ADVANCED MICRO CONTROLS INC.

Manual #: 940-0C011

1241
Resolver Interface Module

User Manual

Rockwell Automation ControlLogix I/O Module

ROCKWELL AUTOMATION ENCOMPASS™ AMERICAS PARTNER

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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We Want Your Feedback

Manuals at AMCI are constantly evolving entities. Your questions and comments on this manual 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*

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Chapter 5: General Installation Guidelines

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ABOUT THIS MANUAL

Read this chapter to learn how to navigate through the manual and familiarize yourself with the conventions used in it. The last section of this chapter highlights the manual's remaining chapters and their targeted audiences.

Audience

This manual explains the set-up, installation, and operation of AMCI's 1241 Resolver Interface Module for the Rockwell Automation ControlLogix PLC platform.

It is written for the engineer responsible for incorporating the 1241 into a design, as well as the engineer or technician responsible for its actual installation.

Navigating this Manual

This manual is designed to be used in both printed and on-line forms. Its on-line form is a PDF document, which requires Adobe Acrobat Reader version 4.0+ to open it.

Bookmarks of all the chapter names, section headings, and sub-headings are in the PDF file to help you navigate through it. The bookmarks should have appeared when you opened the file. If they didn'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 include page numbers.

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.

Manual Conventions

Three icons are used to highlight important information in the manual:

NOTE — **NOTES** highlight important concepts, decisions you must make, or the implications of those decisions.

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

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

The following table shows the text formatting conventions:

Format	Description
Normal Font	Font used throughout this manual.
Emphasis Font	Font used the first time a new term is introduced.
Cross Reference	When viewing the PDF version of the manual, clicking on the cross reference text jumps you to referenced section.

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Revision Record

This manual, 940-0C011, is the first revision of the manual. It was initially released January 22, 2003. It changes the current draw specifications to reflect the changes made to the module starting with serial number 77364. Starting with the serial number, all 1241’s use only the 5 volt DC supply from the backplane. The use of the 24Vdc supply has been eliminated. This eliminates a RIUP (Removal and Insertion Under Power) problem that Rockwell Automation has discovered with all ControlLogix modules that use the 24Vdc backplane supply. This revision also changes the sample program in chapter 9 of this manual.

Revision History

940-0C011: 1/22/2003. RIUP and Sample Program changes.

940-0C010: 7/17/2002. Initial Release.

Where To Go From Here

This manual contains information that is of interest to everyone from engineers to operators. The table below gives a brief description of each chapter’s contents to help you find the information you need to do your job.

CHP Num.	Chapter Title	Intended Audience
1	*INTRODUCTION TO THE 1241*	Anyone new to the 1241. This chapter gives a basic overview of the features available on the unit, typical applications, and complementary equipment.
2	*QUICK START*	Anyone already experienced in installing or using similar products and wants generalized information to get up and running quickly.
3	*SYSTEM CHECKOUT*	A bench test procedure to help you get familiar with the 1241.
4	*SPECIFICATIONS*	Anyone that needs detailed information on the 1241 including electrical specifications and an explanation of its programmable parameters.
5	*GENERAL INSTALLATION GUIDELINES*	Anyone new to installing electronic controls in an industrial environment. The chapter includes general information on grounding, wiring, and surge suppression that is applicable to any controls installation.
6	*INSTALLING THE 1241*	Anyone that must install a 1241. Includes information on mounting, grounding, and wiring specific to the unit.
7	*RSLOGIX 5000 CONFIGURATION*	Anyone that must configure the RSLogix 5000 package to communicate with the 1241.
8	*DATA FORMAT*	Anyone responsible for developing the ladder logic to control the 1241 or anyone that needs to determine the meaning of the data transmitted by the 1241.
9	*SAMPLE PROGRAM*	Anyone that must develop the ladder logic to read and write data to the 1241.

CHAPTER 1
INTRODUCTION TO THE 1241

Overview

The 1241 is the *first* resolver interface module for Rockwell Automation's ControlLogix platform. The module converts resolver signals to digital position and tachometer data that is reported over the backplane. Status information is also reported. The 1241 eliminates the separate resolver decoder box, input card, and associated wiring needed to bring resolver data into a PLC.

Figure 1.1 1241 Module

Like an absolute optical encoder, a resolver is a 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. When attached to a 1241 module, the resolver gives an absolute position value with up to thirteen bits of position resolution over a six conductor cable. An absolute optical encoder would require a cable with at least fifteen wires to accomplish the same resolution.

A 1241 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 press ram. As the press cycles through one turn, the resolver position is used to monitor and control such functions as material feed and part blow-off.
- **Linear Application -** The resolver position correlates to a physical length. These applications can be either single turn or multi-turn. An example of a single turn application is a packaging machine where the resolver completes one turn for each product. An example of a multi-turn application is monitoring the position of a load on a track or ball screw. In this type of application, linear position is translated to rotary position through a wheel or gearing. The transducer completes several rotations in order to travel the entire distance.

The 1241 also has a *Stop Time Monitor* feature. This feature measure the time between a transition on the front panel Brake Input and the stopping of the transducer rotation. The Stop Time Monitor is typically used in press controls but can be used in any application where you need to monitor the stopping time of the resolver. Some other application examples are overhead cranes and mining cars.

Module Description

As you can see in figure 1.1, the 1241 is very simple. There are two status LED's in the display and two connectors behind the door. The eight pin connector is the Transducer Input Connector and the two pin connector is the Brake Input Connector. The LED above this connector is a status LED for the input.

AMCI purchases the case pieces, backplane connector, and backplane interface IC directly from Rockwell Automation under license. These are the same components used by Rockwell Automation products, so the 1241 is 100% mechanically and electrically compatible with the ControlLogix system.

Module Description (continued)

Status LED’s

The two Status LED’s allow you to quickly verify the operating status of the module. The OK LED shows the state of the communications between the 1241 and the backplane. (It’s actually controlled by the A-B interface IC.) It does not indicate the working state of the module.

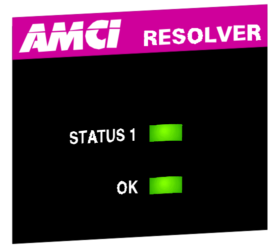


Figure 1.2 Status LED’s

The STATUS LED shows the working state of the module. Any problem with the module itself will cause this LED to turn on red. A problem with the transducer is indicated by blinking the LED. When it blinks green, the transducer signals were temporarily lost but the transducer is now working. This is most commonly caused by a loose connection or a burst of electrical noise. If the LED blinks red, the transducer is not sending back correct signals to the module. This can be caused by improper wiring or a faulty transducer.

A more in-depth description of the status LED’s is given in the ***Hardware Specifications*** section of chapter 4, starting on page 22.

Stop Time Monitoring

If you are using the 1241 in a press control application, you can use the stop time monitoring feature to measure the stopping time of the crankshaft. The stop time monitor on the unit measures the time between the on-to-off transition of the Brake Input and the stopping of the transducer. The Stop Time Timer measures a stopping time of 34 milliseconds to 64.140 seconds with a resolution of 1 millisecond.

The 1241 also captures the position at which the brake is applied and reports this information, along with the stopping time, when a brake cycle is completed. This information is reported over the backplane until the next brake cycle finishes.

If you are not using the unit in a press control application or any other application that requires you to monitor the Stopping time of your machine, then you can leave the Brake Input un-wired and the Stop Time Monitor will never trigger.

> The stop time monitor is a monitoring feature only. Any determination of the correct operation of the brake must be made by the system PLC through a user developed ladder logic program.

Compatible Transducers

Table 1.1 lists the AMCI single-turn transducers that are compatible with the 1241.

Model	Shaft	Mount	Turns	Comments
R11X-J10/7	0.120"	Servo	1	NEMA 1, size 11 resolver. Leads only, no connector.
R11X-J10/7G	0.120"	Servo	1	Same as R11X-J10/7 with AMCI's standard single turn connector wired to the resolver.
R11X-J12/7	0.188"	Servo	1	NEMA 1, size 11 resolver. Leads only, no connector.
R11X-J12/7G	0.188"	Servo	1	Same as R11X-J12/7 with AMCI's standard single turn connector wired to the resolver.
HT-6	0.188"	Front/Side	1	NEMA 13 R11X-J12/7 transducer
HT-20	0.625"	Front/Side	1	NEMA 4 heavy duty transducer
HT-20S	0.625"	Front/Side	1	HT-20 with side connector
HT-20C	0.625"	Front/Side	1	NEMA 4X stainless steel HT-20 w/ Viton® shaft seal, and 0.5" NPT thread for conduit connection. Internal terminal plug for resolver connections.
HT-20K	0.625"	Front/Side	1	NEMA 4X hard coat anodized HT-20, stainless steel shaft w/ Viton shaft seal.
HT-20KS	0.625"	Front/Side	1	HT-20K with side connector.
HT-20L	0.625"	Front/Side	1	NEMA 4X hard coat anodized HT-20, stainless steel shaft w/ Nitrile shaft seal.
HT-20LS	0.625"	Front/Side	1	HT-20L with side connector.
H25-FE	0.375"	Flange	1	NEMA 4, size 25, end connector
H25-F1E	0.375"	Flange	1	NEMA 4, size 25, end connector. Bolt-in replacement for Namco/C&A HT-11B transducers.
H25-FS	0.375"	Flange	1	NEMA 4, size 25, side connector
H25-FL	0.375"	Flange	1	NEMA 4, size 25, integral 15 foot (3 meter) cable
H25-SE	0.375"	Servo/Front	1	NEMA 4, size 25, end connector
H25-SS	0.375"	Servo/Front	1	NEMA 4, size 25, side connector
H25-SL	0.375"	Servo/Front	1	NEMA 4, size 25, integral 15 foot (3 meter) cable
HT-400	0.625"	Front	1	NEMA 4, Bolt-in replacement for Autotech RL100 transducers. Also has HT-20 bolt pattern. 1" NPT thread for conduit connection. Internal terminal strip for resolver connections.
HT-400-1E	0.625"	Front	1	Same as HT-400 with an AMCI MS connector instead of a conduit connection.
HT-20-(x)	0.625"	Front	(x)†	HT-20 with internal (x):1 gear ratio
HTT-20-1	0.625"	Front	1‡	Redundant single turn resolvers, single MS connector
HTT-400-1	0.625"	Front	1‡	Redundant single turn resolvers. Bolt-in replacement for Autotech RL220 transducers. Dual AMCI MS connectors.

† Available gear ratios are: 2:1, 2.5:1, 2.77:1, 3:1, 4:1, 4.8:1, 5:1, 6:1, 7:1, 8:1, 9:1, 10:1, 12:1, 13:1, 15:1, 16:1, 18:1, 20:1, 24:1, 36:1, 40:1, 50:1, 60:1, 64:1, 100:1, 105:1, 150:1, 180:1, 250:1 and 256:1. Additional gear ratios may be available. Check our website, *www.amci.com*, for an up-to-date listing.

‡ This package contain two resolvers geared 1:1 with the input shaft. Most commonly used in systems that mandate redundant sensors, AMCI can install two different size 11 resolvers in the package per customer requirements. Contact AMCI for more information.

Table 1.1 Compatible Transducers

Other AMCI ControlLogix Products

AMCI has a growing line of products for the ControlLogix platform and the ControlNet network. Table 1.2 gives a brief description of these products. Additional information on these units can be found on our web-site, *www.amci.com*.

Model Number	Interface	Description
1242	ControlLogix	Resolver Interface Module. Similar to the 1241 in functionality, the 1242 can be configured to accept 2 single-turn transducers or 1 dual resolver, absolute multi-turn transducer.
8213	ControlLogix	Resolver based Programmable Limit Switch. This programmable limit switch turns outputs on and off based on the resolver's position and speed. The 8213 has 16 limit switch outputs available over the back-plane and 16 available off a relay board that attaches to the module. Two velocity based analog outputs are also available.
3202	ControlLogix	Two channel stepper indexer module for the ControlLogix backplane with incremental encoder position feedback. Featuring blended move profiles and profiles based on encoder feedback, the module also has multiple inputs for homing and over travel protection. AMCI also has a full line of drives and motors to complete your stepper motor system.
3204	ControlLogix	Four channel stepper indexer module for the ControlLogix backplane. Featuring blended move profiles, the module also has multiple inputs for homing and over travel protection. AMCI also has a full line of drives and motors to complete your stepper motor system.
NX2A4C	ControlNet	Resolver Interface unit. Accepts 4 single resolver transducers or 2 dual resolver, absolute multi-turn transducers. Reports position, velocity, and fault diagnostic data. The unit also has a Brake Input for stop time monitoring.
NX2C4C	ControlNet	Four channel LDT interface. Accepts AMCI, Balluff, and Temposonic transducers. Reports position, velocity, and fault diagnostics.
NX2C4C-08	ControlNet	Four channel multiple magnet LDT interface. Same as the NX2C4C except it allows up to sixteen magnets per transducer.
NX2E4C	ControlNet	Four channel SSI interface. Accepts any transducer that outputs SSI data. Supports 1 to 32 bit transfers with a data value programmable from 1 to 28 bits. Reports Data Value, Rate of Change, fault diagnos-tics, and raw SSI data.
NX3B1C	ControlNet	One resolver input, programmable limit switch. Sixteen digital inputs and sixteen solid state relay outputs. Eight outputs available on-board, additional eight output available from an external relay board.
NX1F2C	ControlNet	Two axis stepper indexer. With features similar to the 3202 module, this unit allows you to place the indexer where you need it, thereby sim-plifying wiring on large installations. The ControlNet interface also makes it easy to use the NX1F2C in PLC-5 and SLC500 systems.
NX1F4C	ControlNet	Four axis stepper indexer. With features similar to the 3202 module, this unit allows you to place the indexer where you need it, thereby sim-plifying wiring on large installations. The ControlNet interface also makes it easy to use the NX1F4C in PLC-5 and SLC500 systems.
SD17098IC	ControlNet	Stepper Drive / Indexer Combination with integrated ControlNet inter-face. Programmable over ControlNet or an RS-232/485 port, this microstepping drive is designed for size 23 through 42 motors and fea-tures RMS current control, a 170Vdc output bus and up to 9.8A of motor current. Designed to save the cost of a separate indexer module for applications that are already using ControlNet, the indexer supports blended move profiles as well as velocity mode programming.

