on the front panel. The fault will clear itself when a working transducer is properly attached to the 1761H module. Position and tachometer data are set to zero during this fault. Therefore the values in words 1 through 3 equal -32,768 (8000h).
- R - Reference Error, Bit 03 - When this bit is set, a fault with the module has occurred and is indicated with a blinking green LED on the front panel. The fault will clear itself when a working transducer is attached to the module. If the error still exists, the module needs to be returned to the AMCI for repair.
- M - Module Fault, Bit 02 - When this bit is set, the nvRAM memory is corrupted and is indicated with a red LED on the front panel. Cycle power to the module. If the fault still exists, the module needs to be returned to AMCI for repair.
- C - Invalid Full Scale Count Parameter, Bit 01 - When this bit is set, the count is outside the range of 2 to (4096 * Number of Turns) for AMCI transducers or 2 to (1024 * Number of Turns) for Autotech transducers.
- N - Invalid Number of Turns Parameter, Bit 00 - When this bit is set, the Number of Turns is not valid for the type of transducer selected by the J-2 Jumper. [See Table 3.1 page 20 for parameters and their ranges.](#)

Chapter 3 Block Transfer Format

Block Transfer Write Format

The PLC writes four 16 bit words to the module when a Block Transfer Write takes place. These words can program the Number of Turns and Full Scale Count parameters as well as Count Direction, Transducer Type and Resolver Type. You can also reset the position data to zero (Autozero). The data format is shown in Figure 3.2.

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Word 0	0	0	0	0	0	0	0	0	0	0	0	0	Y	D	P	Z
Word 1	0	0	0	0	0	Number of Turns Parameter										
Word 2	0	0	0	0	0	Upper 3 Digits Full Scale Count Parameter										
Word 3	0	0	0	0	0	Lower 3 Digits Full Scale Count Parameter										

Figure 3.2 Block Transfer Write Format

The full scale count data is divided into two words. For example, using sample data of a 180 turn transducer, and 36 turns for complete travel (36×4096 counts/turn) = 147,456 full scale count. The first three digits (147) are in Word 1, the last three digits (456) are in Word 2.

NOTE  All BTW data must be in BCD format.

In the table below (Table 3.1) the modules' parameters and data ranges for AMCI and Autotech transducers are shown. This data is sent to the module using the BTW Format in Figure 3.2.

<i>PARAMETERS</i>	<i>RANGE</i>	<i>DEFAULT</i>
Number of Turns	AMCI 100/1,000 Turn: 1,2,4,5,10,20,25,50 or 100 AMCI 180/1,800 Turn: 1,2,3,4,5,6,9,10,12,15,18, 20,30,36,45,60,90 or 180 Autotech 128 Turn: 1,2,4,8,16,32,64 or 128	100 Turns 180 Turns 128 Turns
Full Scale Count	AMCI: 2 to (Number of Turns x 4096) Autotech: 2 to (Number of Turns x 1024)	409,600 102,400
Transducer Type	AMCI or Autotech	AMCI
Count Direction	Positive or Negative	Positive

Table 3.1 Parameters and Ranges for BTW Format

Block Transfer Write Format (continued)

Programming Bits

- Z - Autozero, Bit 00 - When this bit is set, the module will zero the position of the transducer.
- P - Program Parameters, Bit 01 - When this bit is set, the module programs itself with the state of bits 02 and 03. These parameters are the Count Direction and Transducer Type of the transducer. Program Bit 1 will also act on the Number of Turns and Full Scale Count parameters.
- D - Count Direction, Bit 02 - This bit is only acted on when the Program Parameter Bit (01) is set. This bit programs the state of the Count Direction parameter. When this bit is reset, the Count Direction is set to its *Positive* value. When this bit is set, the parameter is set to its *Negative* value.
- Y - Transducer Type, Bit 03 - This bit is only acted on when the Program Parameter Bit (01) is set. This bit programs the state of the Transducer Type parameter. When this bit is reset, the Transducer Type bit is set to *AMCI* transducers. When this bit is set, the parameter is set to *Autotech* transducers.

