Module Overview

The 7662 module is a SSI interface module that can reside in either a Rockwell Automation CompactlLogix or MicroLogix 1500 rack system. This module is capable of connecting to two independent SSI output sensors. This module also has two latching inputs, one for each channel, that are used to capture the sensor's data.

The 7662 module uses 8 input and 8 output registers to communicate with the PLC. The Position, Velocity, Actual SSI data, Latched Value, and Status information are reported to the Input Registers. All module setup parameters, including Preset Value, Count Direction, Velocity Response Time, Display Format, as well as the SSI-Logic parameters [Data Type (binary or gray code), Data Logic (positive or negative), Number of Clock Bits, Number of Data Bits, MSB Number, and Clock Frequency] are programmed through the Output registers assigned to the module.

The 7662 module stores its parameters in a non-volatile flash memory when power is removed so it is not necessary to program the module at every power up. However, this flash memory is good for a minimum of 10,000 write cycles so the module must not be programmed during every machine cycle.

The module has two opto-coupler latching inputs that will capture the scaled sensor data on the rising, falling, or both transitions of the input. These inputs can be wired to be sinking or sourcing and will activate when they see a voltage level between 8 and 24Vdc across the + and – latch terminals.

The 7662 module is shipped with channel 2 disabled. Enable channel 2 by simply programming the channel 2 setup data. It is also possible to disable the second channel of the 7662 module. If only one sensor is being used, disabling the second channel is recommended because the module will stop all activities associated with channel two, thereby improving the throughput time.

Sample programs showing how to program the 7662 module in both MicroLogix and CompactLogix systems are available from the following page of our website.

http://www.amci.com/sampleprograms.asp

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

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All equipment being returned to AMCI for repair or replacement, regardless of warranty status, must have a Return Merchandise Authorization number issued by AMCI. Call (860) 585-1254 with the model and serial numbers along with a description of the problem. A "RMA" number will be issued. Equipment must be shipped to AMCI with transportation charges prepaid. Title and risk of loss or damage remains with the customer until shipment is received by AMCI.

24 Hour Technical Support Number
Technical Support, in the form of documents, FAQs, and sample programs, is available from our website, www.amci.com. 24 Hour technical support is also available on this product. For technical support, call (860) 583-7271. Your call will be answered at the factory during regular business hours, Monday through Friday, 8AM - 5PM EST. During non-business hours, an automated system will ask you to leave a detailed message and the telephone number that you can be reached at. The system will page an engineer on call. Please have your product model number and a description of the problem ready before you call.

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Chapter 1: Installing the 7662 module

Disconnect power before attempting to install or remove the 7662 module

1. Verify that your system's power supply has adequate reserve current capacity. The 7662 module requires 375mA at +5Vdc.
2. The 7662 cannot be any farther than the 7th module away from the power supply.
3. Align the tongue-and-groove guides on the left side of the module with the existing rack system and slide the module backwards.
4. When the 7662 module is in position, move the white bus connector lever on the top of the module to the left.
5. If the 7662 module is the right most module in a system, a 1769-ECR End Cap MUST be installed to the right of the module for the system to operate correctly.

CompactLogix Generic Configuration

1. Open RSLogix 5000 and the project in which you want to install the AMCI 7662 module.
2. Right click on I/O Configuration in the Project Tree.
3. Select New Module.
4. Select the following module type and description from the list that appears.
   Type = 1769-MODULE
   Description = Generic 1769 Module
5. Click on OK.
6. Enter the following module properties.
   Name: *Your Choice* (must begin with a letter)
   Description: *Your Choice*
   Comm Format: *Data-INT* (*The default is Input Data-INT. This must be changed to Data-INT)*
   Slot: *location of 7662 module*
7. Enter the Connection Parameters from the following table.

CONNECTION PARAMETERS

	Assembly Instance	Size in 16 bit words
INPUT	101	8
OUTPUT	100	8
CONFIGURATION	102	0

