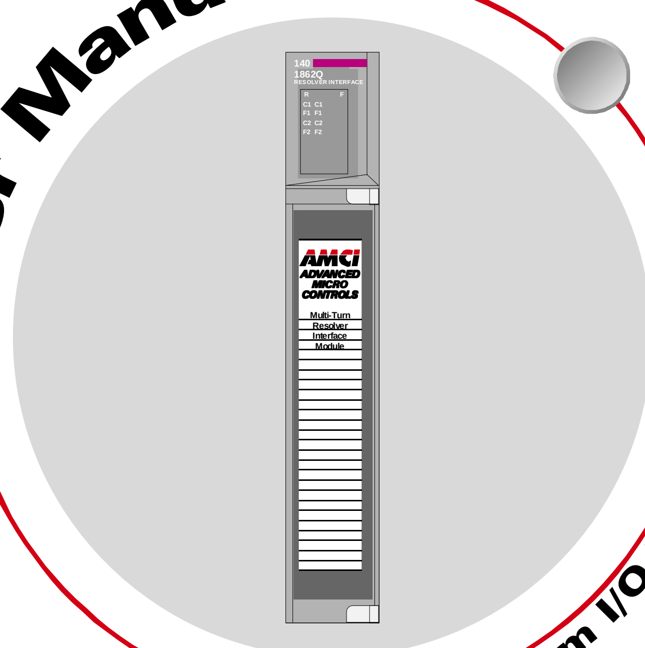
AMCI ADVANCED MICRO CONTROLS INC.

Manual #: 940-08013

SERIES 1860Q
Resolver Interface Modules

1861Q
1862Q

User Manual



Modicon Quantum I/O Modules

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

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

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

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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.

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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 (860) 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 (860) 583-7271. Your call will be answered by the factory during regular business hours, Monday through Friday, 8AM - 5PM EST. During non-business hours an automated system will ask you to enter the telephone number you can be reached at. Please remember to include your area code. The system will page one of two engineers on call. Please have your product model number and a description of the problem ready before you call.

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ABOUT THIS MANUAL

Introduction

This manual explains the operation, installation, programming, and servicing of the 1861Q and 1862Q Intelligent Resolver Interface Modules for the Modicon® Quantum™ programmable controller systems. These modules accept one or two multi-turn resolver transducers and convert the resolvers analog signals into digital position and tachometer data that is transmitted to the processor over the backplane.

AMCI offers eight other modules for the Quantum backplane. These modules, the 1831Q, 1832Q, 1833Q, 1834Q, 1841Q, 1842Q, 1843Q, and 1844Q, offer one to four single-turn resolver inputs and give ten or thirteen bit position resolution. These modules are covered by the *Series 1800Q Resolver Interface Modules* manual. If you need this manual then download it from our web site, *www.amci.com,* or contact us and we will send you the manual upon request.

Written for the engineer responsible for incorporating a Series 1860Q module into a design as well as the engineer or technician responsible for its actual installation, this manual contains information on hardware and software configuration as well as data on compatible transducers and proper installation techniques.

Manuals at AMCI are constantly evolving entities. Your questions and comments on this manual and the information it contains are both welcomed and necessary if this manual is to be improved. Please direct all comments to: Technical Documentation, AMCI, 20 Gear Drive, Terryville CT 06786, or fax us at (860) 584-1973. You can also e-mail your questions and comments to *techsupport@amci.com*

Navigating this Manual

The layout of this manual allows it to be used in both printed and on-line formats. Its on-line form is a PDF document, which requires Adobe Acrobat Reader version 4.0 or a similar reader before you can read it.

Bookmarks of all the chapter names, section headings, and sub-headings were created in the PDF file so that you can easily find what you are looking for. The bookmarks should appear when you open the file. If they don’t, press the F5 key on Windows platforms to bring them up.

Throughout this manual you will also find ***green text that functions as a hyperlink*** in HTML documents. Clicking on the text will immediately jump you to the referenced section of the manual. If you are reading a printed manual, most links have the page numbers included.

The PDF file is password protected to prevent changes to the document. You are allowed to select and copy sections for use in other documents and, if you own Adobe Acrobat version 4.05 or later, you are allowed to add notes and annotations.

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, 940-08013, was released on April 11th, 2001 and corresponds to software rev. 0, checksum E7FF for the 1861Q and software rev. 0, checksum 2F43 for the 1862Q. It adds information on ModSoft software configuration and updates the manual to AMCI’s latest style.

Past Revisions

940-08012: 04/19/2000. Diagram Updates
940-08011: 03/12/1999. Adjusted page numbers for PDF format
940-08010: Initial release of the manual

Notes

CHAPTER 1
INTRODUCTION

This chapter serves as an introduction to the 1861Q and 1862Q modules. It highlights potential applications, compatible transducers, and all of the modules' features.

Overview

The 1861Q and 1862Q modules are the Quantum series compliant cards that converts resolver signals to digital multi-turn position and tachometer data that is reported over the backplane. Position data is transmitted as a double percision integer, while the tachometer is transmitted as single-percision integer. This module eliminates the separate resolver decoder box, PLC input card, and associated wiring needed to bring the resolver data into a PLC.

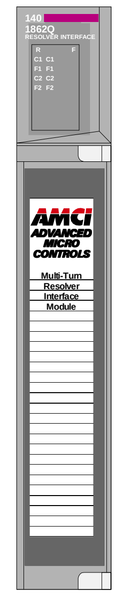


Figure 1.1 1862Q Module

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. These modules can produce an absolute twenty bit multi-turn position value with a maximum twelve bit (4,096 counts) per turn resolution when an AMCI transducer is connected to it.

The transducers that connect to the 1861Q or 1862Q contain 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 1861Q accepts a single dual-resolver transducer while the 1862Q accepts two transducers.

Output registers assigned to the module are used to program it from the backplane. Transducer type, count direction, total number of turns, total number of counts, linear position offset, and position preset are all programmable, as well as the type of resolver used and how transducer faults are handled.

A 1861Q and 1862Q 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 transducer to the drive motor. As the motor rotates, the transducer position is used to 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.

The1861Q and 1862Q modules directly supports Autotech transducers. The modules do this by adjusting the reference voltage to a level that will work with Autotech transducers.

AMCI Compatible Transducers

Table 1.1 lists the AMCI multi-turn transducers that are compatible with the Series 1860Q modules.

Model	Shaft	Mount	Turns	Comments
HTT-20-100	0.625"	Front	100	NEMA 4 heavy duty transducer
HTT-20-180	0.625"	Front	180	NEMA 4 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 w/ required 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.
HTT-400-180	0.625"	Front	180	NEMA 4, HTT-20-180. Bolt-in replacement for Autotech RL210 transducers. Also has HTT bolt pattern. 1" NPT thread for conduit connection. Internal terminal strip for resolver connections.
HTT-400-180E	0.625"	Front	180	Same as HTT-400-180 with an AMCI MS connector instead of a conduit connection.

† A 1,000 turn version is also available. Refer to *www.amci.com* for more information on available connector styles.

Table 1.1 Compatible AMCI Transducers

Each multi-turn transducer contains two resolvers. The first resolver, called the fine resolver, is attached directly to the input shaft through a coupler. The second resolver, called the coarse resolver, is geared to the fine. This gear ratio, either 99:100 or 179:180, determines the 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 1.2A. After one complete rotation, the zero of the coarse 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 1.2B and 1.2C. After 100 or 180 turns, the resolvers' electrical zeros are realigned and the cycle begins again.