Table 1.2 Other ControlLogix Products

Other AMCI Products

AMCI has been serving the industrial automation sector since 1985, and we have a broad range of other products used throughout the market.

- **DURACODERS:** Absolute, Analog, or Incremental encoders that replace the fragile glass disk and sensitive optics with an industrial resolver. The size 25 DuraCoders are drop in replacements for similar sized optical encoders.
- **STEPPER MOTION:** Our line of stepper products that includes motors, drives, and indexers. Stepper motor systems offer low cost motion control for many packaging machines.
- **PLC PLUG-IN MODULES:** AMCI offers a broad range of PLC plug-in modules for most major PLC brands including Rockwell Automation's SLC500 and 1771 I/O, GE Fanuc 90-70 and 90-30, and Modicon Quantum. Modules include resolver, LDT, and SSI interfaces, programmable limit switches, and registration control modules.
- **RESOLVER TRANSDUCERS:** AMCI is the only company in the market place to manufacturer its own resolvers. Not only do we make the resolvers for our own products, we also produce resolvers with different electrical specifications for other position feedback applications such as servo control.

For additional information on these items and the rest of our product lines, browse through our website ***www.amci.com***, or contact AMCI or your local AMCI distributor.

Notes

CHAPTER 2
QUICK START

This chapter was written to help an experienced user get the 1241 up and running quickly. It assumes you have a solid understanding of programming a ControlLogix system, as well as proper installation techniques such as wiring, grounding, and surge suppression.

The chapter also contains references to the other sections in this manual where more information can be found. If you don't feel you have enough information or background to complete the steps listed here, *always read the referenced sections before attempting to complete a step.*

STEP 1: Get Familiar With the 1241

1.1) Chapter 4, ***SPECIFICATIONS***, chapter 7, ***RSLOGIX 5000 CONFIGURATION***, and chapter 8, ***DATA FORMAT***, contain all of the information you'll need to know to program the module.

1.2) Chapter 3, ***SYSTEM CHECKOUT*** walks you through a bench test of the 1241.

STEP 2: Decide On Needed Functionality

2.1) Will you use the Brake Input? If you do, you'll have to develop the circuit to wire into the input. See the ***Brake Input Wiring*** section of chapter 6 starting on page 39 for wiring suggestions. The input triggers when the input transitions from on-to-off. If you're not using the input, then there is nothing to do. Don't wire anything to the input and it won't trigger.

STEP 3: Determine Parameter Values

3.1) The 1241's parameters are described in the ***Module Parameters*** section of chapter 4 starting on page 23. Table 4.1, ***Factory Defaults and Ranges***, on page 25 lists the acceptable values for each parameter.

STEP 4: Install Hardware

4.1) The 1241 installs in the ControlLogix chassis like every other I/O module.

4.2) The part number of the transducer cable is CTL-(x), where 'x' is its length in feet. Note that it's a low power cable and must not be routed with high power AC or DC cabling. Chapter 5, ***GENERAL INSTALLATION GUIDELINES***, which starts on page 31, contains information on installing the cable.
The figure below shows how to wire the CTL to the 1241's included transducer input connector.

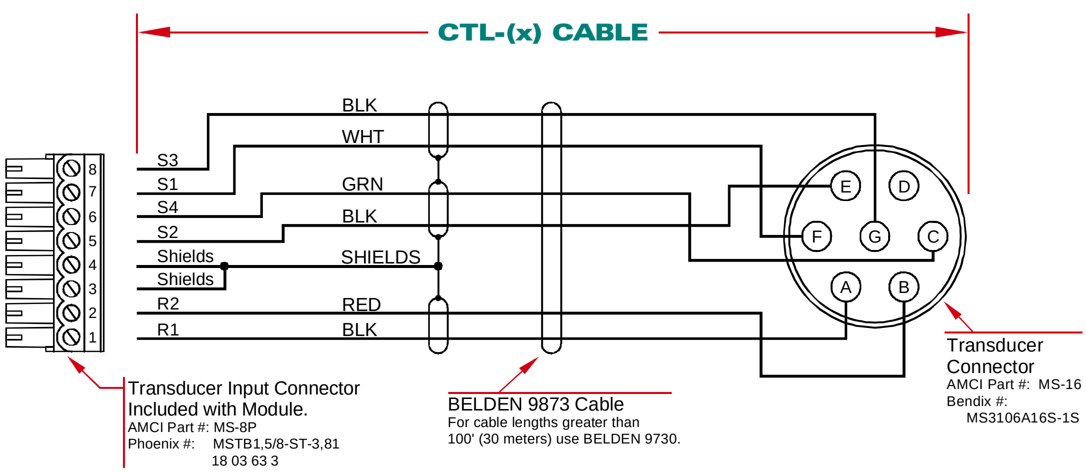


Figure 2.1 CTL-(x) Wiring Diagram

STEP 5: Configure Your RSLogix 5000 Software

5.1) Enter the following information when configuring the 1241's slot:

- **Name:** *Your choice, but it must begin with a letter.*
- **Description:** *Your choice.*
- **Comm Format:** Data - DINT
- **Slot:** *Location of 1241 module.*
- **Connection Parameters:**

	Assembly Instance	Size
Input:	100	6
Output:	195	1
Configuration:	1	0

Table 2.1 Slot Configuration Values

- **RPI Time:** *The Rate Packet Interval Time cannot be set less than 0.4 milliseconds.*

5.2) Define tags to control the Message Instructions that you'll use to setup the module. Depending on your system, you will need up to three Message Instruction tags. Each of these controlling tags must have a data type of *Message*.

5.3) Define tags that contain the setup data to be written to the 1241. All tags must have a data type of *Integer*. The Setup Data is five words long. The Apply Preset and Clear Transducer Fault data are one word long.

STEP 6: Add Ladder Logic to Program the 1241

6.1) Enter the ladder logic to control the 1241. A sample ladder logic segment can be found in chapter 9, ***SAMPLE PROGRAM***, starting on page 49.

STEP 7: Verify and Fine Tune Your System

The steps that you'll have to take depends on your system. However, verify that you can program the module and, if the Transducer Fault Latch is enabled, clear transducer faults. Also cycle the machine to verify that the position remains correct. Remember that a resolver is an absolute device that does not gain or lose counts. If the position appears to drift as you run the machine, the most probable cause is a loose coupler somewhere in the machine.

CHAPTER 3
SYSTEM CHECKOUT

This chapter is for new users that want to bench test the 1241 to become familiar with its features. Because it assumes you're *bench* testing the module, installation practices such as grounding and surge suppression are not covered. This chapter also assumes you have a grasp of the fundamentals of configuring and programing a ControlLogix system.

Needed Equipment

The following equipment is needed to walk through the system checkout:

- The 1241, including the MS-8P Transducer Input Connector that shipped with the unit
- A ControlLogix processor, chassis and power supply
- A PC with programming software such a RSLogix 5000
- A communication cable to connect the PC and ControlLogix processor.
- Wire, and assorted hand tools such as screwdrivers, wire cutters, and wire strippers.

A transducer is not absolutely needed for the system checkout, but certainly can be used. If you decide to use a transducer, you will also need a CTL-(x) transducer cable, where (x) is its length in feet.

Install the Modules in the Chassis

Follow the instructions from Rockwell Automation to attach the power supply to the chassis. Install the processor and 1241 into any free slots. Because the 1241 is built with hardware licensed from Rockwell Automation, it installs in the chassis like every other ControlLogix module.

Faking a Transducer, or Attaching a Real One

If you don't have an AMCI transducer and CTL-(x) cable, you can put wire jumpers on the 1241's Transducer Input Connector as shown in figure 3.1 below. After it's wired, plug the connector back into the module. When you power the chassis, the 1241 will think that the transducer is at 90°.

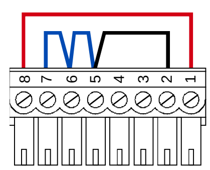


Figure 3.1 Faking a Transducer Connection

If you have a transducer and cable, wire the cable as shown in the figure below and plug the cable into the transducer and 1241 now.

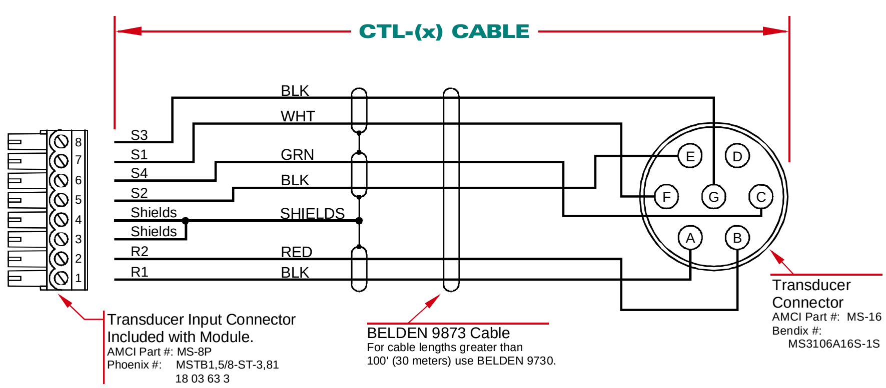


Figure 3.2 CTL-(x) Wiring

Attach the PC to the Processor

Follow Rockwell Automation literature for connecting the communication cable from the PC to the ControlLogix processor.

Apply Power

Review all power wiring and apply power to the PLC. The 1241 should power up in a few seconds and the OK LED should turn on. If it doesn't, remove power and recheck your wiring.

Create a New Project

If necessary, create a new project in your RSLogix software for this system checkout and configure your processor. This step must be performed while offline. Unfortunately, it's beyond the scope of this manual to give details on how to create a new project and configure Rockwell Automation hardware. If your RSLogix software is new to you, refer to Rockwell Automation literature for assistance.

Configure the 1241's Slot

You have to configure the 1241's slot by specifying the data type and connection parameters used by the module. Step 2 of Chapter 7, ***RSLOGIX 5000 CONFIGURATION***, which starts on page 41, describes how to do this in RSLogix 5000 Version 10. The instructions are straight forward so there's no need to take up space by repeating them here.

Add a Message Instruction Controller Tag

The 1241 transmits its position, tachometer, and status data to the processor through the input data words assigned to the slot. However, it doesn't use the output data words to accept programming data. This data is sent to the 1241 with *Message Instructions* in your ladder logic. If you're not familiar with the Message Instruction, refer to your Rockwell Automation literature.

Each Message Instruction requires a controller tag. The 1241 can use up to three different Message Instructions, one to program the module, one to preset the position value, and one to clear transducer faults. For this system check we'll only be using one.

1) If the *Controller Tags* window is not already open in your RSLogix software, click on 'Logic' in the menu bar and then click on 'Edit Tags...' If the window is already open, you may need to click on the **Edit Tags** tab at the bottom of the window.
2) At the bottom of the controller tags table is a blank row marked by an asterisk (*). In this row, enter the name for your new message controller tag as 'amci1241_presetcmd' in the Tag Name column. Any name can be used, but it must begin with a letter.
3) After you press the **Enter** key, the program assumes a controller tag type of *Integer* and jumps to a new controller tag name field. You must set the tag type to *Message*. With your mouse, move the cursor to the 'Type' column of the message controller tag you are creating. When the field gets the program focus, you will see an ellipsis "**...**" button appear. Press this button.
4) In the window that opens, scroll through the list and select *Message*. Click on **OK** to close the window.

Add a Message Instruction Data Tag

In addition to the Message Instruction controller tag you defined above, you must also define the tag that contain the data to be sent to the 1241. It's defined in the same way as the four steps above with these exceptions:

- Set the tag's name to 'amci1241_presetdata'
- Data Type is Integer
- Set the length to '1'. This value is entered in the 'Dim 0' box.

Once the tag is created, set its value to '1'

Create a "send" Tag

The tags you created in the previous two steps are for an *Apply Preset* command. You also have to create a data tag to trigger the Message Instruction in the ladder logic you'll enter below. Creating the tag is the same four step process as the last two sections.

- Set the tag's name to 'send'
- Data Type is Integer
- Set the length to '1'. This value is entered in the 'Dim 0' box.

Once the tag is created, leave it at its default value of zero.

Add Ladder Logic

Add the following two rungs of ladder logic to the "MainRoutine" of the project.

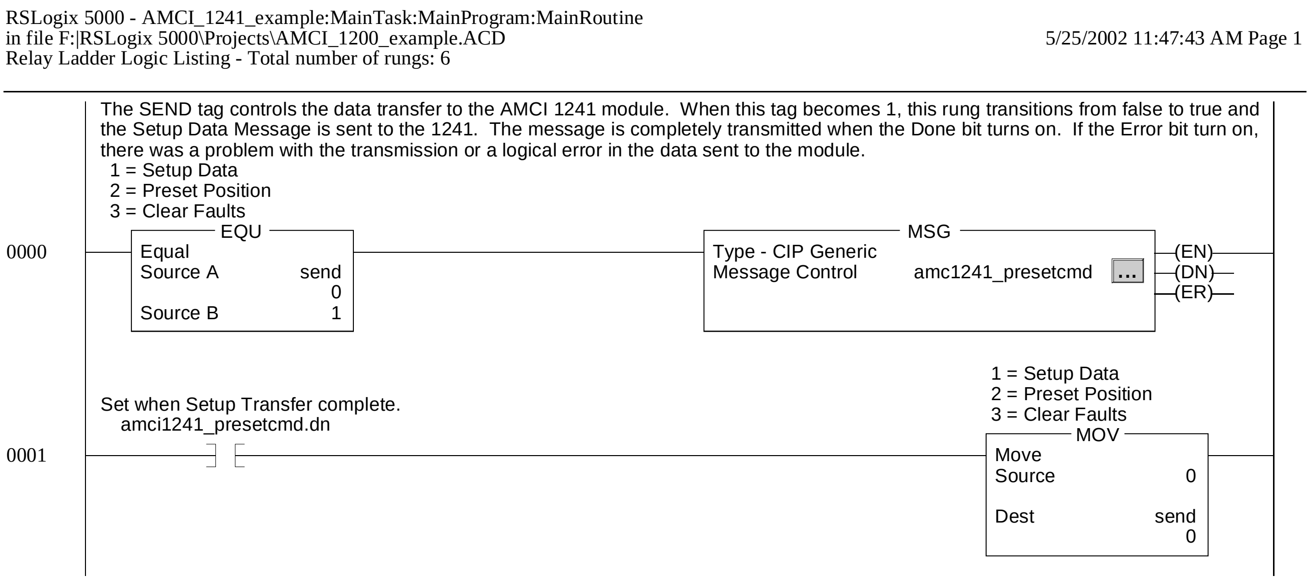


Figure 3.3 System Checkout Ladder Logic

NOTE The Message Instruction only transmits data when the rung makes a 0→1 transition. Therefore you must add some type of input condition to the Message Instruction rung.