Chapter 3 Block Transfer Format

Programming Example

The following example shows a BTR and BTW that accesses the 1761H module. It assumes 1-Slot addressing and the module is in I/O rack 2, I/O Group 5 of the system.

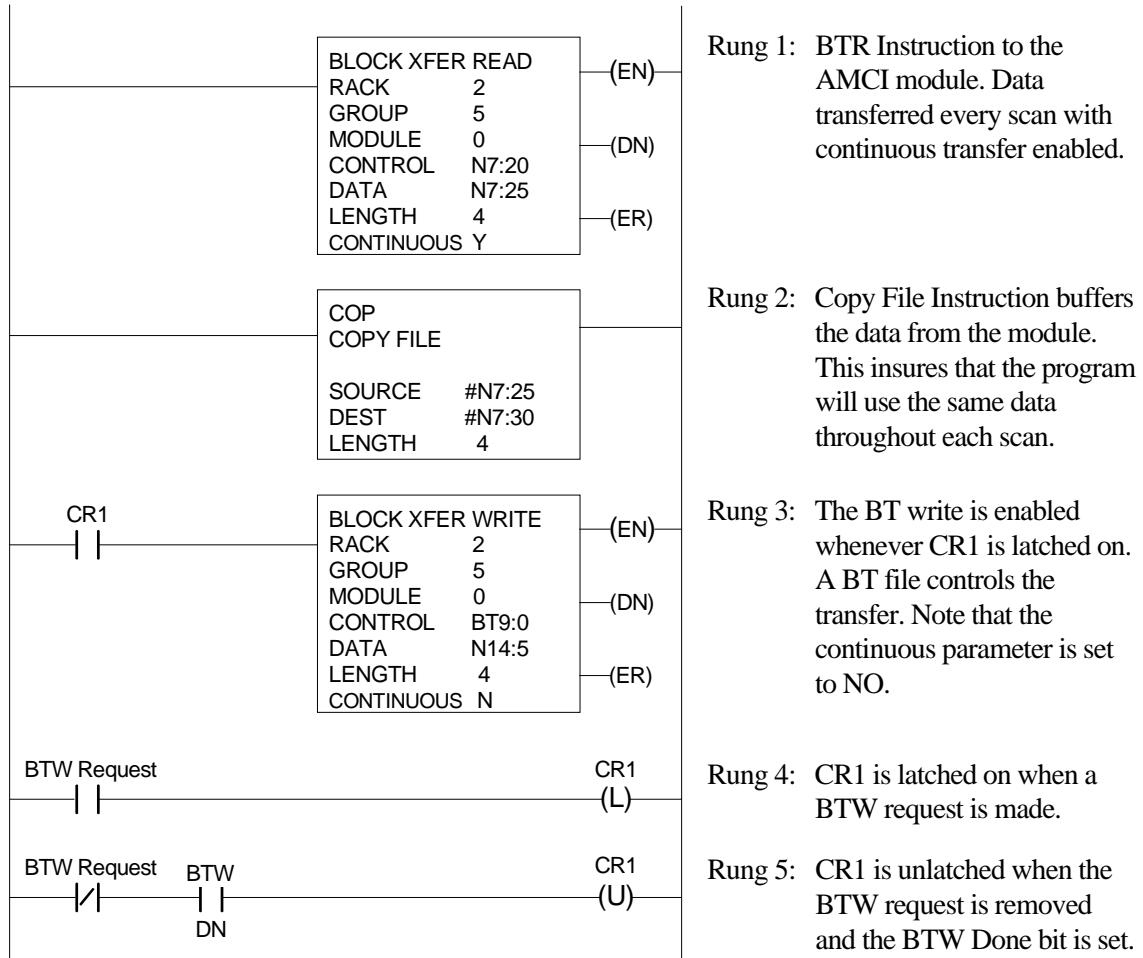


Figure 3.3 PLC-5 Programming Example

Single Transfer Definition

Single transfers are used by most non-intelligent I/O cards such as DC input cards. Single transfers automatically move data between the module and the processor's input or output image tables every program scan. Immediate I/O instructions can also be used to update data during the program scan. The 1761H module accepts and transmits 16 bits of data when in single transfer mode.