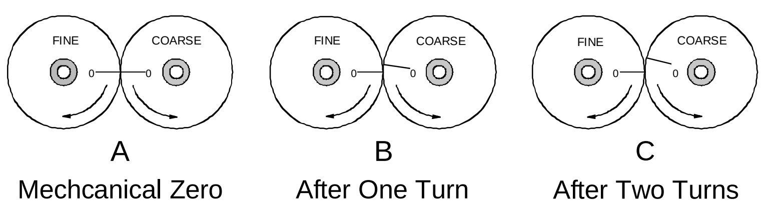


Figure 1.2 Resolver Alignment in Multi-turn Transducers

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.

Transducer Specifications

The following table contains the mechanical and environmental specifications for all AMCI multi-turn transducers that are compatible with the 1861Q and 1862Q modules.

Specification	All HTT-20, HTT-400, HTT-425-F, & HTT-425-T	All HTT425 Motor Mount
Shaft Diameter	0.625"	0.250" or 10mm
Radial Shaft Loading	400 lbs. max.	40 lbs. max.
Axial Shaft Loading	200 lbs. max.	20 lbs. max.
Starting Torque	8oz-in@25°C	1.5oz-in@25°C
Moment of Inertia ($oz\text{-}in\text{-}sec^2$)	$8.75 X 10^{-4}$	$1.25 X 10^{-4}$
Weight	4 lbs.	4 lb.
Enclosure	HTT-20, 400: NEMA 4 HTT-425: NEMA 4X	NEMA 4 When properly installed.
Environmental (All Transducers)		
Operating Temp -20 to 125°C	Shock 50 G's for 11 milliseconds	Vibration 5 to 2000 Hz @ 20 G's

Table 1.2 Multi-Turn Transducer Specifications

Other Compatible Transducers

In addition to AMCI transducers, the 1861Q and 1862Q directly supports transducers from Autotech Controls.

The Autotech models supported are:

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

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

If your project is a new installation, or you can budget the cost of replacing the transducer, we *strongly* suggest using AMCI transducers. Our transducers and electronics are designed to work together, and when specified and installed properly will work for years to come.

If you decide to use your Autotech transducers, you must change the ***Resolver Type*** parameter. If you are using an 1862Q and set the Resolver Type to *Autotech*, then both of the transducers must be Autotech's. You cannot bring an Autotech multi-turn and an AMCI multi-turn into one 1862Q.

NOTE

1) Due to differences in construction, AMCI does not support installations that use transducer cables supplied by Autotech Controls. When using Autotech transducers, you *must* use Belden 9731 cable or exact equivalent.

2) When using Autotech transducers, only 10 bit resolution, (1,024 counts per turn), is supported. If you require a higher resolution in an Autotech style package, AMCI offers the HTT-400-180, which is a direct bolt-in replacement for the Autotech RL210. AMCI strongly suggests using the HTT-400-180 transducer instead of the Autotech RL210 in all new installations.

3) For more information on interfacing with Autotech transducer, see the AMCI's FAQ, *"Using Transducers From Other Manufacturers"*, posted on our website, *www.amci.com*.

The remainder of this chapter introduces the many programmable features of the 1861Q and 1862Q module. It also introduces backplane programming concepts that allows you to control the module from the processor.

Programmable Parameters

You configure your module by setting the values of its *Programmable Parameters.* These parameters are stored in nonvolatile memory. Therefore, there is no need to configure the module after every power up.

NOTE The nonvolatile memory is an EEPROM that is rated for approximately 100,000 write cycles. Therefore, continuously presetting the position or writing new parameters to the module should be avoided. If your application requires continuous presetting of the position, consider using your ladder logic program to calculate the offset.

Count Direction

This parameter sets the increasing position count direction in relation to the transducer shaft. *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*.

Transducer Fault Latch

The modules can detect a fault with the transducer that would prevent the module from calculating the correct position value. This includes transient faults such as electrical noise in the resolvers signal from an outside source that the module may be able to detect and recover from faster than the PLC can scan it. The *Transducer Fault Latch* parameter gives you ability to latch the transient fault when it occurs or have the module clear the transient fault as soon as its able. If a fault is latched, you must send a command to the module to clear the fault.

- The Transducer Fault Latch default value is *enabled*. This latches a transducer fault when it occurs.

In addition to status bits in the input words, the module's status LED's show when a transducer fault has occurred, and whether or not it can now be cleared.

Resolver Type

The Resolver Type parameter makes Autotech 128 turn transducers compatible with the 1861Q and 1862Q modules.

- The Resolver Type default value is *AMCI*.
- The parameter can be programmed for Autotech 128 turn 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 resolver inside the transducer into one multi-turn position. The *Resolver Type* parameter controls what values this parameter can be set to.

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

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

When the *Resolver Type* is set to *Autotech*, the Transducer Type parameter is fixed. It specifies a 128 turn transducer.

Autotech also manufacturers 64 turn transducers. These transducers are not supported by the 1861Q or 1862Q modules.

Programmable Parameters (continued)

Number of Turns

The maximum number of turns a multi-turn transducer can encode is fixed by the gearing inside of it. However, the 1860Q modules have 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 1.3. 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.

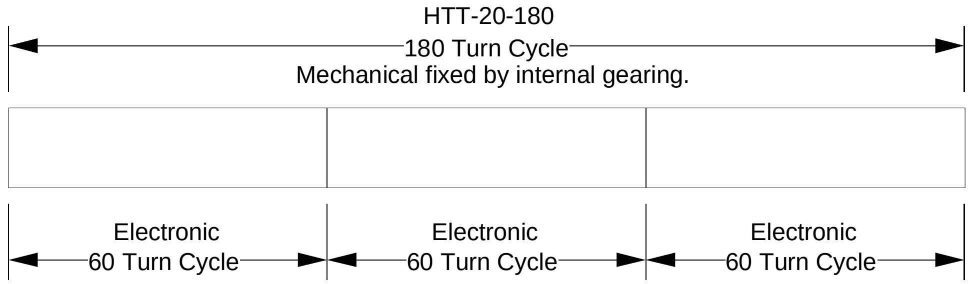


Figure 1.3 Programmable Number of Turns Example

The range of values for the Number of Turns parameter is dependent on the value of the ***Transducer Type*** parameter.

- **When Transducer Type = 100:** Number of Turns is programmable to 1, 2, 4, 5, 10, 20, 25, 50, or 100.
- **When Transducer Type = 180:** 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 Transducer Type = 1,000:** Number of Turns is programmable to 10, 20, 40, 50, 100, 200, 250, 500, or 1,000.
- **When Transducer Type = 1,800:** Number of Turns is programmable to 10, 20, 30, 40, 50, 60, 90, 100, 120, 150, 180, 200, 300, 360, 450, 600, 900, or 1,800.
- **When Transducer Type = 128:** Number of Turns is programmable to 1, 2, 4, 8, 16, 32, 64, or 128.

Full Scale Count

The Full Scale Count specifies the total number of counts generated by the module. This number is the total number of counts over the programmed *Number of Turns*.

For AMCI Transducers

- Default value is (Number of Turns * 4,096) if Transducer Type equals 100 or 180
- Default value is (Number of Turns * 409.6) if Transducer Type equals 1,000 or 1,800
- Range is 2 to (Default Value)

For Autotech 128 Turn Transducers

- Default value is (Number of Turns parameter) * 1,024
- Range is 2 to (Default Value)

Programmable Parameters (continued)

Linear Offset

The Linear Offset parameter changes the *range* of count values output by the module and is used when the transducer position directly correlates to a linear measurement that does not start at zero. One such example is an overhead crane. Another example is a press shut height measurement.

As an example of how the Linear Offset affects position values, when the ***Full Scale Count*** is set to 1,500 and the Linear Offset is set to zero, the 1860Q will output position values from 0 to 1,499. If the Linear Offset is changed to 100, then the module will then output values from 100 to 1,599.

- The default Linear Offset is zero.
- The range of the Linear Offset is 0 to (2^{31} – (Full Scale Count – 1)).