If you are using the *Language Element* toolbar to enter the Message Instruction, the Message icon is under the Input/Output tab. If you are entering instructions in the text bar that appears when you double click the rung, the mnemonic is MSG. If you enter the instruction this way, you can also enter the name of the message controller tag which is "amci1241_presetcmd" in this example.

Before you can use the Message Instruction, you must configure it by clicking on the ellipsis "..." button. Once you click on the ellipsis button, enter the following data in the Configuration tab of the window that appears.

- **Service Type:** Custom
- **Service Code:** 4C
- **Class:** 4
- **Instance:** 204
- **Attribute:** 0
- **Source Element:** amci1241_presetdata.
- **Source Length:** 2
- **Destination:** *Leave Blank*

Add Ladder Logic (continued)

Click on the *Communications* tab in the Message Configuration window and set the path parameter to point to the 1241 module. All of the remaining parameters, including everything under the *Tag* tab, can be left at their defaults. Click **OK** to close the window.

Download the Program and Switch to Run Mode

It's beyond the scope of this manual to tell you how to accomplish this in the RSLogix 5000 software. If you need help downloading the program refer to your Rockwell Automation documentation.

Monitor Your Data Values

Once the system is up and running, view the data in the *Local:X.I.Data[Y]* tags, where 'X' is the slot number of the 1241 and 'Y' is the data word number. The data values should be as follows:

Data Word	Value	Description
[0]	16#0000_3000	Status Bits: Velocity at Zero and Brake Input Status bits are on.
[1]	254-258	Position Data: Values given assume the transducer connection is faked.
[2]	0	Tachometer Data
[3]	0	Circular Offset Data
[4]	0	Stop Time Data
[5]	0	Brake Applied Position Data

Table 3.1 Data Values Before Preset

Preset the Data Value

Change the value of the 'send' integer tag to one. This will trigger the Message Instruction to the 1241. Note that this tag resets itself in one or two scans when the Message Instruction completes.

Now look at the *Local:X.I.Data[Y]* tags. The values should be similar to what's below. (The tags that haven't change their value from the table above are omitted.)

Data Word	Value	Description
[0]	16#0000_B000	Status Bits: Acknowledge, Velocity at Zero, and Brake Input Status bits are on.
[1]	0	Position Data: The position has been preset to zero.
[3]	767-770	Circular Offset Data

Table 3.2 Data Values After Preset

What's Going On

The Message Instruction is configured to send down the *Apply Preset* command to the 1241. This is done by setting the instruction's instance to 204, its length to 2 bytes, and its data tag to a value of 1.

When you power up a 1241 with its factory default settings, its number of counts per turn, which we call the *Full Scale Count*, is set to 1,024. With the transducer faked, the module thinks that the position is set to 90 degrees, which translates to count 256. With the input wiring faked, the analog inputs are slightly over driven, so the module displays a count between 254 and 258.

When you enable the Message Instruction, the position data is set to zero by the 1241 . This is accomplished by changing the *Circular Offset* parameter. The Acknowledge Bit, which is bit 15 of I.Data[0], also changes state, and it does this every time you write a command to the module. For example, if you enable the Message Instruction again by setting the 'send' tag to one, the only change you will see in the module is that the Acknowledge bit becomes zero. The writer recognizes that all of the terms introduced in the last two paragraphs can be a little confusing, but they're all fully described in the following chapter.

CHAPTER 4
SPECIFICATIONS

This chapter contains the full specifications of the 1241. Included in it are mechanical, electrical, and environmental specifications of the unit as well as descriptions of the programmable parameters, their defaults and range of values. This chapter concludes with the specifications of other equipment used with the 1241 such as AMCI transducers and cabling.

Module Location

Any ControlLogix module slot. Occupies a single slot.

Module Type

Generic 1756 Module

Registers Used (32 bit DINT words)

	Instance	Qty
Input	100	6
Output	195	1
Config	1	0

All backplane programming from processor to 1241 is accomplished with RSLogix's *Message Instruction*

Data Available to Processor

Transducer Position, Velocity and Fault Diagnostic data

Stop Time and Brake Applied Position available when using Stop Time Monitor.

Min Rate Packet Interval (RPI) Time

400 microseconds. Can be set to higher values.

Position Transducer

Default of AMCI brushless resolver transducer

Transducer Input Isolation

1500 Vac through isolation transformers

Position Resolution

Programmable to 1 part in 8,192

Position Update Time

200 microseconds

Tachometer Resolution and Range

1 RPM over 0 to 5,000 RPM range

Stop Time Monitor

On board timer measures the time between the on→off transition of the module's DC Brake Input and the transducer rotation stopping.

Most commonly used in press applications to collect data to determine brake functionality, the module measures a stopping time of 34 milliseconds to 65.410 seconds with 1 millisecond resolution.

Programmable Parameters

Full Scale Count (counts per turn)
Preset Value
Count Direction
Circular Offset
Linear Offset
Tachometer Update Time
Transducer Fault Latch
Transducer Type
COS Interrupt Enable

Program Storage

EEPROM Memory
Minimum 100,000 write cycles

Brake Input

10 to 30 Vdc isolated input. Requires 10 mA minimum to operate.

DC Supply Voltage from Backplane

Serial #: 77364 and above:

0.540A max. @ 5Vdc

Serial #: Below 77364

0.250A max. @ 5Vdc nominal
0.065A max. @ 24Vdc nominal
0.250A max. @ 24Vdc under short circuit conditions

Environmental Conditions

Operating Temperature: 0 to 60° C
Relative Humidity: 5 to 95% (w/o condensation)
Storage Temperature: -40 to 85°

Functionality Overview

The functionality of the 1241 is fairly easy to outline.

1) **The 1241 supplies position and velocity feedback from a rotating shaft to a ControlLogix processor.**
   - The position sensor is an AMCI brushless resolver.
   - The position value is absolute, re-calculated every 200 microseconds, and is in no way dependent on the previous value.
     - If the shaft is rotated while power is removed from the 1241, the 1241 will be able to correctly determine the position of the shaft when power is re-applied.
     - If a position value is incorrectly calculated due to a transient condition such as electrical noise, future position values will be correct once the transient condition ends.

2) **The position value can be scaled to any value between 2 and 8,192 counts per turn.**
   - A scaling of 360 implies one count per degree of transducer shaft rotation.

3) **The 1241 contains multiple parameters that allow you offset the position value.**
   - These eliminate the need to mechanically align the transducer's shaft with the machine's shaft.

4) **The 1241 contains a Count Direction parameter that allows you to program the direction of rotation needed to increase position values.**
5) **The velocity value is calculated as a change in position over time. This time can be set to 32 or 120 milliseconds. The velocity value is always scaled to revolutions per minute (RPM).**

6) **The 1241 has a Brake Input that can be used to monitor the stopping time of the transducer shaft.**
   - This feature is typically used in press applications, but is applicably to any system that must monitor the stopping time of a load such as an overhead crane, mining cart, or an indexing table.
   - The DC input triggers a brake measurement cycle when it makes an on→off transition.
   - The time from the deactivation of the input until the transducer motion stops is measured with one millisecond resolution.
   - The position value where the input deactivated and the stopping time are reported to the processor.
     - The stop time monitor is a monitoring feature only. Any determination of the correct operation of the press brake must be made by the system PLC through a user developed ladder logic program.

Stop Time Monitoring

Figure 4.1 shows how the stop time is measured.

> The stop time monitor is a monitoring feature only. Any determination of the correct operation of the brake must be made by the system PLC through a user developed ladder logic program.

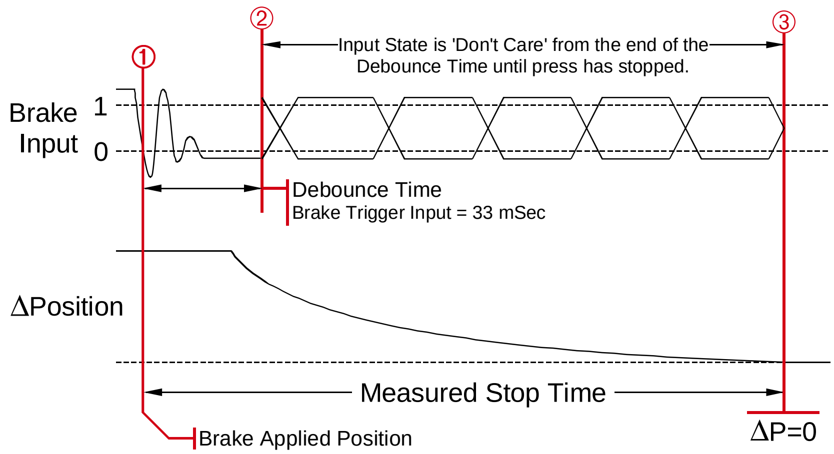


Figure 4.1 Stop Time Measurement

1) The 1241 captures the Brake Applied Position and starts the Stop Time Timer when the Brake Input makes a 1→0 (on→off) transition. The Brake Applied Position is not immediately placed in the input data. It is updated, along with the Stop Time, when the brake cycle completes.
    a) If the Brake Input returns to its normal state for sixteen milliseconds in the next thirty-four, the input transition is considered noise and the brake cycle is aborted. The next transition on the Brake Input starts another brake cycle.
    b) If the Brake Trigger Input is not in its active state for twelve of the last sixteen milliseconds of the thirty-four millisecond debounce time, the input transition is considered noise and the brake cycle is aborted. If the input is in its active state at the end of the thirty-four milliseconds, the brake cycle will begin again immediately. If the input is in its normal state, the brake cycle will start on the next transition.
2) Once the debounce time is exceeded, the state of the brake trigger is ignored until the brake cycle is complete. From this point on, the Stop Time timer runs until the transducer position stops changing. The 'ΔPosition' section of the diagram shows the press coming to a stop.
3) The Stop Time timer stops when the change in position value equals zero. The transducer is considered stopped when there is less than 1/1,024th of a rotation made in 125 milliseconds. This translates into less than one turn every 2.1 minutes. Obviously, it takes 125 milliseconds to determine that the position has not changed for that amount of time. Therefore, the Stop Time timer runs until the transducer does not move for 125 milliseconds, and it then subtracts 125 milliseconds from the Stop Time value.

Hardware Specifications

Status LED's

The two Status LED's on the front panel allow you to quickly verify the operating status of the module. The OK LED tells you the status of the backplane communication. (It's actually controlled by the A-B interface IC.) The STATUS LED give you information on the working state of the module itself.

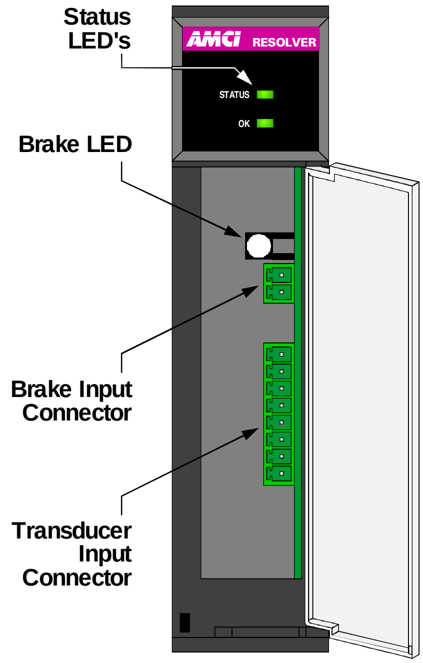


Figure 4.2 Front Panel Layout

- **OK LED:** *Solid Green* – Module owned, two-way communication.
  Blinking Green – PLC is in Program Mode or one-way communication. Module only sending data to the PLC.
  Blinking Red – No communication between module and PLC.
- **STATUS LED:** *Solid Green* – Module and transducer are OK.
  Blinking Green – Clearable transducer fault
  Blinking Red – Non-clearable transducer fault
  Solid Red – Module fault, such as no reference voltage

Any problem with the module will cause the STATUS LED to turn on red. A problem with the transducer is indicated by blinking the LED. When it blinks green, the transducer signals were temporarily lost but the transducer is now working. This is most commonly caused by a loose connection or a burst of electrical noise. If the LED blinks red, the transducer is not sending back correct signals to the module.

The most common causes of a non-clearable transducer fault are:

- Broken transducer cable
- Non-compatible transducer
- Improper wiring of the transducer cable
- Improper transducer cable installation
- Faulty transducer
- Faulty module

Transducer Input Connector

Figure 4.3 shows the pinont of the Transducer Input Connector. The mating connector, AMCI part number MS-8P is not shown, but is included with the module. The figure also shows the resolver signals. Cabling specifications are given later in this chapter in the ***Transducer Cable Specification*** section starting on page 28. Wiring diagrams are given there and in ***Transducer Cable Installation*** section of chapter 6 starting on page 37.

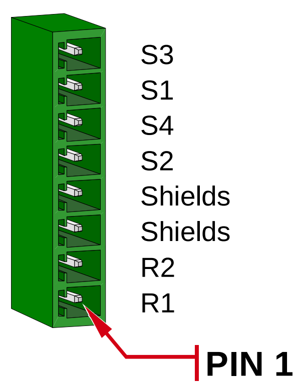


Figure 4.3 Transducer Input Connector

- R1/R2 – Reference Winding (Rotor)
- S1/S3 – COS Winding (Stator)
- S2/S4 – SIN Winding (Stator)

The mating connector is made by Phoenix Contact. Their part number is MC1,5/8-ST-3,81, with an order number of 1803633.