NOTE When using 2-slot addressing, you must not install a card in the adjacent slot of the slot pair. The 1761H module uses 16 input and 16 output bits. A power supply card can be in the adjacent slot of the pair.

Single Transfer Input Format

When using a 1761H module in Single Transfer Mode, (Jumper J3-1 Removed), the position data is written into the processors' input table at the slot address assigned to the module. In Single Transfer Mode, the setting of J3-2 (Binary/BCD data jumper) has no effect, the position data is always written in binary. Table 4.1 shows AMCI and Autotech transducer position data.

	<i>Full Scale Number of Turns (fixed)</i>	<i>Counts per Turn</i>	<i>Total Counts</i>
AMCI 100 Turn	25	1,000	25,000
AMCI 1,000 Turn	250	100	25,000
AMCI 180 Turn	30	1,000	30,000
AMCI 1,800 Turn	300	100	30,000
Autotech 128 Turn	32	1,000	32,000

Table 4.1 Position Data for AMCI and Autotech Transducers

Data Format

The Single Transfer data format is shown in figure 4.1.

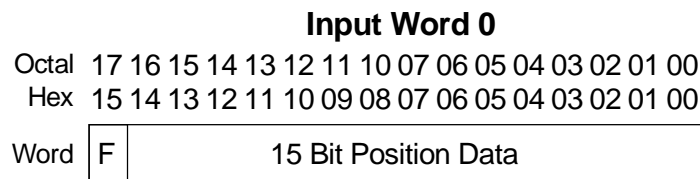


Figure 4.1 Single Transfer Input Format

Fault Bit

F - Transducer, Reference or Module Fault, Bit 15 - When this bit is set, the decimal number -32768 (8000h MSB set) is sent to the processor in place of the position value. The module will indicate the type of fault on the front panel by indicator LED's (see page 17). A transducer fault will clear itself once a working transducer is properly attached to the module. If you encounter a module fault, cycle power to the module. If the fault remains, the module must be returned to AMCI for repair. See Table 2.6 on page 17 for more information on LED patterns and their functions.

Chapter 4 Single Transfer Format

Single Transfer Output Format

When using a 1761H module in Single Transfer Mode, the processor is writing to the module's output table at the address assigned to the slot. The format of the data is binary. The setting of J3-2 (Binary/BCD data jumper) has no effect. Number of Turns and Full Scale Count parameters are fixed. Figure 4.2 shows the format of Output Word 0.

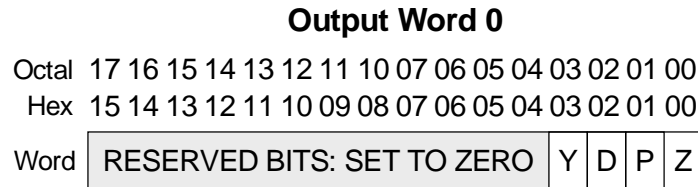


Figure 4.2 Single Transfer Output Format

Programming Bits

- Z - Autozero, Bit 00 - When this bit is set, the module will zero the position of the transducer.
- P - Program Parameters, Bit 01 - When this bit makes a 0→1 transition, the module programs itself with the state of bits 02 and 03. These parameters are the Count Direction and Transducer Type of the transducer.
- D - Count Direction, Bit 02 - This bit is only acted on when the Program Parameter Bit (01) is set. This bit programs the state of the Count Direction parameter. When this bit is reset, the Count Direction is set to its *Positive* value. When this bit is set, the parameter is set to its *Negative* value.
- Y - Transducer Type, Bit 03 - This bit is only acted on when the Program Parameter Bit (01) is set. This bit programs the state of the Transducer Type parameter. When this bit is reset, the Transducer Type bit is reset to *AMCI* transducers. When this bit is set, the parameter is set to *Autotech* transducers.



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