A detailed example of using the Linear Offset, Full Scale Count, and Preset Value in a shut height application is given in Appendix A, ***SHUT HEIGHT SETUP EXAMPLE***, starting on page 25.

Preset Value

The Preset Value parameter allows you to set the value of the position data to any count value within its range. The range of the count values is (Linear Offset) to (Linear Offset + (Full Scale Count - 1)). When the *Linear Offset* equals zero, this translates into 0 to (Full Scale Count -1). Programming the Preset Value does not change the position data, it only sets the value that the position will change to when an *Apply Preset Command* is initiated.

- The default Preset Value is equal to the Linear Offset, which is typically zero. If you program the Linear Offset, the Preset Value will be set equal to it.
- The Preset Value range is (Linear Offset) to (Linear Offset + (Full Scale Count - 1)). When the Linear offset equals zero, this reduces to 0 to (Full Scale Count -1)

A detailed example of using the Linear Offset, Full Scale Count, and Preset Value in a shut height application is given in Appendix A, ***SHUT HEIGHT SETUP EXAMPLE***, starting on page 25.

Backplane Programming

An 1860Q module is programmed over the backplane through the input and output registers assigned to it. Because these registers are constantly updated, the module implements a simple hand-shaking protocol to control when it accepts new programming data. This hand-shaking protocol is called a Programming Cycle.

Programming Cycle

A Programming cycle consists of six steps and is controlled by the *Transmit Bit* in the first output register and the *Acknowledge Bit* in the first input register.

1) Write the new programming data into the output registers with the Transmit Bit reset. This step insures that the correct data is in the output registers before the Programming Cycle begins.
2) Set the Transmit Bit. A Programming Cycle is initiated when this bit makes a 0→1 transition.
3) Once the unit is done with the programming data, it will set any necessary error bits and the Acknowledge Bit in its input registers.
4) Once you see the Acknowledge Bit set, check for any errors. The error bits are only valid while the Acknowledge Bit is set.
5) Respond to any errors and reset the Transmit Bit.
6) The 1860Q responds by resetting the Acknowledge Bit. The Programming Cycle is complete.

INSTALLATION

This chapter gives information on installing the module and transducers. This includes information on module power requirements, transducer mounting, shaft loading, and cable installation.

Power Requirements

An 1860Q series module draws power from the I/O backplane +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 backplane when sizing the system power supply.

	1861Q	1862Q
Maximum Current Draw	415 mA	475 mA
Maximum Power Draw	2.08 W	2.38 W

Table 2.1 Backplane Power Draw

Installing the Module

Like all Quantum I/O modules, the 1861Q and 1862Q modules can be removed and installed under power (hot swapped) without damaging the module or backplane. The module can be installed in a local or remote I/O rack.

NOTE Unplug the Transducer Input Connector before hot swapping the module.

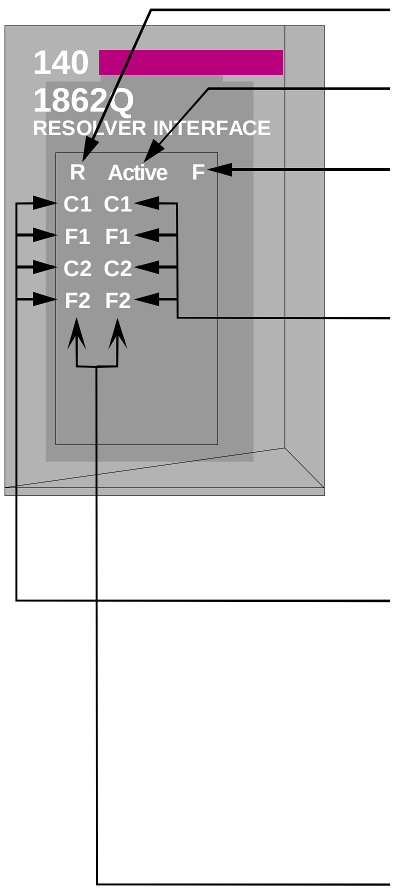
The 1861Q and 1862Q install into the backplane like all other Quantum modules.

1) At an angle to the backplane, align the two mounting pins on the top of the module's case with the two hooks at the top of the backplane.
2) Gently rotate the module down until it makes electrical connection with the backplane's I/O bus connector.
3) Tighten the mounting screw at the bottom of the module's case to fasten it to the backplane. Use care when starting this screw so that you do not strip the backplane's threads. The maximum tightening torque for this screw is 4 in-lbs (0.45 Nm)

WARNING The mounting screw must be tightened for proper operation. If this screw is not tightened, the module will not have a solid connection to chassis ground and this could affect module operation.

Status LED Patterns

Depending on the model number that you are using, the module's front panel has seven or eleven status LED's. Figure 2.1 shows the position of the LED's on an 1862Q and their meaning. An 1861Q does not have the C2 and F2 LED's



RUN – On when the module is operating without a fault.

Active – On when the module is communicating with the processor.

FAULT – On when one of the following module error has occured.
- EEPROM Error
- Reference Error

TRANSDUCER FAULT –
When one of these red LED's are on, there is a problem with the module's transducer connection. 'C' is the Coarse Resolver of the transducer, 'F' is the Fine Resolver. '1' designates transducer 1, '2' designates transducer 2.

TRANSDUCER OK –
When these green LED's are on, the transducer connection to the module is OK. Note that both of the channels LED's, C1 & F1 for channel one and C2 & F2 for channel two, must be on before the transducer operates correctly.

ALTERNATE FLASHING –
When the Transducer Fault Latch is enabled and a transient condition faults the transducer connection, the green and red transducer LED's will alternately flash to signify that the latched transducer fault is clearable.

Figure 2.1 Status LED Pattern

Transducer Input Connector

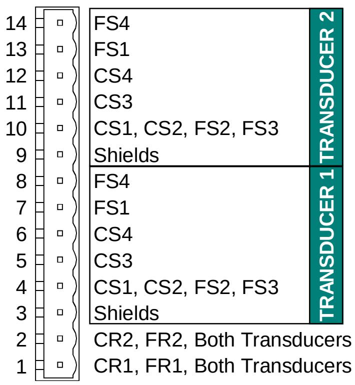
The transducer input connector of an 1861Q module has eight contacts while the connector of an 1862Q module has fourteen contacts. The following table lists the AMCI and Phoenix Contact part numbers on the mating connectors:

	8 Pin Connector	14 Pin Connector
AMCI Part #	MS-8	MS-14
Phoenix Part #	MSTB2.5/8-ST-5.08 1757077	MSTB2.5/14-ST-5.08 1757132

Table 2.2 Transducer Input Connector

Transducer Input Connector (continued)

Figure 2.2 shows the pin out to industry standard resolver wire designations. Note that the connector for the 1862Q is shown. The connector for the 1861Q modules has only eight pins and its connections corresponds to pins 1-8 in the figure.



- F – Fine Resolver
- C – Coarse Resolver
- R1/R2 – Reference Winding
- S1/S3 – COS Winding
- S2/S4 – SIN Winding

Figure 2.2 Transducer Input Connector

Transducer Connector Pin Designations

Figure 2.3 shows the connector pin outs for AMCI multi-turn transducers. Note that some AMCI transducers have integral cables or conduit connections. For a complete listing of AMCI transducers without connectors, refer to ***AMCI Compatible Transducers***, starting on page 6.

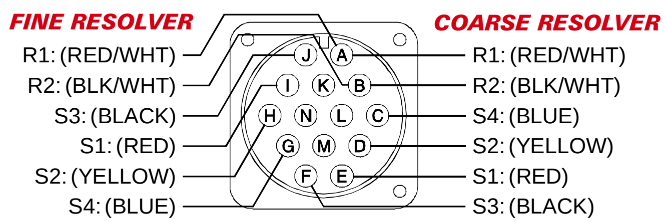


Figure 2.3 Transducer Connector Pin Designations

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 numbers. If you are making your own cables, cable and connectors can be ordered from AMCI.