Hardware Specifications (continued)

Brake Input Connector

As shown in figure 4.2 on the previous page, directly above the Transducer Input Connector is the two pin Brake Input Connector and its indicator LED. This input is used to trigger a stop time monitoring cycle that begins when the input transitions from on to off and ends when the transducer stops rotating.

The mating connector, AMCI part number MS-2P is not shown, but it is included with the module. The connector is made by Phoenix Contact. Its part number is MC1,5/2-ST-3,81, with an order number of 1803578.

This 24Vdc input is on when the input voltage is between 10 and 30Vdc @ 5mA. Either pin can be used as the common and the input can be wired as a sinking or sourcing input. Pin 1 is the bottom pin when the connector is installed. When +24 volts is applied to pin 1 relative to pin 2, the indicator LED turns on green. When +24 volts is applied to pin 2 relative to pin 1, the indicator LED comes on red. The figure below shows one way to wire to the Brake Input Connector. .

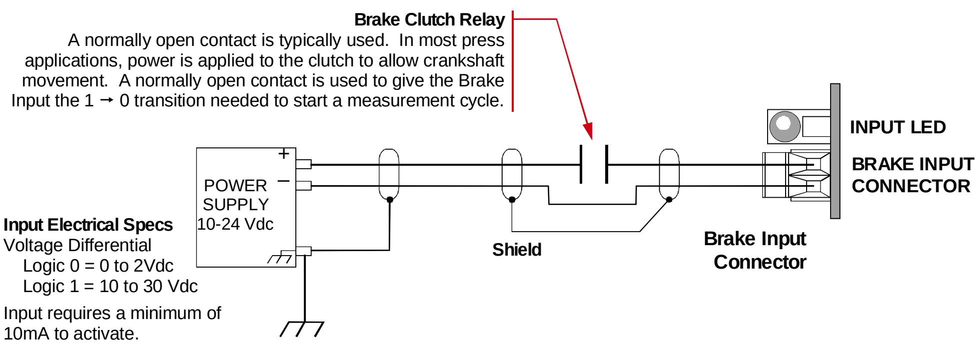


Figure 4.4 Brake Input Wiring

Module Parameters

Full Scale Count

The Full Scale Count specifies the number of counts generated by the 1241. For single-turn transducers, such as the HT-20's and H25's, this is the number of counts generated per turn. In the case of our multi-turn transducers, such as the HT-20-(x) family, this is the number of counts generated over the transducer's number of turns. (For example, an HT-20-20 with a Full Scale Count of 1,000 would generate 1,000 counts over 20 turns. This equals 1,000/20 = 50 counts per turn.)

- The default Full Scale Count is 1,024.
- Range is 2 to 8,192. Setting the Full Scale Count to 360 gives 1 degree resolution.

Circular Offset

The Circular Offset lets you change the position count without rotating the transducer shaft. This offset is most commonly used to force the position to the correct count after the machine has been mechanically aligned.

- The Circular Offset's default value is zero.
- The Circular Offset can be programmed from zero to (Full Scale Count -1).

NOTE The Preset Value parameter is directly related to the Circular Offset. Applying the Preset Value is accomplished by recalculating the Circular Offset. For more information on the Preset Value parameter, see its section below.

Module Parameters (continued)

Linear Offset

The Linear Offset parameter changes the *range* of count values output by the unit 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.

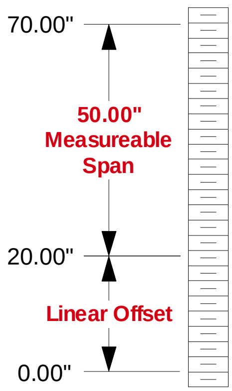


Figure 4.5 Linear Offset Example

For example, a 1241 is used to measure a 50.00 inch span with 0.01 inch resolution. Therefore, the total number of counts over the full travel is: 50.00 inches / 0.01 inches/ count = 5000 counts. The Full Scale Count parameter is then set to this value.

The 50 inches measured by the 1241 is in the range of 20.00 to 70.00 inches on the machine. You can use the Linear Offset to force the 1241 to send the position data to the processor in the correct format instead of using the processor to add an offset once the position value is in the data tag. The formula for the Linear Offset is:

Minimum Desired Value	*	**Resolution**	=	**Linear Offset**
20.00 inches	*	**100 counts/inch**	=	**2000 counts**

- The default Linear Offset is zero.
- The Linear Offset's range is 0 to (32,768 – Full Scale Count).

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).

NOTE 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 range of the Preset Value 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). If you program a Linear Offset and leave the Preset Value at zero, the 1241 will respond with an error.

COS Interrupt Enable

The COS (Change of State) Interrupt Enable parameter allows the 1241 to interrupt the processor whenever the position value changes. The processor should respond by reading the module's data. These readings are in addition to the readings at the programmed Rate Packet Interval (RPI) Time. This is commonly used in programmable limit switch applications when the limits are being generated by the PLC.

NOTE Even though you will decrease the update time of the 1241, you will increase your overall scan time because the processor is forced to service the interrupts. In fact, do not enable this parameter if you are running at a high speed and/or high resolution. For example, setting the Scale Factor to 1000 and running the machine at 200 RPM will cause the 1241 to raise an COS interrupt every 300 microseconds.

Count Direction

This parameter sets the direction of transducer shaft rotation that increases the position count. *If the transducer is wired as specified in this manual* and the count direction is set to *positive*, the 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 default Count Direction Value is *positive*.

NOTE It is also possible to reverse the count direction by reversing wire pairs in the transducer cable. Once the machine is setup, you can easily change this parameter if the position is increasing in the wrong direction.

Module Parameters (continued)

Tachometer Response

This parameter sets the time between tachometer updates. It *only* affects the update time of the tachometer. It *does not* affect the update time of the position value, which is always 200 microseconds.

- The default Tachometer Response is 120 milliseconds.
- The Tachometer Response can be set to 120 or 32 milliseconds.

Transducer Fault Latch

Transducer faults can be caused by improper wiring, electrical noise, or a damaged transducer. When the module detects a transducer fault, it sets an error flag in the data it transmits over the backplane. By default, the 1241 clears the fault message as soon as a working transducer is properly attached. It's possible to latch transducer faults, which forces the 1241 to send the error flag until a *Clear Errors* command is received from the processor.

If you have a situation where electrical noise is causing spurious transducer faults that you can safely ignore, you can leave the Transducer Fault Latch disabled and force the 1241 to clear faults as soon as possible. Note that an intermittent wiring problem may also cause spurious faults. If you want to reliably capture these transient faults, then you must enable the Transducer Fault Latch because the 1241 can detect and clear transducer faults much faster than the processor scans the module.

- The default Transducer Fault Latch value is *disabled.*

Resolver Type

The Resolver Type parameter makes most Autotech Controls single turn transducers compatible with the 1241 module.

- The Resolver Type default value is *AMCI*.

Parameter Defaults and Ranges

Parameter	Range	Default
Full Scale Count	2 to 8,192 inclusive	1,024
Circular Offset	0 to (*Full Scale Count* – 1)	0
Linear Offset	0 to (*32,768 – Full Scale Count*)	0
Preset Value	(*Linear Offset*) to (*Linear Offset* + (*Full Scale Count*–1)) **When the Linear Offset equals zero:** 0 to (*Full Scale Count* – 1)	0
COS Interrupt Enable	Disabled / Enabled	Disabled
Count Direction	Positive / Negative	Positive
Tachometer Response	120 or 32 milliseconds	120 milliseconds
Transducer Fault Latch	Disabled / Enabled	Disabled
Resolver Type	AMCI / Autotech	AMCI

Table 4.1 Factory Defaults and Ranges

RSLogix Message Instruction

Message Instructions are used to program setup data, apply a preset value, and clear a transducer fault. The function performed by the instruction is determined by the *Instance* value you specify when entering the instruction in your ladder logic.

This section only gives the specifications on the data you need to enter in the instruction. Complete information on entering the data can be found in chapter 7, ***RSLOGIX 5000 CONFIGURATION***, starting on page 41.

1) The *USER_DEFINED_TAG* for the Message Instruction Control must have the MESSAGE data type.
2) The *USER_DEFINED_TAG* error bit is set when there is a problem with the setup of the instruction or the data sent to the 1241. If the problem is with the data, *USER_DEFINED_TAG.ERR* equals "9" and the type of error is *USER_DEFINED_TAG.EXERR*.
3) In the message configuration window, enter the following data under the *Configuration* tab.

Service Type: Custom
Source Element: The name of the tag that contains the data to be sent to the 1241.
Service Code: 4C
Class: 4
Attribute: 0
Instance and Source Length:

Programming Data	Instance	Source Length
Setup Data	200	10
Apply Preset	204	2
Clear Transducer Fault	205	2

'Setup Data' Message Format

Setup Data programs the 1241's parameters and is sent with an RSLogix 5000 Message Instruction, not through the single 32 bit DINT output word assigned to the module.

The information presented here is not explained in detail. A complete format description be found in the ***Setup Data Message Format*** section of chapter 8, starting on page 46.

SETUP DATA WORDS
Instance = 200, Source Length = 10

	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	RType	0	0	0	0	TFLtch	VelUdT	CntDir	COS

Word	Contents	Range
Word 1	Full Scale Count	2 to 8,192. Default of 1,024
Word 2	Preset Value	Linear Offset to (Linear Offset + (Full Scale Count – 1))
Word 3	Circular Offset	0 to (Full Scale Count – 1)
Word 4	Linear Offset	0 to (32,768 – Full Scale Count)

Figure 4.6 Setup Data Format

COS – **Word 0, Bit 0:** Change Of State Interrupt Enable 0 = Disabled

CntDir – **Word 0, Bit 1:** Count Direction 0 = Positive (CW)

VELUdT – **Word 0, Bit 2:** Velocity Update Time 0 = 120 milliseconds

TFLtch – **Word 0, Bit 3:** Transducer Fault Latch 0 = Disabled

RType – **Word 0, Bit 8:** Resolver Type 0 = AMCI

'Apply Preset' Message Format

This programming block applies the Preset Value programmed with the Setup Data programming block, causing the Position value to become equal to the programmed Preset Value. This block is also sent with an RSLogix 5000 Message Instruction, not through the single 32 bit DINT output word assigned to the module.

The information presented here is not explained in detail. A complete format description can be found in the ***Apply Preset Message Format*** section of chapter 8, starting on page 47.

APPLY PRESET

Instance = 204, Source Length = 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	0	0	0	AplyPV

Figure 4.7 Apply Preset Format

AplyPST - Word 0, Bit 0: Apply Preset Value - This bit must be set when transmitting this message. Therefore, the value of the word must equal 1.

'Clear Transducer Fault' Message Format

This programming block clears a latched transducer fault. This block is also sent with an RSLogix 5000 Message Instruction, not through the single 32 bit DINT output word assigned to the module.

The data word is not used with this command. Therefore, the state of the bits is "Don't Care" and can be set to either zero or one. The module reads the Instance value of the command and clears the transducer fault if possible.

CLEAR TRANSDUCER FAULT

Instance = 205, Source Length = 2

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Word 0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0

Figure 4.8 Clear Transducer Fault Format

Message Instruction Error Codes

The *USER_DEFINED_TAG* error bit is set when there is a problem with the setup of the instruction or the data sent to the 1241. If the problem is with the data, *USER_DEFINED_TAG.ERR* equals "9" and the type of error is *USR_DEFINED_TAG.EXERR*.

EXERR:	ERROR DESCRIPTION
1	1) Any reserved bits are set to '1' 2) Sending the "Apply Preset Value" message without bit 0 being set. 3) Sending the "Apply Preset Value" message while there is a transducer fault.
2	Full Scale Count out of its range
3	Preset Value out of its range
4	Circular Offset out of its range
5	Linear Offset out of its range

Input Data Format

Input data is produced by the 1241 and is consumed by the processor. Note that all data is transmitted with 32 bit double integer (DINT) words. The information presented here is not explained in detail. A complete format description can be found in the ***Input Data*** section of chapter 8, starting on page 45.

INPUT DATA WORDS

	31 – 16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
I.Data[0]	RESERVED Set to Zero	ACK	0	Vel@0	BrakeIn	0	0	0	0	0	0	0	0	0	0	TransFlt	ModErr

I.Data[1]	Position Data	0 to (Full Scale Count – 1)† 0 to 8,191 max.†
I.Data[2]	Tachometer Data	0 to 5,000 max.
I.Data[3]	Circular Offset	0 to (Full Scale Count – 1) 0 to 8,191 max.
I.Data[4]	Stop Time	34 to 65,410 milliseconds
I.Data[5]	Brake Applied Position	0 to (Full Scale Count – 1) 0 to 8,191 max.

† Assuming a Linear Offset of zero. When the Linear Offset value is not zero, the Position Data will range from Linear Offset to (Linear Offset + (Full Scale Count - 1)) In this case, the maximum position value is 32,767.

Figure 4.9 Input Data Words

ModErr - Word 0, Bit 0: Module Error

TransFlt - Word 0, Bit 1: Transducer Fault

BrakeIn - Word 0, Bit 12: Brake Input State. Set to '1' when Brake Input is active. (Brake is active when it is *not* receiving power.)

Vel@0 - Word 0, Bit 13: Velocity at Zero.

ACK - Word 0, Bit 15: Acknowledge Bit. Set when a new message is received via a Message Instruction.

> The remainder of this chapter gives the specification of equipment that should be used with the 1241. This includes specifications on transducer cabling, transducers, and resolvers.

Transducer Cable Specification

The cable specified for use with the 1241 depends on the total length of the run.

- For runs under 100 feet (30 meters), AMCI specifies Belden 9873 or an exact equivalent. Quabbin 6155 is an acceptable alternative.
- For runs over 100 feet, AMCI specifies Belden 9730 or an exact equivalent. Quabbin 8606 is an acceptable alterative. These cables can be used for runs under 100 feet.

NOTE

1) "Total length of run" refers to the distance from the transducer to the 1241. If you have four 26 foot lengths of cable that are spliced together to form a 104 foot total run, then each 26 foot cable must be Belden 9730 or equivalent.

2) The important characteristic when determining an acceptable equivalent is the capacitance between conductors. Belden 9873 has a conductor–conductor capacitance of 30 pf/ft. Belden 9730 has a conductor–conductor capacitance of 12.5 pf/ft.