Module	AMCI Part # (x) = feet	Belden Cable #	Module Connector	Transducer Connector
1861Q	C1T-(x)	9731	MS-8	MS-20 (qty 1)
1862Q	C2T-(x)	9731	MS-14	MS-20 (qty 2)

Table 2.3 Transducer Cable Numbers

NOTE

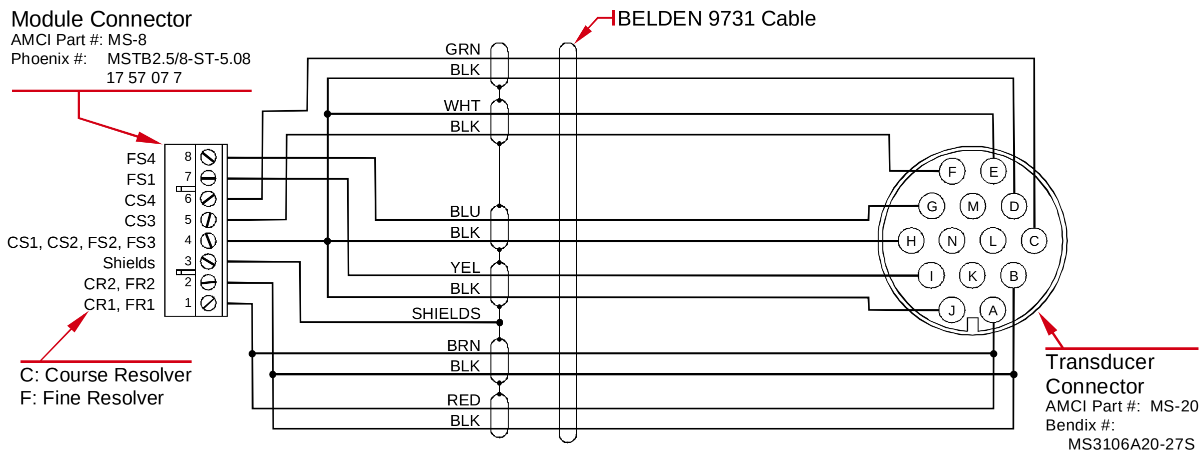
1) Resolvers are low voltage devices. The cable can be installed in conduit along with other low power cabling such as communication cables and low power ac/dc I/O lines. It cannot be installed in conduit with ac power lines or high power ac/dc I/O lines.

2) The shields of the transducer cable must be grounded at the module only! When installing the cable, treat the shield as a signal 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.

The 9731 cable number listed is for a vast majority of applications. If your application involves high temperatures, or your cable will be constantly flexing and you are concerned about failures, check our website for an FAQ on other acceptable cables for use with these modules.

Transducer Cable Wiring Diagrams

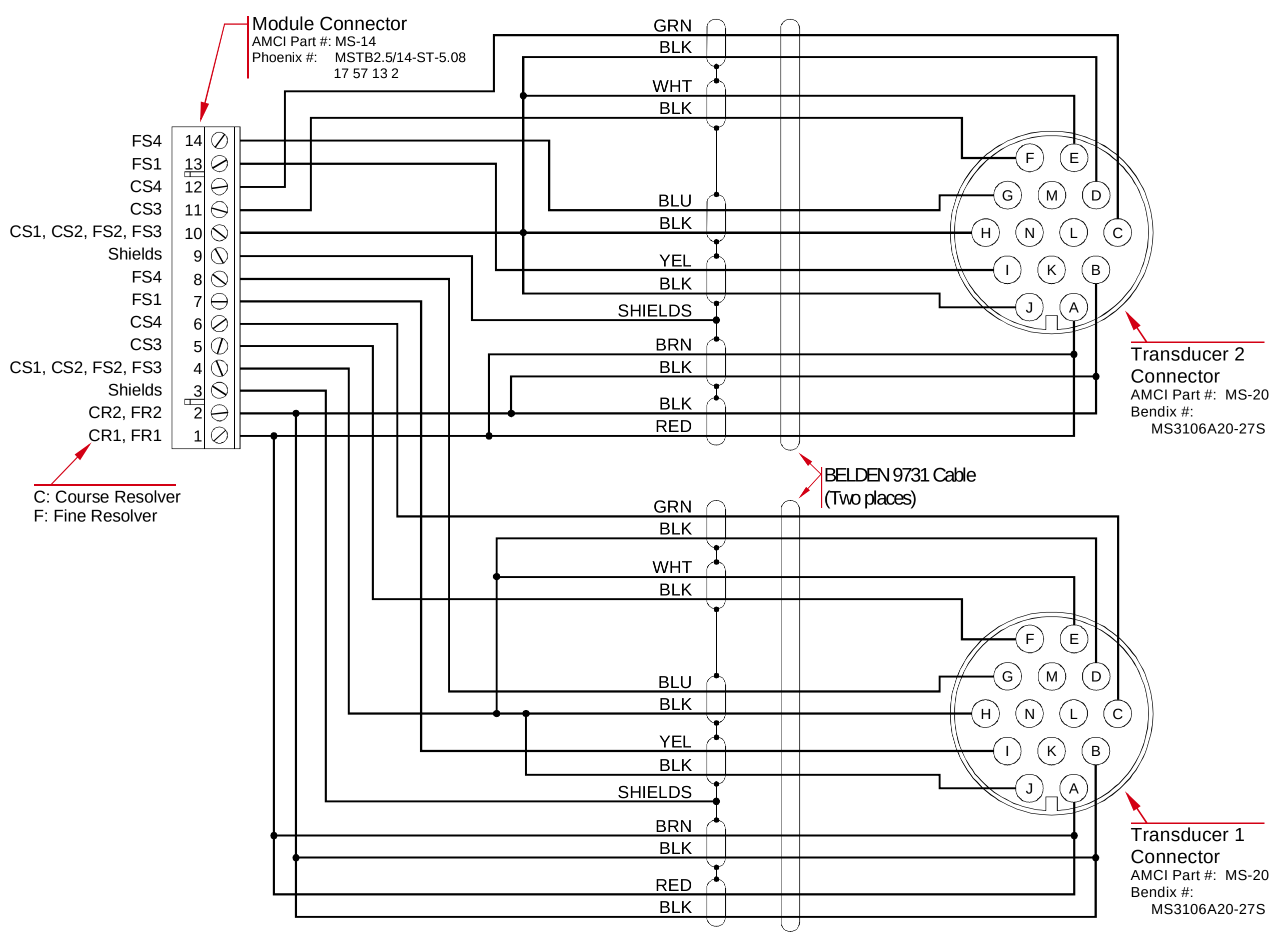
CTT-(x) Wiring Diagram (1861Q)



Note: Pin 1 of the Transducer Input Connector is towards the bottom of the module when plugged in.

Figure 2.4 CTT-(x) Wiring Diagram

C2TT-(x) Wiring Diagram (1862Q)



Note: Pin 1 of the Transducer Input Connector is towards the bottom of the module when plugged in.

Figure 2.5 C2TT-(x) Wiring Diagram

AMCI 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 N)
All 0.375" Shafts	30 lbs. (133 N)	15 lbs. (66.7 N)
All Other Shafts	1 lb. (4.45 N)	0.5 lb. (2.22 N)

Table 2.4 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.

AMCI Transducer Outline Drawings

AMCI offers a broad line of resolver based transducers for use with the 1861Q and 1862Q modules. (See ***AMCI Compatible Transducers*** starting on page 6.) Outline drawings for all of these transducers, and full spec sheets for our most popular transducers, are available on our website, *www.amci.com*. If you do not have internet access, contact AMCI and we will fax the information to you. Our most common multi-turn transducer package is shown below.

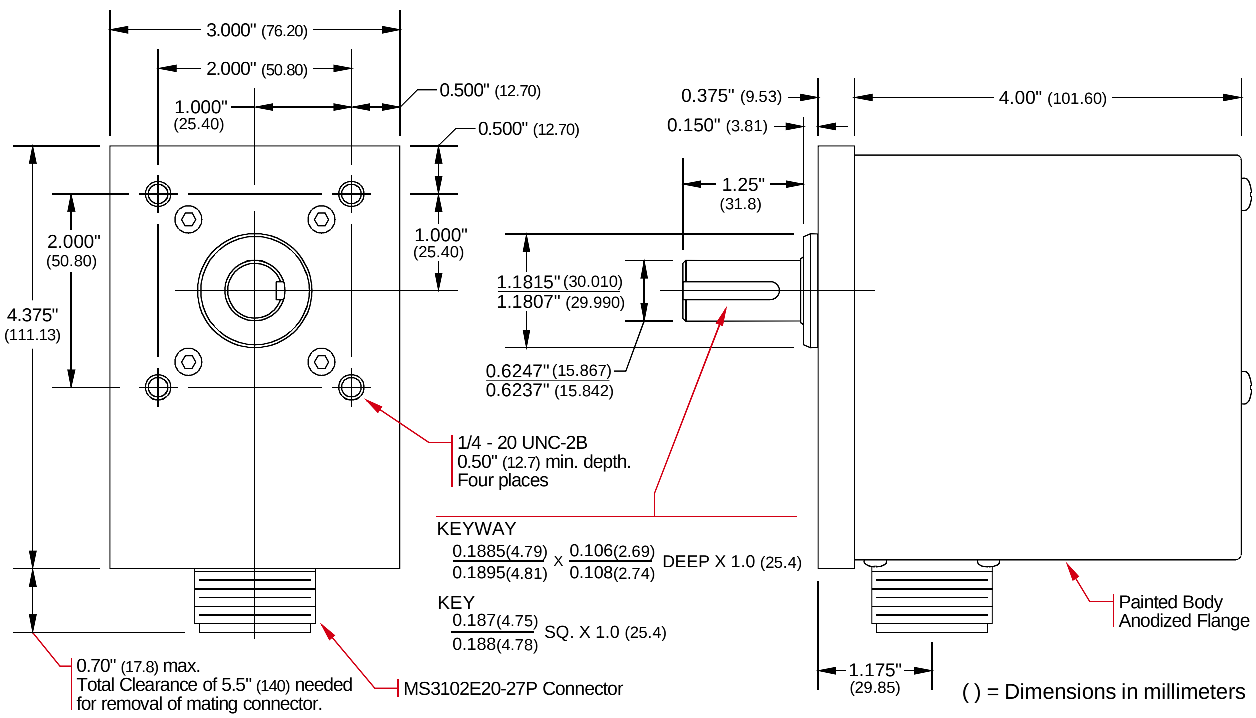


Figure 2.6 HTT-20-(x) Outline Drawing

Autotech Transducer Installation

The manual is intended to be distributed on-line in PDF format, so file size is always a concern. If you require information on installing Autotech transducers, or using AMCI and Autotech transducers together, download the FAQ, *"Using Transducers From Other Manufacturers"*, posted on our website.

Even though Autotech transducers are usable, we strongly recommend using AMCI transducers whenever possible. Refer to ***Other Compatible Transducers*** on page 7 for notes on our recommended replacements for Autotech transducers. Remember that if you do decide to use Autotech transducers, you cannot use Autotech transducer cable. Due to differences in construction, you must use the cable types specified by AMCI.

MODULE SETUP & OPERATION

Installing the Concept Software Driver

Getting the Driver Files

If this is your first time using a Series 1860Q module, then you will probably need to install our driver files for the Concept software. These files are available on our website, *www.amci.com*. You'll find them as a single ZIP file in our Document Retrieval section. Once you've downloaded the ZIP file, decompress it to either your hard drive or a floppy disk.

Configuring Your Concept Software

NOTE

1) Your Concept software must be version 2.1 or above in order to install the driver for our Series 1860Q modules.
2) Our driver is for all of our Quantum modules. When you install the driver, you have the choice of installing all of the modules or only the one that you are presently using. If you install all of them, then you will not have to install the driver again at a later date.

Use the following procedure to install the driver on a Windows 95, 98 or NT 4.0 system.

1) If you un-zipped the driver files to a floppy, insert the disk into its drive.
2) Click on the Windows **START** button.
3) Select **Programs → Concept -0VX.x → ModConnect Tool**. The *Concept Module Installation* screen will appear. 'X.x' is the revision number of the software. It must be 2.1 or above in order to install the supplied driver.
4) Click on **File** in the menu bar.
5) Click on the **Open Installation File** choice in the pull down menu. The *Open MDC-File* screen will appear.
6) Click on the **Drive** pull down box and select the location of the AMCI driver files that you un-zipped after downloading them from *www.amci.com.*
7) Select the file *amcirslv.mdc*.
8) Click on the **Add All** button to add all of our Quantum modules to your list, or select only the module you wish to install and click the **Add Module** button.
9) Click the **Close** button
10) Click on **File** in the menu bar.
11) Click on the **Save Changes** choice in the pull down menu.
12) Close the Concept Module Installation.

The help file that is included in the ZIP file with the software drivers does not contain any information at this time but it must remain on the disk or in the folder with the rest of the files in order for the drivers to install properly.

Adding AMCI Modules to the Modsoft Module List

If you are using Modsoft to configure your system, you must edit one of the Modsoft system text files to add the AMCI module definitions before you can add one of our modules to your system. Use the following procedure to edit the *gcnftcop.sys* file used by Modsoft.

1) Before editing *gcnftcop.sys,* copy this file to a safe location or to a new file name, such as *gcnftcop.old.* The file resides in the 'X':\Modsoft\Runtime directory where 'X' is the drive letter that Modsoft is installed on. This gives you a backup copy of the file in case you make an error editing it.
2) Using a text editor such as Edit for DOS or Notepad for Windows, open the gcnftcop.sys file in the 'X':\Modsoft\Runtime directory. 'X' is the drive letter that Modsoft is installed in.
3) Scroll through the file until you find the last Quantum module currently listed.
4) Add the appropriate module definitions from the list below. Note that the *List Number* field must be unique for each module and is set to the next available number. Therefore, it may not be the same as what is given here.
5) Save the changes to "GCNFTCOP.SYS" and exit your text editor.

Any modules added from the list below should now appear in the list of modules available to Modsoft when the rack is being configured.

Module Definitions

AMCI 1861Q, 248, 0, 8, 20, 1 channel multi-turn, 1, L0146, 2, 0000, 0
AMCI 1862Q, 249, 0, 16, 20, 2 channel multi-turn, 1, L0146, 2, 0000, 0

List Number field. This number must be unique for each module in the list. Therefore, the number you actually use may be different than the numbers given here.

Data Addressing

When setting up your rack, you must select the module from the drivers list and the starting address of the input and output registers used by the module. The actual starting address used is dependent on your setup, but the input registers start at 30,001 and the output registers start at 40,001.

Table 3.1 shows the number of input and output registers used by the module.

	ID Code	Input Registers	Output Registers
1861Q	146h	4	10
1862Q	146h	8	10

Table 3.1 ID Code and I/O Registers

Programming Cycle

As covered in chapter 1 on page 10, a ***Programming Cycle*** is used to configure the module or preset a position value. The next sections of this manual cover the formats of the output and input registers and explains how these registers are used during a Programming Cycle. If you don't know how a Programming Cycle works, refer back to chanpter 1.

Output Registers Format

The format and order of the Output Registers are shown in figure 3.1. Note that only one channel can be programmed at a time and that all data must be present when programming the channel. All programming data is in decimal format.