CTL-(x) Specifications

If you order a CTL-(x) cable from AMCI that is less than 100 feet long, we ship a cable that is made from Belden 9873 or equivalent. If you order a CTL-(x) that is over 100 feet, we ship a cable made from Belden 9730 or equivalent.

One end of the CTL-(x) has a Bendix MS connector that mates with all AMCI single turn transducers that have a connector†. The other end is pigtailed at the factory for easy connection to the MS-8P connector included with the 1241. The following is a wiring diagram from a CTL to the 1241's MS-8P.

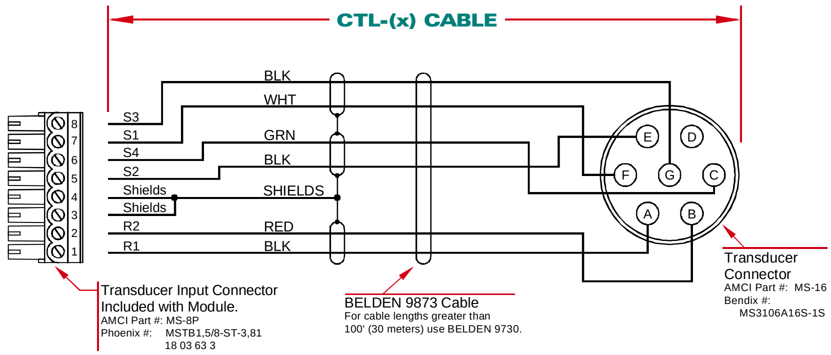


Figure 4.10 CTL-(x) Wiring Diagram

† HT-20C and HT-400 transducer are designed for conduit connections and do not have Bendix MS connectors. The H25-FL and H25-SL have integral cables instead of connectors. For these transducers, you can order bulk cable from AMCI.

CTLR-(x) Specifications

CTLR-(x) cable is used with an HTT-20-1 transducer. The HTT-20-1 has two independent resolvers in one transducer package for applications that require redundant control systems. If you order a CTLR-(x) cable from AMCI that is less than 100 feet long, we ship a cable that is made from Belden 9873 or equivalent. If you order a CTL-(x) that is over 100 feet, we ship a cable made from Belden 9730 or equivalent.

One end of the CTLR-(x) has a Bendix MS connector that mates with the HTT-20-1 transducer†. The other ends are pigtailed at the factory for easy connection to the MS-8P connector included with the 1241 or the MS-8 connector used by most other AMCI modules. The following is a wiring diagram from a CTLR to the 1241's MS-8P connectors.

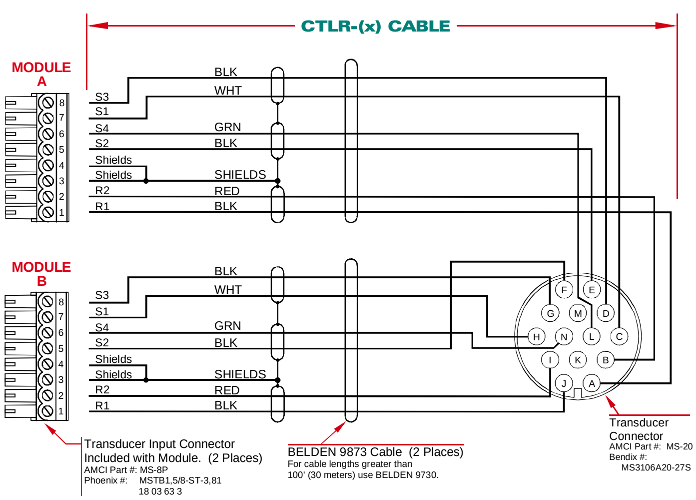


Figure 4.11 CTLR-(x) Wiring Diagram

† The HTT-400-1 redundant resolver transducer has two separate connectors for the resolvers. For this transducer, order two CTL-(x) cables.

Transducer Specifications

The following table contains mechanical and environmental specifications for all of AMCI's single-resolver transducers that are compatible with the 1241. Table 1.1, ***Compatible Transducers*** found on page 9 gives complete part numbers and descriptions of all compatible transducers.

Specification	All HT-20's	All HT-20-(x), HT-400, HTT-20-1, & HTT-400-1	All H25's	HT-6	All R11's
Shaft Diameter	0.625"	0.625"	0.375"	0.188"	0.120" or 0.188"
Radial Shaft Loading	400 lbs. max.	400 lbs. max.	40 lbs. max.	8 lbs. max.	2 lbs. max.
Axial Shaft Loading	200 lbs. max.	200 lbs. max.	20 lbs. max.	4 lbs. max.	1 lb. max.
Starting Torque	8oz.-in@25°C	8oz.-in@25°C	1.5oz.-in@25°C	0.5oz.-in@25°C	0.1oz.-in@25°C
Moment of Inertia (oz.-in-sec.^{2})	$6.25 X 10^{-4}$	$8.75 X 10^{-4}$	$6.00 X 10^{-4}$	$2.10 X 10^{-4}$	$0.51 X 10^{-4}$
Weight	4 lbs.	4 lbs.	1 lb.	0.7 lb.	0.25 lb.
Enclosure	NEMA 4 or 4X	NEMA 4	NEMA 4	NEMA 13	NEMA 1

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 4.2 Single-Turn Transducer Specifications

Outline drawings of our transducers, and full spec sheets for our most popular models, are available on our website, *www.amci.com*. If you do not have internet access, contact AMCI and we'll fax you the information.

Transducer Connector Pinout

Figure 4.12 shows the connector pinout and internal resolver colors for all AMCI single transducers that have connectors. Note that some AMCI transducers have integral cables or conduit connections. For a complete listing of AMCI transducers without connectors, refer to Table 1.1, ***Compatible Transducers*** on page 9.

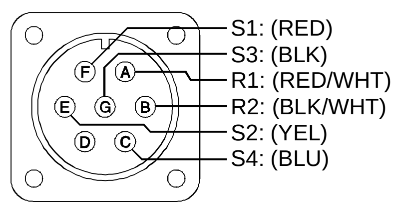


Figure 4.12 Transducer Connector Pinout

CHAPTER 5
GENERAL INSTALLATION GUIDELINES

This chapter gives general information on installing electronic controls in an industrial environment including the importance of proper wiring, grounding, and surge suppression. If you are responsible for installing the 1241, make sure you are familiar with these practices and follow them when installing the system.

WARNING This chapter is presented as a tool in the hopes of avoiding common installation problems. It is not a substitute for the safety practices called out in local electrical codes or, in the United States, the National Electrical Code published by the National Fire Protection Association. If *any* conflicts exist, local and national codes must be followed. *It is the responsibility of the user* to determine what installation practices must be followed in order to conform to all local and national codes.

Background

AMCI has extensively tested the 1241, both in the lab and in the field, under a wide range of conditions to see how the unit reacts to an adverse environment. This includes testing the unit after intentionally installing it incorrectly. The results of our testing is the following list of areas that must be addressed when engineering your system. The order of the list shows the areas that have the largest impact on system operation first.

1) Surge Suppression
2) Grounding
3) Wiring
4) Power Supply Wattage and Filtering

This list also shows the first areas that should be investigated if your installation experiences problems.

Surge (EMI) Suppression

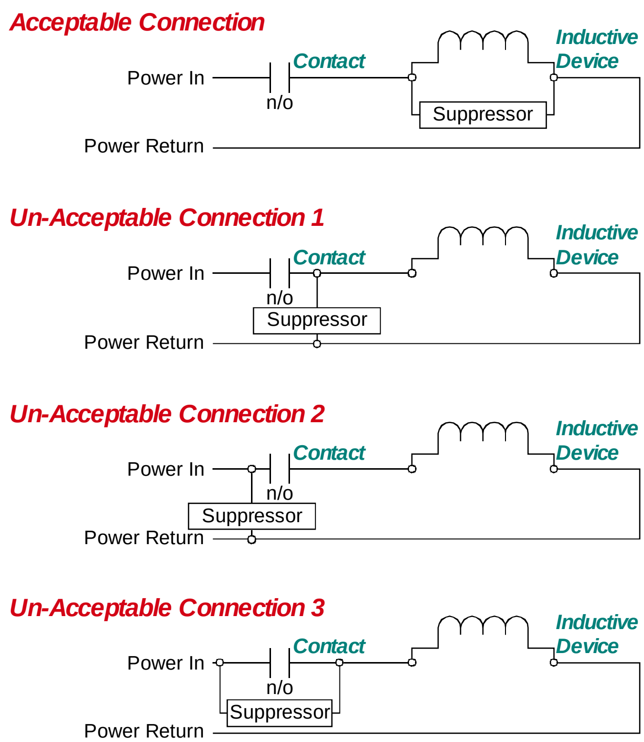
NOTE All inductive devices in the system, such as motors, motor starters, contactors, relays and solenoids, must have surge suppression devices installed across their coils.

This includes all devices that share a power supply with the ControlLogix system, have wiring in the system's enclosure, or wiring that is run in the same conduit as wiring connected to the 1241. DC loads are typically suppressed with a flyback diode, while AC loads are typically suppressed with a RC network or varistor.

➤ **RC Networks are the preferred suppressor for AC loads**

Surge (EMI) Suppression (continued)

The figure below show where surge suppression devices should be placed in the circuit.



The acceptable connection supresses noise at its source. The wiring that connects the load to the power supply and contacts will not radiate noise when the load is switched and noise will not be coupled into the power supply.

This connection protects the power supply and contact, but allows noise to radiate through the load's wiring where it can be coupled into other cables around it, including the 1241's transducer cable.

This connection protects the power supply but nothing else. Noise can radiate through the load's wiring where it can be coupled into other cables around it and the contact may eventually be damaged by high voltage inductive spikes.

This connection protects the contact but nothing else. Noise can radiate through the load's wiring where it can be coupled into other cables or into the power supply. Noise in the supply may affect any device powered by it, including the ControlLogix system. Also, if the suppressor shorts out, the load will always receive power.

Figure 5.1 Installing Surge Suppression Devices

Surge Suppression: DC Outputs

All inductive DC loads require a commutating, or “fly-back” diode across the load. Inductive DC loads include relays, solenoids, and DC motors.

Unlike resistors, diodes have a polarity and only conduct current in one direction. Therefore, care must be taken when installing diodes. As shown in the figure below, the *cathode* of the diode, which is denoted by the white or black band on one end of the diode, must be installed on the positive side of the load. If you install the diode backwards, it will most likely destroy itself as soon as you apply power to the load.

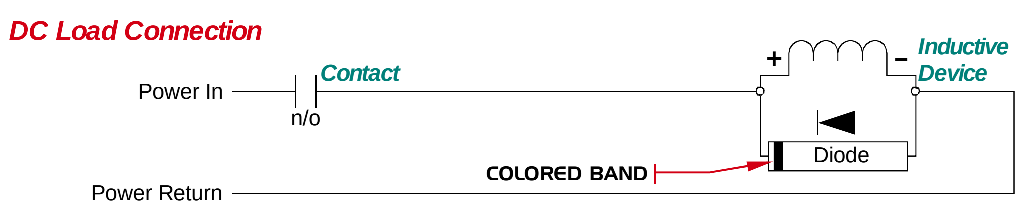


Figure 5.2 DC Output Surge Suppression

- The diode must be sized to handle the inductive surge of the load when it turns off.
- Some devices can be ordered with built in fly-back diodes, or the device manufacturer will offer suppressors designed specifically for the device. These types of devices are strongly recommended.

I/O Wiring (continued)

Surge Suppression: AC Outputs

If you are switching AC loads with hard contacts such as mechanical relays, solenoids or contactors, then you must install a suppression network on the load switched by the relay. The two most common suppressors for AC loads are varistors and R-C networks.

➤ **AMCI strongly suggests R-C networks for all AC applications.**

A varistor is a solid state device that turns on and conducts when the voltage across its terminals exceeds its rated value. Herein lies the problem with using a varistor as an AC suppressor. The voltage (problem) must be generated before the varistor responds. In our testing we have found that hard contacts will still arc when a varistor is placed across the AC load. This arcing is due to the fact that the breakdown voltage of the air between the contacts when they first open can be less than the rated voltage of the varistor. If the instantaneous AC voltage applied to the contacts is above the breakdown voltage of air, but less than the rated voltage of the varistor, the contacts will arc.

On the other hand, an R-C network acts as a low-pass filter, instantaneously dampening fast transients when they occur. The main drawback of R-C networks is that they are harder to correctly specify than varistors. Varistors only require you to specify breakdown voltage and power dissipation ratings. R-C networks require you to balance the need of suppression when the contacts open against the amount of surge current the relay can tolerate when the contacts close. Table 5.1 shows the trade-offs you must be aware of when specifying R-C networks.

	When Contacts Close	When Contacts Open
Low Resistance, High Capacitance	Higher surge current through relay contacts to charge capacitor. (Negative)	Lower transient voltage spike. (Positive)
High Resistance, Low Capacitance	Lower surge current through relay contacts to charge capacitor. (Positive)	Higher transient voltage spike. (Negative)

Table 5.1 R-C Network Trade-offs

In general, capacitor values range from 0.1 to 1.0 µF and resistor values range from 150 to 680 ohms.

The easiest way to specify a R-C network is by following the recommendations of the load's manufacturer. Most manufacturers have tested and specify standard R-C networks, and many sell networks that are designed to integrate with their products. If you cannot get help from your load's manufacturer, feel free to contact AMCI for assistance.

Grounding

Proper grounding is the single most important consideration for a safe installation. Proper grounding also ensures that unwanted electrical currents, such as those induced by electromagnetic noise, will be quickly shunted to ground instead of flowing through the machine.

AMCI strongly suggests the use of a ground bus in the enclosure that houses the 1241. As shown in figure 5.3, the ground bus becomes the central grounding point for the enclosure and its equipment. Bonding wires are run from the enclosure and each piece of equipment to the ground bus, and then a single grounding electrode conductor is run directly to the system's grounding electrode.

Each connection must be separate, so a ground bus is typically fabricated in-house or by the panel shop responsible for wiring the enclosure.