	Output Registers
Register 1	Command Word
Register 2	Configuration Word
Register 3	Transducer Type
Register 4	Number of Turns
Register 5	Double Percision Full Scale Count
Register 6	
Register 7	Double Percision Linear Offset
Register 8	
Register 9	Double Percision Preset Value
Register 10	

Figure 3.1 Output Register Format

Command Word Format

The first of the output registers assigned to the module is the Command Word. This word defines what actions will be taken with the ***Programming Cycle***. Figure 3.2 shows the format of the Command Word. Note that bits 3 through 12 are reserved and must always equal zero.

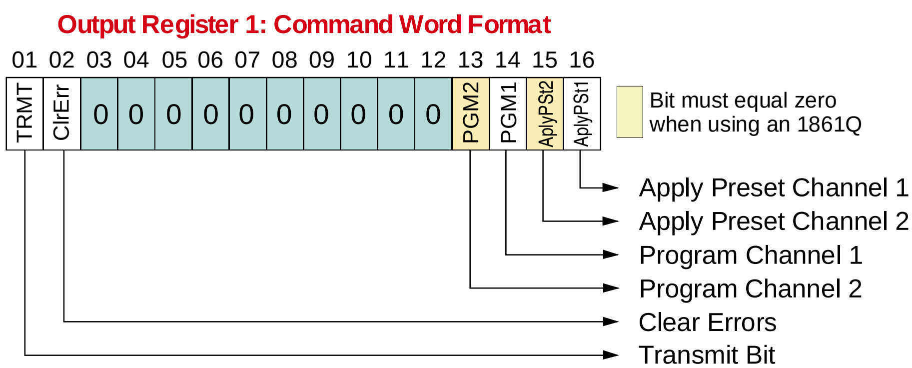


Figure 3.2 Command Word Format

Command Word Bit Values

TRMT: **Transmit Bit, Bit 01.** A 0→1 transition on this bit starts a Programming Cycle. The state of the other bits in the word are ignored until this bit makes the 0→1 transition.

ClrErr: **Clear Errors, Bit 02.** The module will attempt to clear all pending errors when this bit is set. This includes all module errors, programming errors, and latched transducer faults.

PGM2: **Program Channel 2, Bit 13.** If you are using a 1861Q, this bit must be zero. If you have an 1862Q, setting this bit will program the parameters of transducer 2 to the values specified in the remaining output registers. Note that this bit and bit 14, Program Channel 1, *cannot* be set at the same time.

PGM1: **Program Channel 1, Bit 14.** Setting this bit will program the parameters of transducer 1 to the values specified in the remaining output registers. If you have an 1862Q, this bit and bit 13, Program Channel 2, *cannot* be set at the same time.

Output Registers Format (continued)

Command Word Bit Values (continued)

AplyPst2: **Apply Preset Channel 2, Bit 15.** If you are using a 1861Q, this bit must be zero. If you have an 1862Q, setting this bit will preset the position value of transducer 2 to the latest value of the Preset Value parameter. Note that this bit and bit 16, Apply Preset Channel 1, *can* be set at the same time.

AplyPst1: **Apply Preset Channel 1, Bit 16.** Setting this bit will preset the position value of transducer 1 to the latest value of the Preset Value parameter. If you have an 1862Q, note that this bit and bit 15, Apply Preset Channel 2, *can* be set at the same time.

NOTE You can program and preset a channel with one Programming Cycle. The programming data is accepted first. Therefore, the position will preset to the value specified in the programming data.

Configuration Word

The second output register assigned to the module is the Configuration Word. It programs the three parameters that can be set with single bits.

NOTE If you have an 1862Q, the Resolver Type bit, bit 14, must equal zero when programming channel two. It is programmed in channel one only because the Resolver Type parameter affects both channels.

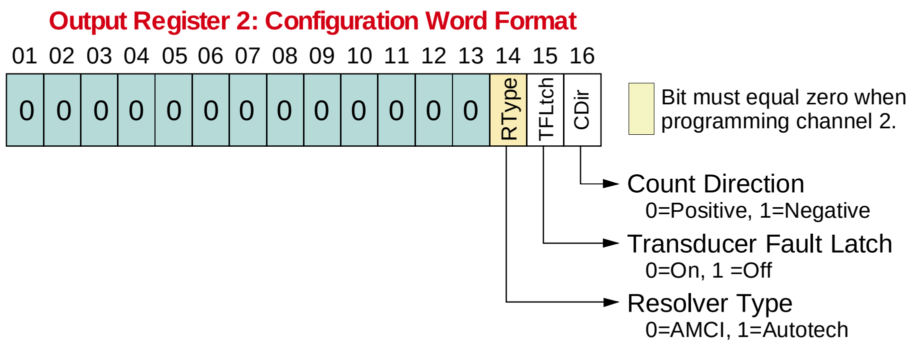


Figure 3.3 Configuration Word Format

Output Registers Format (continued)

Ranges and Factory Default Values

Parameter	Range	Default
Count Direction	Positive / Negative	Positive
Transducer Fault Latch	Enabled / Disabled	Enabled
Tach Response	24 or 120 milliseconds	120 milliseconds
Resolver Type	AMCI / Autotech	AMCI
Transducer Type Register 3	100, 180, 1,000, 1,800, 128	100
Number of Turns Register 4	100 Turn: 1, 2, 4, 5, 10, 20, 25, 50, and 100 180 Turn: 1, 2, 3, 4, 5, 6, 9, 10, 12, 15, 18, 20, 30, 36, 45, 60, 90, and 180 1,000 Turn:(Any 100 turn value) * 10 1,800 Turn:(Any 180 turn value) * 10 128 Turn: 1, 2, 4, 8, 16, 32, 64, 128	100
Full Scale Count Registers 5 & 6 (Double Percision)	2 to (# of Turns * 4,096) if AMCI 100 or 180 Turn 2 to (# of Turns * 409.6) if AMCI 1,000 or 1,800 Turn 2 to (# of Turns * 1,024) if Autotech 128 Turn	409,600
Linear Offset Registers 7 & 8 (Double Percision)	0 to (2^{31} – (Full Scale Count –1))	0
Preset Value Registers 9 & 10 (Double Percision)	Linear Offset to (Linear Offset + (Full Scale Count - 1))	0

Table 3.2 Parameter Ranges and Defaults

Input Registers Format

The format of the input registers assigned to the 1861Q or 1862Q modules is shown in figure 3.4. The status, position and velocity data is in the same order for each channel. The *Status Word* contains module fault, transducer fault, and programming error bits as well as a motion direction and 'zero at velocity' bits. The two word position data is in double precision format.

	1861Q Input Registers
Register 1	Status Word
Register 2	Position (Double Percision)
Register 3	
Register 4	Velocity

	1862Q Input Registers
Register 1	Status Word 1
Register 2	Position 1 (Double Percision)
Register 3	
Register 4	Velocity 1
Register 5	Status Word 2
Register 6	Position 2 (Double Percision)
Register 7	
Register 8	Velocity 2

Figure 3.4 Input Register Format

Input Registers Format (continued)

Status Word Format

Figure 3.5 shows the format of the Status Registers. Each register is identical except for the *Acknowledge Bit*, which is only in register 1.

Input Register 1 or 5: Status Word Format

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
ACK1	ModFlt	TranFlt	0	0	0	Vel@0	MotDir	MsgIgn	CMDErr	PVErr	LOErr	FSCErr	NTErr	TTErr	CFGErr

Figure 3.5 Input Status Word Format

Status Word Error Bits

CFGErr: Configuration Register Error, Bit 16. Set when any reserved bits in the Configuration Word, (output register 2) are set. Also set if the Resolver Type bit (bit 14) is set when programming the second channel of an 1862Q module. See page 20 for information on the format of the ***Configuration Word***.