- All ground connections must be permanent and continuous to provide a low-impedance path to earth ground for induced noise currents.
- The ControlLogix chassis must be connected to earth ground through its mounting in the enclosure, and with a grounding wire connected to the grounding stud on the bottom of the ControlLogix chassis.
- Any non-isolated power supply attached to the ControlLogix system must be connected to the same earth ground as the chassis to avoid ground loops.
- All isolation transformer secondary windings that are grounded to conform to local or national codes must be grounded to the same earth ground as the machine ground.

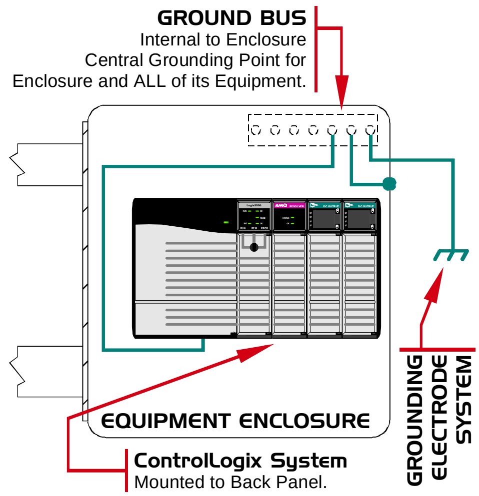


Figure 5.3 Ground Bus System

Wiring

The most important aspect of wiring is determining the amount of voltage and power carried by the cable and separating low power cabling from high power cabling. Inside of an enclosure, separate the two types of cabling with as much physical distance as possible and keep the wiring neat. Outside of the enclosure, low and high power cabling must be run in separate conduits.

- **Transducer Cabling (Low Power)**
  1) Transducer signals are of low voltage and low power. If you are using A-B guidelines for cabling installation, treat the transducer cable as a Category 2 cable. Transducer 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 shield of the cable must be grounded at the 1241 only. If you must splice the transducer cable, it must be done in a grounded junction box. When splicing, treat the shield as a signal-carrying conductor. Do not connect the shield to earth ground at the junction box or transducer. If your transducer cable has individually shielded pairs, then ideally the shields in the cable are also kept isolated from each other in the junction box as well.

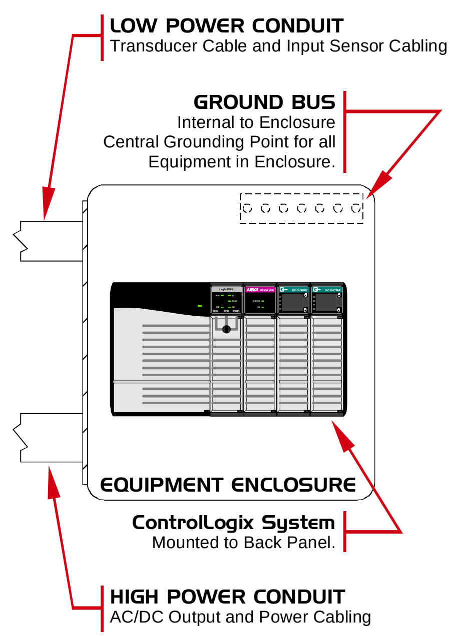


Figure 5.4 Typical Enclosure

Wiring (continued)

- **Input Cabling (Low Power DC & AC)**

1) Cabling from low power DC sensors or relays, typically tied to PLC input cards or the Brake Input of the 1241, must be shielded. Follow the two guidelines given above for Transducer Cabling. DC Input cabling and the transducer cable can be installed in the same conduit.
2) Depending on local codes, cabling from low power AC sensors or relays may or may not be installed with cabling from DC sensors. Follow the two guidelines given above for Transducer Cabling. Cabling for AC sensors, must, without exception, be shielded.

- **Output Wiring (High Power AC & DC)**

1) Output Wiring must be kept separate from the transducer and input wiring in order to lessen the possibility of coupling transient noise into the low power cabling.
2) If a conduit containing the transducer cable or input wiring must cross conduit that contains Output Wiring, they must cross at right angles.

- **Power Supply Wiring (24Vdc)**

1) If you have a separate DC supply for the ControlLogix system, then it is most likely a small one that is mounted in the enclosure with the system. In this case, AC power for the supply can be routed with output wiring. AC power should never be routed with the transducer or input cabling.
2) If you are using a system supply and it's outside the enclosure, then the supply lines should be run with the output lines if local codes permit.

- **Other Power Wiring (High Power AC & DC)**

1) Power Wiring must be kept separate from the transducer and input wiring in order to lessen the possibility of coupling transient noise into the low power cabling.
2) If a conduit containing the transducer cable or input wiring must cross conduit that contains Power Wiring, they must cross at right angles.
3) Whenever possible, conduit that contains transducer or input cabling must be kept 1 foot (30 cm) away from 120Vac conductors, 2 feet (61 cm) from 240Vac conductors, and 3 feet (91 cm) from 480+ Vac conductors.

Power Supply Wattage and Filtering

A properly sized power supply is vital to system operation. The best guideline that we can give you is to buy the best supply your budget allows.

When sizing system supplies, take into consideration the surge requirements of the components you are attaching to the supply. Most devices draw a "surge" current for a brief time when they power up. If your supply cannot accommodate these surge currents, the output voltage may momentarily drop when a device turns on, causing data errors.

The other thing to consider when choosing a supply is output filtering. The better the supply's filtering, the better it can absorb noise that may be induced into the power supply wiring.

Notes

INSTALLING THE 1241

This chapter gives installation information specific to the 1241, its transducer, and its brake input. The chapter assumes you are familiar with installing electronic controls in an industrial environment including the importance of proper wiring, grounding, and surge suppression. If you are responsible for installing the 1241, make sure you are familiar with these practices and follow them when installing the system. The previous chapter, which starts on page 31, give general guidelines you should follow when installing the 1241.

WARNING This chapter is not a substitute for the safety practices called out in local electrical codes or, in the United States, the National Electrical Code published by the National Fire Protection Association. If *any* conflicts exist, local and national codes must be followed. *It is the responsibility of the user* to determine what installation practices must be followed to conform to all local and national codes.

Installing the Module

The 1241 can be installed in any ControlLogix module slot as long as power supply requirements are met. The table below shows the current requirements of the modules. A change was made to the power requirements starting with serial number 77364, which was shipped December 20, 2002. All units shipped from AMCI after this date use the 5Vdc supply only.

Backplane Supply	Serial 77364+	Serial <77364
5Vdc	0.540A (2.70W)	0.250A (1.25W)
24Vdc (nominal)	0A	0.065A (1.56W)
24Vdc (SC† condition)	0A	0.250A (6.00W)

† SC = Short Circuit condition. This value occurs if there is a short placed across the reference voltage pins, which are pins 1 and 2 of the eight pin Transducer Input Connector.

1) Align the module's circuit board with the top and bottom card guides in the rack.
2) Gently slide the module into the rack until the top and bottom latches secure the module in place.

To remove the module, depress the top and bottom latches and slide the module out of the rack.

NOTE The ControlLogix backplane is hot-swappable, however, Rockwell Automation discovered a problem with hot-swapping modules that use the 24Vdc supply. All 1241's with a serial number of 77364 or above can be installed and removed while power is applied to the chassis. Rockwell Automation's guidelines for installing and removing modules under power must be followed to insure safe operation. If you have a module with a serial number below 77364 and you need the hot-swap capability, contact AMCI for assistance.

Transducer Cable Installation

Pre-assembled and tested CTL-(X) and CTLR-(x) cables are available from AMCI. They come with the transducer connector soldered and assembled on the cable and the module connections dressed and ready for connection to the 1241's Transducer Input Connector, which is included with the module. Cable specifica- ound under *CTL-(x) Specifications* on page 29.

NOTE

1) Resolvers are low voltage, low power 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.

2) The shields of the transducer cable must be grounded at the 1241 module only! Grounding is accomplished through the module. (The **Shield** pins on the Transducer Input Connector is brought to the ControlLogix chassis.) When installing the cable, treat the shield as a signal carrying conductor. Do not connect the shield to ground at any junction box or the transducer. This will eliminate ground loops that could damage the module or ControlLogix system.

CTL-(x) Wiring Diagram

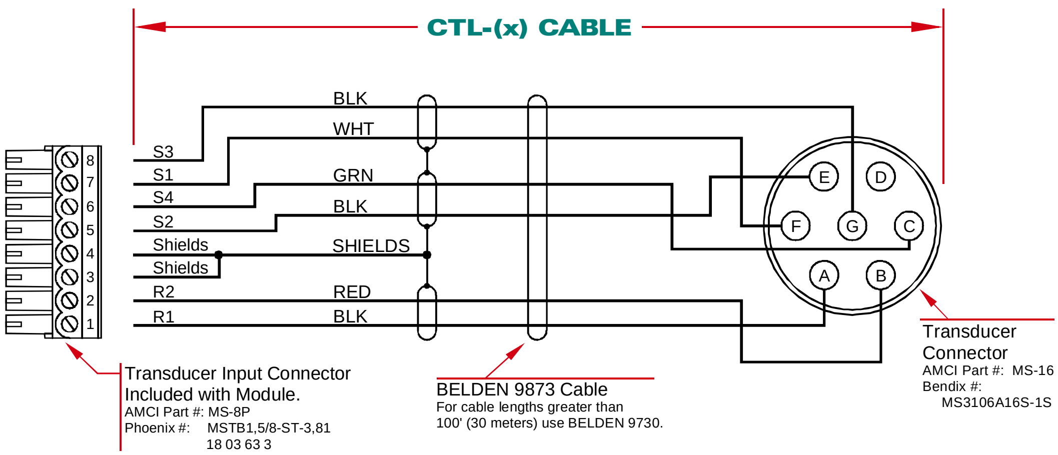


Figure 6.1 CTL-(x) Wiring Diagram

CTLR-(x) Wiring Diagram

The CTLR-(x) is used to attach a HTT-20-1 redundant transducer to two 1241 modules. The HTT-400-1 has a separate connector for each resolver and uses two standard CTL-(x) cables.

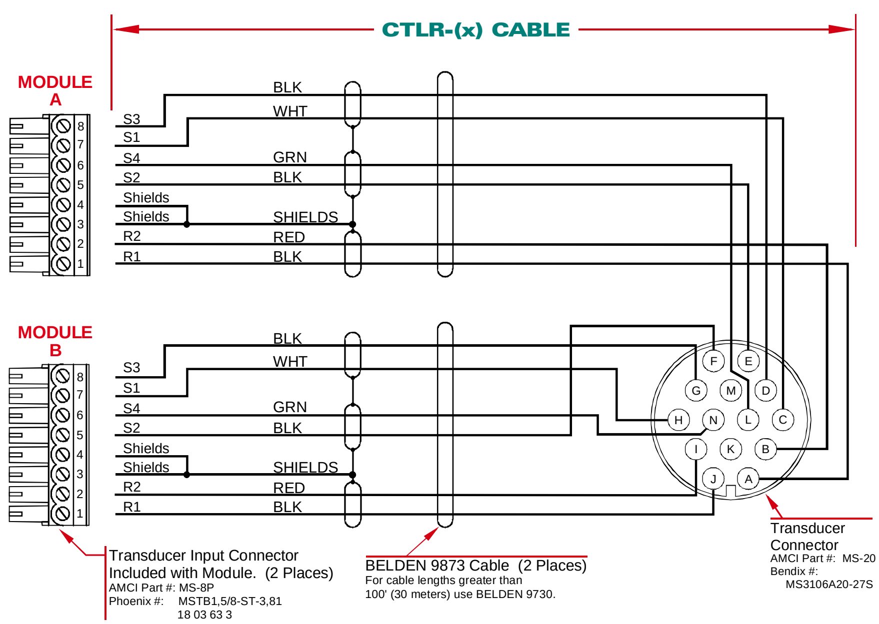


Figure 6.2 CTLR-(x) Wiring Diagram

Transducer Installation

Transducer Outline Drawings

AMCI offers a broad line of resolver based transducers for use with the 1241 module. (See ***Compatible Transducers*** on page 9.) 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.

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" & 10mm 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 6.1 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. A flexible coupler is *required* for all HT-6 transducers and R11 resolvers.

Autotech Transducers

Most single turn transducer resolvers from Autotech Controls can be made compatible with the 1241 through the use of the *Resolver Type* parameter. An AMCI RM-3 Reference module is not required. Further information on using Autotech transducer can be found in the FAQ section of our website, *www.amci.com*. The FAQ is entitled "*Can I Use Transducer From Other Manufacturers With AMCI Controllers?*".

Brake Input Wiring

If you are using the 1241 in a press control application, or any application that requires you to measure the stopping time of a load once a brake is applied, you can use the stop time monitor of the unit. See ***Stop Time Monitoring*** on page 21 for information on how the stop time monitor works. If your application does not have this requirement, you can disable the stop time monitor by not wiring the Brake Input.

Input Connector

Figure 6.3 shows a simplified schematic of the Brake Input. Note that the input requires 10 - 30 Vdc at 10 mA to operate. The circuit is completely isolated, so it can be wired as a sinking or sourcing input as shown in figure 6.4 on the following page.

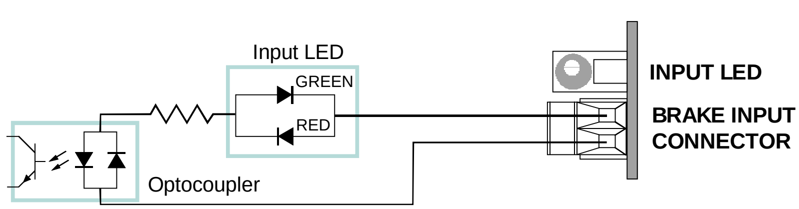


Figure 6.3 Brake Input Schematic

Brake Input Wiring (continued)

Connector Wiring

Figure 6.4 below is an example of how to wire the Brake Input. The figure assumes that a relay is used to trigger it. A normally open contact is shown because an on-to-off (1 → 0) transition is needed to trigger the stop time monitoring cycle. In typical press control configurations, power must be applied to the brake clutch before the crankshaft can rotate. In this case, the normally open contact is closed and power is applied to the input. When power is removed from the clutch to apply the brake, the contact opens and the unit sees the on-to-off transition needed to start the stop time monitoring cycle.

NOTE Shielded cable should be used to help with signal noise immunity. Treat the shield as a signal carrying conductor and ground it only at the power supply *or* the 1241. Do not ground the shield at any junction box or at both the power supply and unit. This will help eliminate potential ground loops in your system.

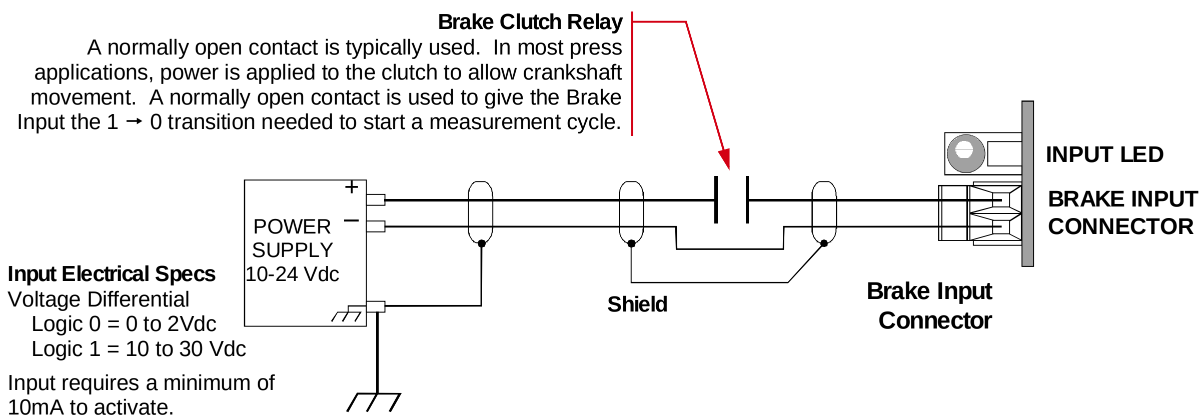


Figure 6.4 Brake Input Wiring

RSLOGIX 5000 CONFIGURATION

This chapter covers how to add a 1241 to a ControlLogix project. It covers how to configure the 1241's slot, how to add data and controller tags, and how to add a Message Instruction to your ladder logic. The next chapter covers the format of the data you will read and write to the module.

This chapter was written using RSLogix 5000, Standard Edition, Version 10.0.0. If you are not running this version, your setup may differ slightly. Refer to your Rockwell Software documentation if you have any questions.

A Word About Message Instructions

Message Instructions are used to program the 1241 instead of the output words assigned to the module. AMCI decided on this because the Message Instruction has built in hand shaking and error codes so you don't have to create this with your ladder logic. The Message Instruction also has Extended Error Codes, which the 1241 uses to tell the processor when there is an error in the data sent to it. Extended Error Codes are given in the ***Error Checking*** section of the Sample Program chapter, starting on page 51.

STEP 1: Open Your Project

Once you've started RSLogix 5000, open and existing project or create a new one.

STEP 2: Configure the 1241's Slot

2.1) Right click on the *I/O Configuration* branch in the open project tree window and select New Module...

2.2) Select 1756-MODULE as the module type. The description field will change to "Generic 1756 Module".

2.3) Click **OK**. The *Module Properties* window will open and it will look similar to figure 7.1 below.

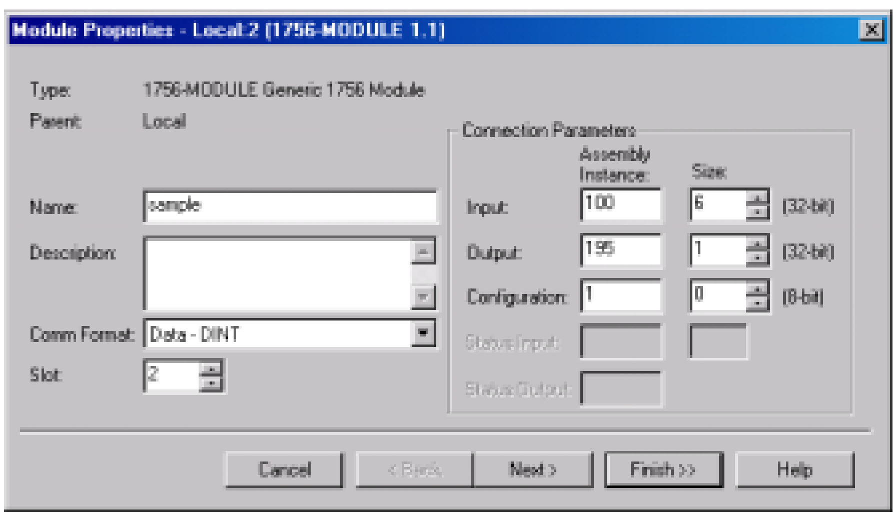


Figure 7.1 Module Properties Window

Enter the following data into the page:

- **Name:** *Your choice, but it must begin with a letter.*
- **Description:** *Your choice.*
- **Comm Format:** Data - DINT
- **Slot:** *Location of 1241 module.*
- **Connection Parameters:**

	Assembly Instance	Size
Input:	100	6
Output:	195	1
Configuration:	1	0

STEP 2: Configure the 1241's Slot (continued)

2.4) Click on **Next >** to go to the *Connection* page. Set the RPI (Rate Packet Interval) Time to the desired value. The minimum value for the 1241 is 0.4 milliseconds.

2.5) The other pages in the Module Properties window are not used be the 1241, so click on **Finish >>**.

The 1241 will now appear in the project tree under the I/O Configuration branch. Three data tags, that appear in the Controller Tags window, are also created.

- Local:X.C.Data[0] ("X" = slot number. Configuration data is not used by 1241.)
- Local:X.I.Data[5] ("X" = slot number. Six Input double integer words. Contains Status, Position, Tachometer and Stop Time data from 1241. The words are numbered 0 to 5)
- Local:X.O.Data[0] ("X" = slot number. Output data is not used by 1241.)

You can view that data that is in these tags in the *Controller Tags* window. If this window in not presently open in your project, click on Logic in the menu bar and then click on Monitor Tags...

STEP 3: Add a Controller Tag For Each Message Instruction

Before adding an RSLogix 5000 Message Instruction to your ladder logic, it's best to define the controller tag needed by the instruction. The controller tag contains the bits needed to actually accomplish the data transfer.

3.1) If the *Controller Tags* window is not already open, click on Logic in the menu bar and then click on Edit Tags... If the window is already open, you may need to click on the **Edit Tags** tab at the bottom of the window.

3.2) At the bottom of the controller tags table is a blank row marked by an asterisk (*). In this row, enter the name for your new message controller tag in the Tag Name column. The name must begin with a letter.

3.3) After you press the Enter key, the program assumes a controller tag type of *Integer* and jumps to a new controller tag name field. You must set the tag type to *Message*. With your mouse, move the cursor to the Type column of the message controller tag you are creating. When the field gets the program focus, you will see an ellipsis "**...**" button appear. Press this button.

3.4) In the window that opens, scroll through the list and select *Message*. Click on **OK** to close the window.

It's possible for two or more Message Instructions to run concurrently. Therefore, each Message Instruction requires its own controller tag. Repeat the steps above for each Message Instruction that will access the 1241. This could be as many as three instructions, one to program the module, one to apply the Preset Value, and one to clear transducer faults.

STEP 4: Add Controller Tags for the 1241 Data

In addition to the controller tags defined in step three above, you also need to create the tags that contain the data to be transferred to the 1241. They are defined in the same way as step three above with the following exceptions:

- Data type is *Integer.*
- The number of words you associate with the tag depends on what you are doing with the tag. Tags used to send setup data to the module require 5 words. Tags to preset the position value or clear latched transducer faults require 1 word. Enter the correct value in the *Dim 0* list box at the bottom of the window.

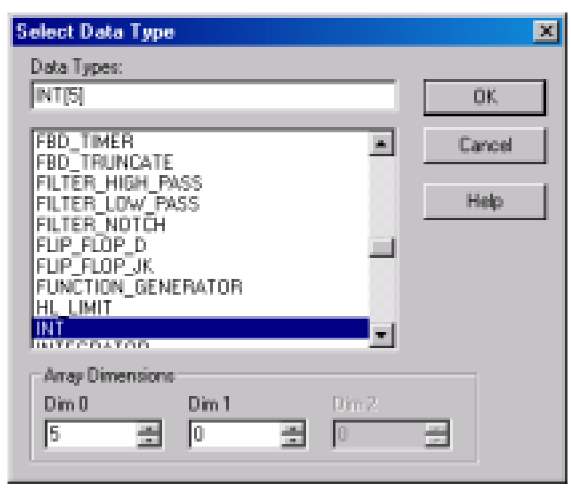


Figure 7.2 Data Type Window

STEP 5: Add Message Instructions to Ladder Logic

The next-to-last step in configuring RSLogix 5000 is to add Message Instructions to you ladder logic.

NOTE The Message Instruction only transmits data when the rung makes a 0→1 transition. Therefore you must add some type of input condition to the Message Instruction rung.

5.1) Open the ladder logic window that will contain the Message Instruction.

5.2) Add your input condition(s).

5.3) Add the Message Instruction. If you are using the *Language Element* toolbar, the Message icon is under the Input/Output tab. If you are entering instructions in the text bar that appears when you double click the rung, the mnemonic is MSG. If you enter the instruction this way, you can also enter the name of the message controller tag.

5.4) Before you can use the message instruction, you must configure it by clicking on the ellipsis "**...**" button. Figure 7.3 shows two Message Instructions entered into ladder logic. The Language Element toolbar is docked above the ladder logic window with the Input/Output tab selected. Note that the first message shows a type of "CIP Generic" and the second shows "Unconfigured".

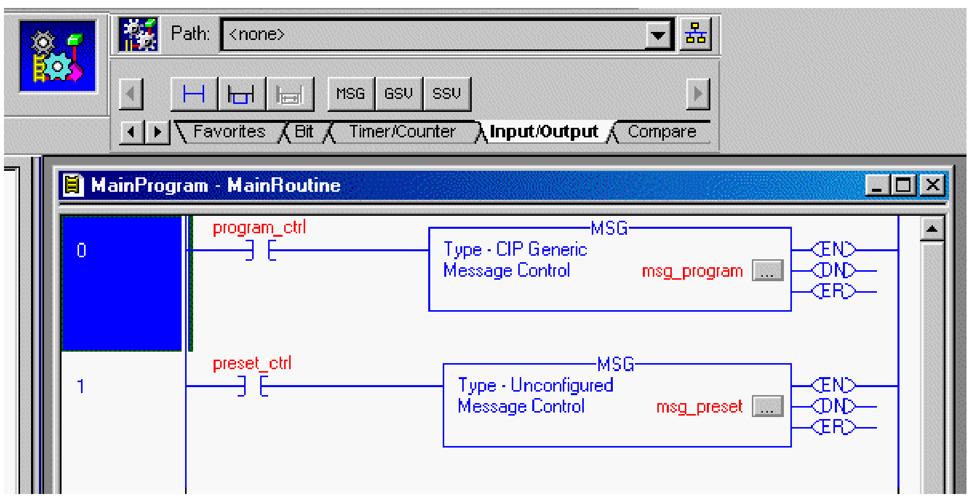


Figure 7.3 Message Instructions

STEP 6: Configure the Message Instruction

6.1) Once you click on the ellipsis button, the following window will appear.

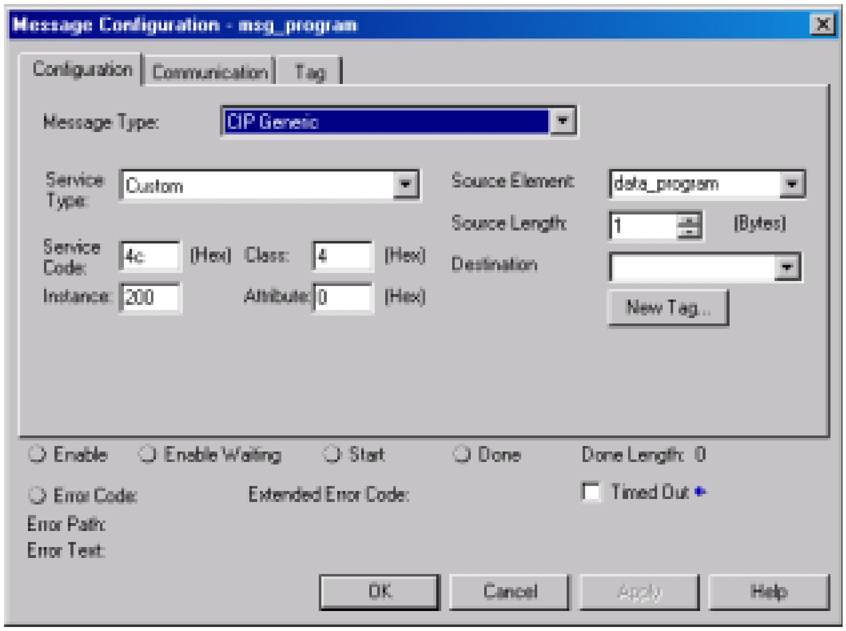


Figure 7.4 Message Instruction Configuration

6.2) Enter the following data into the fields:

- **Service Type:** Custom
- **Service Code:** 4C
- **Class:** 4
- **Instance:** For a Setup Data block: 200
  For a "Apply Preset" command block: 204
  For a "Clear Fault" command block: 205
- **Attribute:** 0
- **Source Element:** The name of the tag that holds the data to be sent to the 1241 with this instruction. This tag must exist before the Message instruction can be configured.
- **Source Length:** For a Setup Data block: 10
  For a "Apply Preset" command block: 2
  For a "Clear Fault" command block: 2
- **Destination:** *Leave Blank*

6.3) Click on the *Communications* tab in the *Message Configuration* window. You must then set the path parameter to point to the 1241 module. All of the remaining parameters, including everything under the *Tag* tab, can be left at their defaults. Click on **OK** to close the window.

The only thing left to do is initialize the tags that contain the programming data. The format of this data, along with the format of the position and tachometer data produced by the 1241 is the subject of the next chapter.