TTErr: Transducer Type Error, Bit 15. Set when programming the Transducer Type parameter (output register 3) incorrectly. The source of the problem may be an incorrectly programmed Resolver Type parameter.

NTErr: Number of Turns Error, Bit 14. Set when programming the Number of Turns parameter (output register 4) incorrectly. The acceptable values for this parameter depends on the value of the Transducer Type parameter. See the ***Parameter Ranges and Defaults*** table on page 21 for a list of the valid values for the Number of Turns parameter.

FSCErr: Full Scale Count Error, Bit 13. Set when programming the Full Scale Count parameter (output registers 5&6) incorrectly. The acceptable values for this parameter depends on the value of the Number of Turns parameter. See the ***Parameter Ranges and Defaults*** table on page 21 for a list of the valid values for the Full Scale Count parameter. Also note that the data must be in unsigned double precision format.

LOErr: Linear Offset Error, Bit 12. Set when programming the Linear Offset parameter (output registers 7&8) incorrectly. See the ***Parameter Ranges and Defaults*** table on page 21 for a list of the valid values for this parameter. Also note that the data must be in unsigned double precision format.

PVErr: Preset Value Error, Bit 11. Set when programming the Preset Value parameter (output registers 9&10) incorrectly. See the ***Parameter Ranges and Defaults*** table on page 21 for a list of the valid values for this parameter. Also note that the data must be in unsigned double precision format.

CMDErr: Command Error, Bit 10. Set when any bits reserved in the Command Word, (output register 1) are set. If you are using an 1861Q, this bit is also set if the *Program Channel 2* or *Preset Channel 2* bits are set. If you are using an 1862Q, this bit is set if you attempt to program both channels at the same time. See ***Command Word Format*** on page 19 for more information on the Command Word.

MsgIgn: Message Ignored, Bit 09. Set under the following conditions:

1) Your ladder logic attempts to program the module while there is an EEPROM memory fault.
2) All of the other bits in the Command Word, (output register 1), equaled zero when you initiated a Programming Cycle by setting the Transmit Bit.
3) If one of the error bits in this word are set, (bits 16-10), the error must be cleared by reprogramming the incorrect parameter. The Message Ignored bit is set if you attempt to program a different parameter before correcting the error on the first.

The Message Ignored bit is reset when valid instructions are sent to the module or the Clear Errors bit in the Command Word, (output register 1, bit 02) is set when the Programming Cycle is initiated.

Input Registers Format (continued)

Status Word Module Status Bits

MotDir: Motion Direction, Bit 08. This bit is reset when the position counts are increasing or set when the position counts are decreasing. The bit stays in its last state when there is no motion.

Vel@0: Velocity at Zero, Bit 07. This bit is set when the transducer's speed equals zero for greater than 125 milliseconds.

TranFlt: Transducer Fault, Bit 03. This bit is set when there is a transducer fault. If the Transducer Fault Latch is enabled, it may be possible to clear the fault by setting the Clear Error bit (output register 1, bit 15), and initiating a Programming Cycle.

ModFlt: Module Fault, Bit 02. This bit is set when there is a EEPROM or Reference Voltage Fault. It may be possible to clear the fault by setting the Clear Error bit (output register 1, bit 15), and initiating a Programming Cycle. If this works, the module's parameters will be reset to their default vakues. If this does not work, ***contact AMCI*** for assistance.

Status Word Acknowledge Bit (Word 1 only)

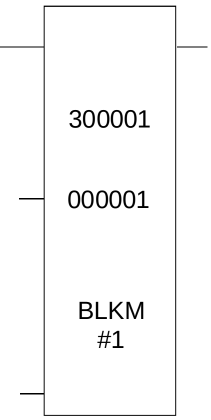
ACK1: Acknowledge Bit, Bit 01. This bit is only available in input register 1. It is set by the module to acknowledge setup instructions from the processor. Error bits in the status words are only valid while this bit is set. The Status bits is the status words are always valid. The module will reset the Acknowledge bit after your ladder logic resets the Transmit Bit.

Sample Program

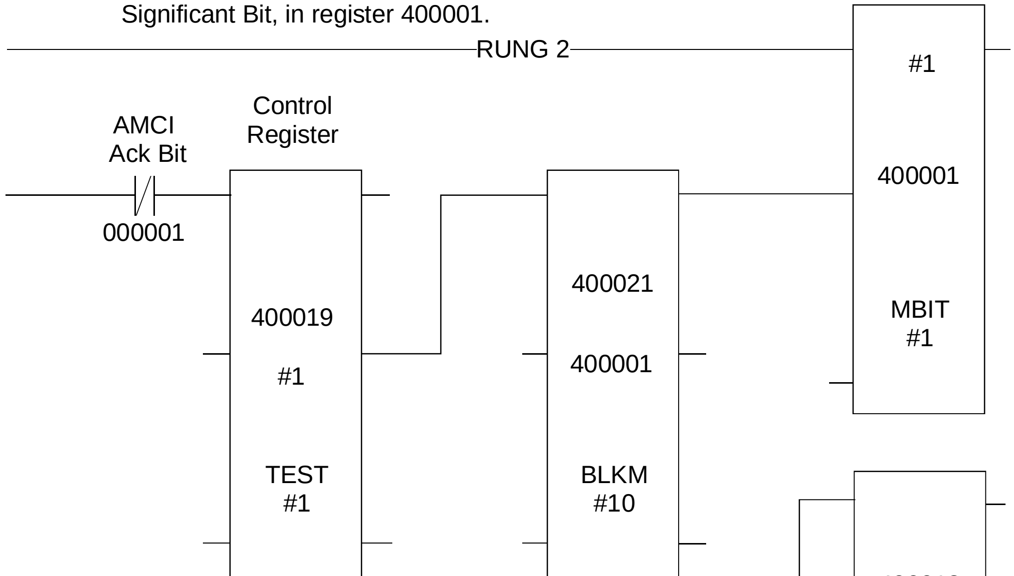
The sample program on the following page can be used to program an 1861Q or the first channel of an 1862Q. It assumes the modules input registers start at register 30,001 and the output registers start at 40,001.

Sample Program (continued)

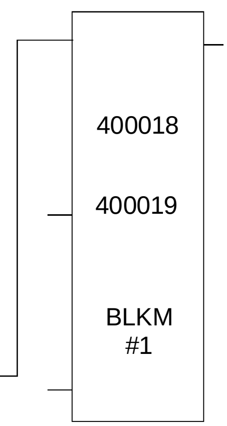
RUNG 1 When scanned, this rung will copy the Channel 1 status data from Input Register 300001 to internal bits 000001 through 000016. This will allow the PLC to interrogate the status bits using relay contact instructions.



RUNG 2 When Acknowledge Bit 000001 is not set, and internal register 400019 is equal to 1, copy the data contained in registers 400021 through 400030 to the Output Registers assigned to the 1860Q module. Internal register 400019 can be set to 1 by either typing it in manually, or having your ladder logic program set it. After the 10 data words have been copied, the MBIT instruction initates the transfer by setting the Transmit Bit, the Most Significant Bit, in register 400001.



RUNG 3 When Acknowledge Bit 000001 is set, the 1860Q module has accepted the data transferred to it by the previous rung. When the transfer is complete, this rung resets register 400019, which initiated the programming cycle to 0. The programming cycle is now complete.