DATA FORMAT

Input Data

Input data is the status, position, tachometer, and stop time information produced by the 1241. Assuming the 1241 is located in the local chassis, the data is located in Local:X.I.Data[0-5], where 'X' is the 1241's slot number. Note that all of the data is transmitted as thirty-two bit double precision integers.

INPUT DATA WORDS

	31 – 16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
I.Data[0]	RESERVED Set to Zero	ACK	0	Vel@0	BrakeIn	0	0	0	0	0	0	0	0	0	0	TransFlt	ModErr

I.Data[1]	Position Data	0 to (Full Scale Count – 1)† 0 to 8,191 max.†
I.Data[2]	Tachometer Data	0 to 5,000 max.
I.Data[3]	Circular Offset	0 to (Full Scale Count – 1) 0 to 8,191 max.
I.Data[4]	Stop Time	34 to 65,410 milliseconds
I.Data[5]	Brake Applied Position	0 to (Full Scale Count – 1) 0 to 8,191 max.

† Assuming a Linear Offset of zero. When the Linear Offset value is not zero, the Position Data will range from Linear Offset to (Linear Offset + (Full Scale Count - 1)) In this case, the maximum position value is 32,767.

Figure 8.1 Input Data Format

I.Data[0] Bit Descriptions

ModErr: **Module Error, Bit 0.** This bit is set by the 1241 when it detects an error with its hardware. If this bit is set, cycle power to the module. If the bit remains on, the module must be replaced. Refer to the ***Inside Front Cover*** for information on contacting AMCI about our repair policy.

TransFlt: **Transducer Fault, Bit 1.** This bit is set when there is an active transducer fault or when a transient fault has been latched by the module. If the ***Transducer Fault Latch*** parameter is enabled, sending the *Clear Transducer Fault* command message may clear the fault. If the fault message remains after this command message is sent, then you have an active transducer fault that you must troubleshoot before continuing.

BrakeIn: **Brake Input State, Bit 12.** This bit is set whenever the brake input is not receiving power. Therefore, this bit will always be on if you are not using the brake input in your application. The reason for this "inverted" behavior is that in most press applications, the brake is mechanically applied when power is removed from the clutch brake assembly. Therefore, if the press were to loose power, the brake would automatically be applied.

Vel@0: **Velocity at Zero, Bit 13.** With a name that says it all, this bit is set when the tachometer data is less than 1 RPM. The state of this bit is updated at the programmed tachometer update time.

ACK: **Acknowledge Bit, Bit 15.** This bit changes state when any new message is received from the processor via a Message Instruction.

Setup Data Message Format

Setup data is sent to the 1241 with a Message Instruction that has an *Instance* of 200. As shown below, Setup data consists of five single precision (16 bit) integer words, that are programmed into the Message Instruction as ten bytes. Note that these are integers (INT), not double precision integers (DINT) like those used as input words. These words are referenced by the tag you specified as the Source Element when configuring the Message Instruction.

See ***Configure the Message Instruction*** on page 44 for more information on setting the instruction Instance, Length, and Source Element values.

SETUP DATA WORDS
Instance = 200, Source Length = 10

	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	RType	0	0	0	0	TFLtch	VelUdT	CntDir	COS

Word 1	Full Scale Count 2 to 8,192. Default of 1,024
Word 2	Preset Value Linear Offset to (Linear Offset + (Full Scale Count – 1))
Word 3	Circular Offset 0 to (Full Scale Count – 1)
Word 4	Linear Offset 0 to (32,768 – Full Scale Count)

Figure 8.2 Setup Data Format

Bit Descriptions

COS: **Change of State Interrupt Enable, Bit 0.** When this bit is reset, the 1241 will send data to the processor at the RPI (Rate Packet Interval) Time specified when you configured the module. When this bit is set and the position value changes, the 1241 will issue an interrupt to the processor which will cause the data be read again. This is typically used in programmable limit switch applications where the processor determines limit switch states instead of leaving this function to a dedicated module such as AMCI's 8213.

CAUTION If you are running the transducer at high speeds, setting this bit can adversely affect the response time of the processor. See ***COS Interrupt Enable*** on page 24 for more information.

CntDir: **Count Direction, Bit 1.** When this bit is reset, the Count Direction parameter is set to *Positive* (clockwise increasing counts). When set, Count Direction is set to *negative*.

VelUdT: **Velocity Update Time, Bit 2.** When this bit is reset, the Velocity Update Time is set to 120 milliseconds. When set, the Velocity Update Time is set to 32 milliseconds. Note that this only affects the tachometer response, the position data always updates at 200 microseconds.

TFLtch: **Transducer Fault Latch, Bit 3.** When this bit is reset, the 1241 will clear transducer fault errors as soon as it can correctly determine position based on the resolver signals. When this bit is set, the 1241 will latch transducer faults when they occur and will leave the error flag set until the fault is cleared with a *Clear Transducer Fault Message Instruction* from the processor. See ***Transducer Fault Latch*** on page 25 for more information.

RType: **Resolver Type, Bit 8.** When this bit is reset, the 1241 is configured to use AMCI resolver transducrs. When set, the 1241 is configured to use most resolver transducers from Autotech Controls.

The remaining data words contain the rest of the 1241's parameters. See ***Module Parameters*** starting on page 23 if you need a detailed description of the parameters.

Apply Preset Message Format

The Preset Value parameter is not applied to the position data when it's programmed with the *Setup Data Message*. (Programming the Preset Value doesn't change the position data.) Changing the position data to the Preset Value requires you to send an Apply Preset Message to the 1241.

An *Apply Preset Message* is a Message Instruction to the 1241 that has an *Instance* of 204 and a length of 2 bytes. Note that these bytes are treated as a single integer (INT) This word is referenced by the tag you specified as the Source Element when configuring the Message Instruction.

See ***Configure the Message Instruction*** on page 44 for more information on setting the instruction Instance, Length, and Source Element values.

APPLY PRESET

Instance = 204, Source Length = 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	0	0	0	AplyPV

Figure 8.3 Apply Preset Data Format

Bit Description

AplyPV: **Apply Preset Value, Bit 0.** This bit must always be set when you send this Message Instruction. If it's not, the 1241 will respond with an error. Since all other bits must be zero, this word must equal 1.

CAUTION The EEPROM is guaranteed 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.

Clear Transducer Fault Message Format

A *Clear Transducer Fault Message* is a Message Instruction to the 1241 that has an *Instance* of 205 and a length of 2 bytes. Note that these bytes are treated as a single integer (INT). This word is referenced by the tag you specified as the Source Element when configuring the Message Instruction.

See ***Configure the Message Instruction*** on page 44 for more information on setting the instruction Instance, Length, and Source Element values.

The data sent to the 1241 with this instruction is ignored. Therefore it can be set to any value. However, AMCI strongly suggests setting this word to zero.

CLEAR TRANSDUCER FAULT

Instance = 205, Source Length = 2

	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Word 0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0

Figure 8.4 Clear Transducer Fault Data Format

Notes

CHAPTER 9
SAMPLE PROGRAM

About the Program

The ladder logic itself is very simple. That's because most of the work is being done automatically by the Message Instruction. The sample makes use of an integer value named *send*. Your program, or you if you're changing its value manually, set the value of *send* to 1, 2, or 3.

- **When *send* = 1:** The *Setup Data* Message is sent to the 1241
- **When *send* = 2:** The *Apply Preset* Message is sent to the 1241
- **When *send* = 3:** The *Clear Transducer Fault* Message is sent to the 1241

When the Message Instruction finishes, its Done bit gets set, which resets the value of *send* to zero.

Message Instruction Configurations

Setup Data Message

Message Controller Tag:	Tag Name:	amci_setup_message
	Service Type:	Custom
	Service Code:	4C
	Class:	4
	Instance:	200
	Attribute:	0
	Source Element:	*data_program* (Name of tag that contains the programming data)
	Source Length:	10
data_program values:	Word 0:	16#000C Transducer Fault Latch is enabled, Velocity Update set to 32 mS Resolver Type, Count Direction, and COS Interrupt set to default.
	Word 1:	360 - Full Scale Count
	Word 2:	180 - Preset Value
	Word 3:	000 - Circular Offset
	Word 4:	000 - Linear Offset

Apply Preset Message

Message Controller Tag:	Tag Name:	amci_preset_message
	Service Type:	Custom
	Service Code:	4C
	Class:	4
	Instance:	204
	Attribute:	0
	Source Element:	*data_preset* (Name of tag that contains the Apply Preset data)
	Source Length:	2
data_preset values:	Word 0:	1 This word must always equal 1 when writing it to the 1241.

Clear Transducer Fault Message

Message Controller Tag:	Tag Name:	amci_preset_message
	Service Type:	Custom
	Service Code:	4C
	Class:	4
	Instance:	205
	Attribute:	0
	Source Element:	*data_clear* (Name of tag that contains the Clear Fault data)
	Source Length:	2
data_clear values:	Word 0:	0 This word can be any value, but a default of zero is recommended.

Program Listing

RSLogix 5000 - AMCI_1241_example:MainTask:MainProgram:MainRoutine
in file F:|RSLogix 5000\Projects\AMCI_1241_example.ACD 1/9/2003 11:18:42 AM Page 1
Relay Ladder Logic Listing - Total number of rungs: 4

The SEND tag controls the data transfer to the AMCI 1241 module. When this tag becomes 1, this rung transitions from false to true and the Setup Data Message is sent to the 1241. This data is 10 bytes long and contains the Setup Bits, Scale Factor, Preset Value, Circular Offset, and Linear Offset parameters. The message is completely transmitted when the Done bit turns on. If the Error bit turn on, there was a problem with the transmission or a logical error in the data sent to the module. If the problem is the data, the tag: *amci_setup_message.err* will equal 9 and the tag *amci_setup_message.exerr* will indicate the type of error.

1 = Setup Data
2 = Preset Position
3 = Clear Faults

0000 EQU: Equal, Source A send 0, Source B 1 — MSG: Type - CIP Generic, Message Control amci_setup_message ... —(EN)— —(DN)— —(ER)—

The SEND tag controls the data transfer to the AMCI 1241 module. When this tag becomes 2, this rung transitions from false to true and the Apply Preset Message is sent to the 1241. This data is two bytes long. The message is completely transmitted when the Done bit turns on. If the Error bit turn on, there was a problem with the transmission or a logical error in the data sent to the module. If the problem is the data, the tag: *amci_preset_message.err* will equal 9 and the tag *amci_preset_message.exerr* will indicate the type of error.

1 = Setup Data
2 = Preset Position
3 = Clear Faults

0001 EQU: Equal, Source A send 0, Source B 2 — MSG: Type - CIP Generic, Message Control amci_preset_message ... —(EN)— —(DN)— —(ER)—

The SEND tag controls the data transfer to the AMCI 1241 module. When this tag becomes 3, this rung transitions from false to true and the Clear Transducer Fault Message is sent to the 1241. The data for this message is 2 bytes long and can be any value, because the 1241 only uses the Instance Value of the message. The message is completely transmitted when the Done bit turns on. If the Error bit turn on, there was a problem with the transmission or message parameters. The Clear Error command does not have any Extended Error Codes.

NOTE: The Clear Error Command will not clear the Extended Error Codes from a different Message Instruction. The only way to clear these errors is by re-transmitting valid data to the 1241 with the Message Instruction that faulted.

1 = Setup Data
2 = Preset Position
3 = Clear Faults

0002 EQU: Equal, Source A send 0, Source B 3 — MSG: Type - CIP Generic, Message Control amci_clear_message ... —(EN)— —(DN)— —(ER)—

0003
Set when Setup Transfer complete. amci_setup_message.dn] [
Set when Apply Preset Transfer complete. amci_preset_message.dn] [
Set when Clear Error Transfer complete. amci_clear_message.dn] [

1 = Setup Data
2 = Preset Position
3 = Clear Faults

MOV: Move, Source 0, Dest send 0

(End)

Error Checking

The Message Instruction includes the ability to communicate error messages from the 1241 when there's a problem with the data. To try this out:

1) Add a new control tag to your project named *amci_buffer* with an integer data type.
2) Change the value in word 1 of the *data_program* tag to 10,000. This will attempt to program a Full Scale Count of 10,000, which is invalid.
3) Add the following rung to your ladder logic sample program.

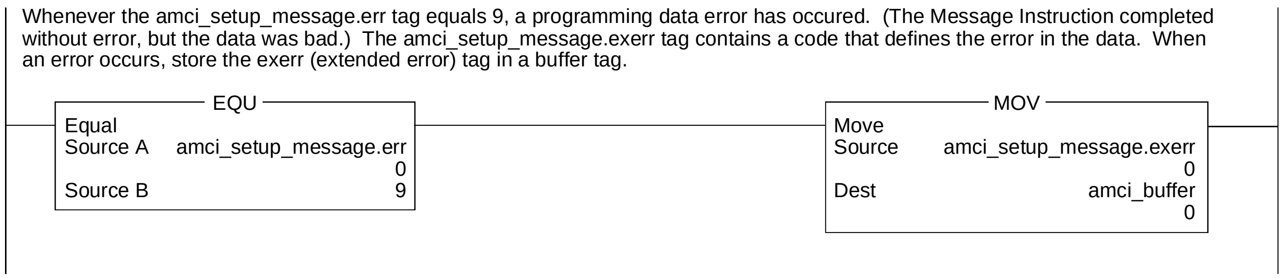


Figure 9.1 Error Message Buffering

4) Set your *send* tag equal to 1.

The error tag, amci_setup_message.err, will be set to 9 and the extended error tag, amci_setup_message.exerr, will be set to 2.

Extended Error Codes

.exerr Code	Description
1	Error in the first word of the Message Instruction data. 1) Unused bits in Word 0 of a Setup Data Message are set. See ***Setup Data Message Format*** on page 46. 2) Sending an Apply Preset Message with a data word that does not equal 0001. See ***Apply Preset Message Format*** on page 47. 3) Sending an Apply Preset Message while there is a transducer fault.
2	Full Scale Count outside its range of: 2 to 8,192
3	Preset Value outside its range of: Linear Offset to Linear Offset + (Full Scale Count−1)
4	Circular Offset outside its range of: 0 to (Full Scale Count−1)
5	Linear Offset outside its range of: 0 to (32,768 – Full Scale Count)

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