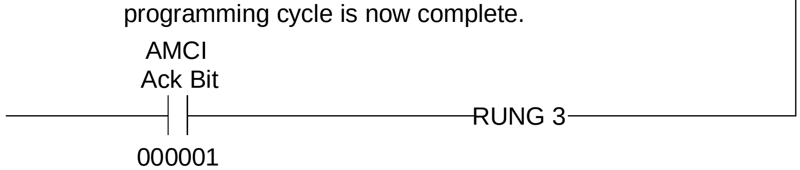


Figure 3.6 Sample Program

APPENDIX A
SHUT HEIGHT SETUP EXAMPLE

Background

This appendix covers a common setup problem encountered in the press industry. However, in its simplest form, the problem breaks down into setting the *Full Scale Count*, *Linear Offset*, and *Preset Value* parameters so that the transducer measures a linear distance in some form of engineering units such as inches or meters. Therefore, this appendix should be helpful in other applications, such as palletizing or overhead crane positioning.

> An 1861Q or 1862Q can only monitor the position of the load. Controlling the motor that positions the load is the responsibility of the PLC.

Definitions

Many large mechanical power presses have the ability to adjust the starting position of the ram or slide to accommodate different size dies. As shown in figure A.1, *Shut Height* refers to the distance between the slide and the base of the press when the press is at the bottom of its stroke.

Total Travel: The difference between the minimum and maximum shut heights. This is the maximum distance that can be travelled under normal operating conditions.

Transducer Travel: The distance that the transducer can encode. This distance must be greater than the Total Travel distance for the system to operate correctly.

Over Travel & Under Travel: As a safety feature, the parameters of the module will be programmed so that the position value will be correct if the slide travels over or under its normal limits. The value of the Over Travel and Under Travel limits is equal to:

(Transducer Travel – Total Travel) / 2.

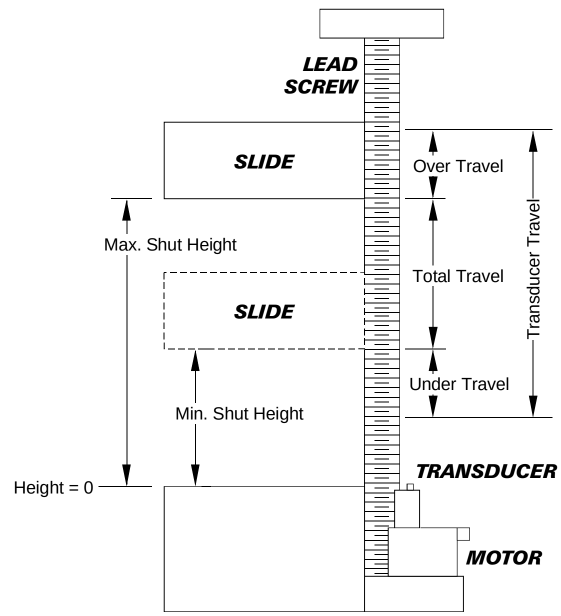


Figure A.1 Shut Height Example

Example Assumptions

1) The correct transducer has been chosen for the application. This means that the number of turns needed to traverse the Total Travel distance is less that the total number of turns of the transducer. This assumption also means that the number of counts needed per turn is less than or equal to the number of counts per turn available from the transducer. Both parts of this assumption are tested during the procedure.

2) The example uses an AMCI 180 turn transducer. If you are using a different transducer, refer to table 3.2, ***Parameter Ranges and Defaults*** on page 21 for a listing of parameter ranges you'll need while programming the module.

3) The minimum shut height is 29.000 inches and the maximum shut height is 64.000 inches.

4) Desired position resolution is 0.001 inches.

5) The slide moves 0.250 inches for each turn of the transducer shaft.

Calculating the Full Scale Count Parameter

If you know the minimum and maximum position values, (assumption 3), desired position resolution, (assumption 4), and the amount of travel per turn, (assumption 5), then you can easily determine the proper transducer to use and calculate the Full Scale Count parameter.

1) Total Travel equals the difference between the min. and max. position values:
   Total Travel = 64.000 - 29.000 = 35.000 inches
2) Total Travel / Travel per Turn = Number of turns needed from the transducer.
   35.000 / 0.250 = 140 turns. *100 and 128 turn transducers cannot be used in this application.*
3) Counts per Turn = Travel per Turn / Desired Resolution
   Counts per Turn = 0.250 / 0.001 = 250. *The calculated counts per turn is below the maximums that can be programmed into the unit. Therefore, any transducer not eliminated by step 2 can be used.*
4) Full Scale Count = Transducer's Number of Turns * Counts per Turn
   Full Scale Count = 180 * 250 = 45,000

Calculating the Linear Offset Parameter

Before calculating the Linear Offset parameter, you must calculate the amount of Under Travel available in you system. The amount of Over Travel is the same.

1) Under Travel equals one half of the difference between the Transducer's number of turns and the needed number of turns, multiplied by the number of counts per turn.
   Under Travel = 1/2 * ((180 turns – 140 turns) * 250 counts/turn) = 5,000 counts. (5.000 inches)
2) The Linear Offset equals the count at your minimum shut height minus the under travel count.
   Linear Offset = 29,000 - 5,000 = 24,000.

Determining the Preset Value

Instead of calculating the Preset Value, its often easier the drive the slide to its low position and physically measure the shut height distance to determine the Preset Value. In our example, once the slide is driven to its low position, the actual shut height distance is measured as 29.031 inches. The Preset Value would then be 29,031. Once the shut height distance is measured, it is important that you leave the slide at this position while programming the module.

Programming the 1860Q Module

This example, which will work with an 1861Q or 1862Q, programs channel 1. Table A.1 shows output data table values that must be sent to the 1860Q to program it for this application.

This programming block must be sent to the module while the slide is at the Preset Value position. If it is not, the unit will not be preset to the correct position.

		Value (hex / dec.)	Parameter
Output Registers	1	4005h / 16,389	Control Word. Program and preset channel 1
	2	0000h / 0	Configuration Word. AMCI transducer, Transducer Fault Latch enabled, Positive count direction
	3	180	Transducer Type = 180
	4	180	Number of Turns = 180
	5, 6	45,000	Full Scale Count = 45,000
	7, 8	24,000	Linear Offset = 24,000
	9, 10	29,031	Preset Value = 29,031

Table A.1 Programming Values

Verifying the Setup

Once the module is programmed, the last step is to verify the setup. This is done by first driving the slide to its maximum shut height. It is important to drive it to its maximum so that you see the greatest accumulated error. Once at the maximum shut height, physically measure the distance and verify that the position value from the module is correct at this height. If it is correct, your setup is complete.

If the position value from the module is incorrect, then your value for the amount of linear travel per transducer turn was not accurate enough for these calculations and this ratio must be recalculated along with the Full Scale Count and Linear Offset parameters.

Before you can recalculate the linear travel per turn ratio, you must calculate the expected count change, and the actual count change. The Expected Δ Count is based on your physical measurements, the Actual Δ Count is based on the position readings from the module.

If the physical reading at the maximum shut height was 63.980 inches, then:

Expected Δ Count = (Maximum Shut Height – Minimum Shut Height) * Resolution
Expected Δ Count = (63.980 inches - 29.031 inches) * 1,000 counts/inch = 34,949 counts.

If the position value at the maximum shut height was 63,942, then:

Actual Δ Count = Count at Max. Shut Height – Count at Min. Shut Height
Actual Δ Count = 63,942 - 29,031 = 34,911.

To recalculate the linear travel per turn ratio, use the following formula:

Actual Ratio = Present Ratio * (Expected Δ Count / Actual Δ Count)

Therefore, the actual ratio becomes:

Actual Ratio = 0.250"/turn * (34,949 / 34,911) = 0.25027"/turn

You must use this ratio to re-calculate the Full Scale Count and Linear Offset values. If you don’t move the slide before re-programming the module, the Preset Value must be changed to the maximum shut height value that you physically measured.

After re-programming the module, drive the slide to the minimum shut height and physically measure the gap. The position value from the unit should now be correct. If it isn’t, the most likely culprit is that the slide is settling between the time that you measured the gap and the time you program this measurement into the module as the Preset Value.

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