8. Click on Finish >>

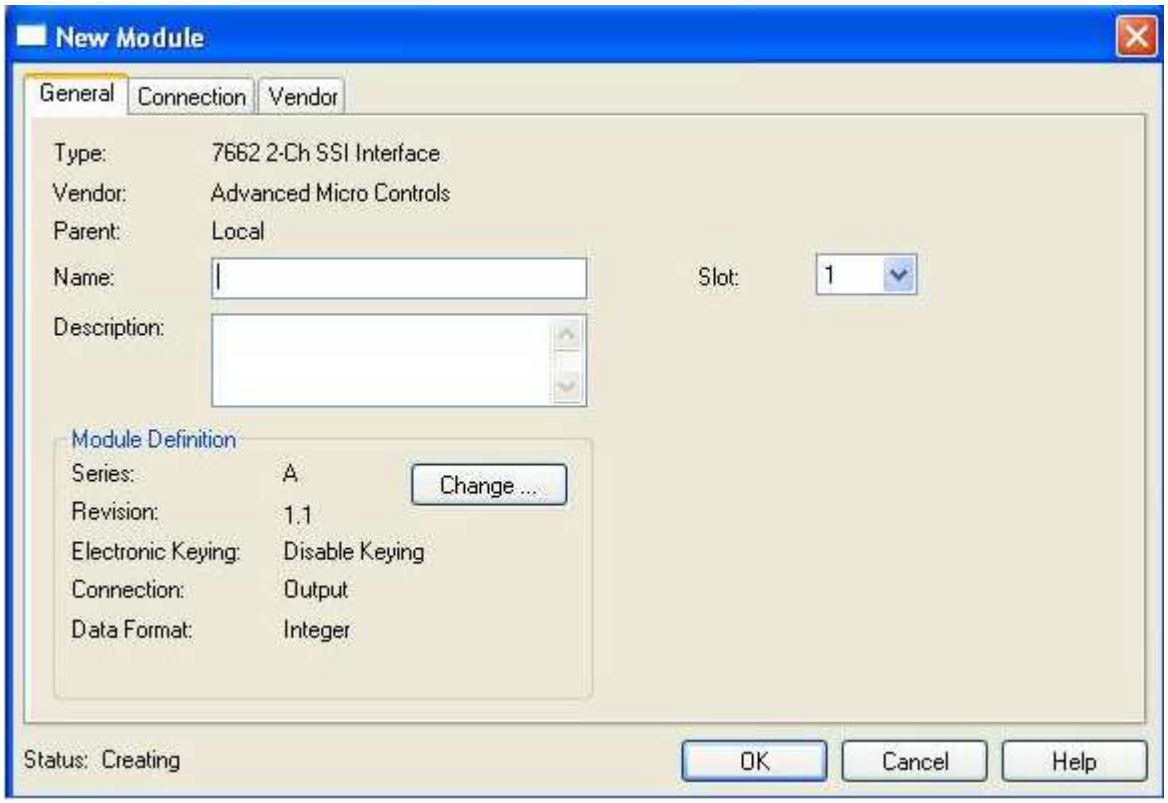
The 7662 module will now appear in the project tree and three new data tags will have been created, Local:X.I.Data[Y], Local:X.O.Data[Y] and Local:X.C.Data[Y] where "X" is the slot number and "Y" is the word number. The status, data value, velocity, latched value, and the actual SSI value are located in the Input tags. All commands are sent to the 7662 module through the Output tags. The 7662 module does not use the Configuration tags.

CompactLogix RSLogix 5000 V20 or higher configuration

With the release of V20 of RSLogix 5000, the AMCI 7662 module is now present in the list of available CompactLogix I/O modules, so you now have the option of using either this or the Generic module described above when adding the AMCI 7662 module to your I/O.

1. *Open RSLogix 5000 and the project in which you want to install the AMCI 7662 module.*
2. *Right click on I/O Configuration in the Project Tree.*
3. *Select New Module.*
4. *Verify that the **By Vendor** tab is selected at the bottom of the Select Module window and expand Advanced Micro Controls. The following window will open.*

5. Double click on the 7662 module. The following window will appear.



6. Enter a name in the Name field. This parameter must begin with a letter.
7. If desired, describe the function of the 7662 module in the *Description* field.
8. Click on the ▼ next to the *Slot* field and select the slot where the AMCI 7662 module is to be located.
9. Click on OK to add the 7662 module to your I/O configuration.
10. Using the above setup changes how the data from the 7662 module will be read into the Controller tags. Instead of the generic Local:X:I.Data and Local:X:O.Data tags, the module will now use tags that are specific for the 7662 module.

MicroLogix 1500 PLC Configuration

1. Open or create the RSLogix 500 project in which you want to use the 7662 module.
2. Double click on I/O Configuration in the project tree.
3. Select the slot where the 7662 module will be installed.
4. Double click on "Other.. Requires I/O Card Type ID" from the bottom of the list of available modules.
5. Enter the following information in the window that appears.

Vendor ID:	3
Product Type:	11
Product Code:	25
Input Words:	8
Output Words:	8
Input Bits:	0
Output Bits:	0
Extra Data Length:	0
Ignore Configuration Error:	*Your Choice, but not recommended*

6. The 7662 module will now appear in the I/O Configuration with a Part Number of Other and a Description of I/O Module – ID Code = 25.
7. Input Data (data from the 7662 module to the PLC) will appear in Input Image Table registers I:X.0 to I:X.7, where X is the slot number.
   Output Data (data from the PLC to the 7662 module) will be written to registers O:X.0 to O:X.7, where X is the slot number.

Chapter 2: Hardware Overview

Module Specifications

Current Draw
375mA @5Vdc typical

Throughput Time
0.1mS to 1mS depending on SSI frequency and number of bits and channels.

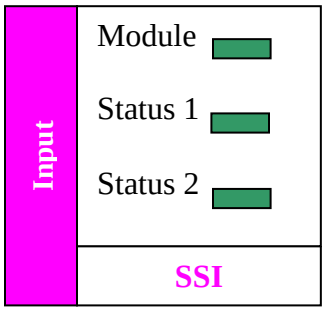
Environmental Conditions
Operating Temperature: 0 to 60° C
Relative Humidity: 5 to 95% (non-condensing)
Storage Temperature: -40 to 85° C

Latch Inputs
The Latching Input terminals accept an up to 24VDC signal across pins15-13 and 16-14. The latching function is performed as programmed when power is applied/removed, OFF to ON and/or ON to OFF, to/from the input.

Voltage Range: 0 to 24Vdc
On State: 8 to 24Vdc
Off State: 0 to 2Vdc
Current Draw: 10mA @ 24Vdc
Minimum On Time: 300µs
Noise filtering is not performed on the input

Compatible Transducers
Any transducer that outputs data in single word SSI format. This data format can either be binary or gray code. The number of bits transferred is programmable from 1 to 32. Multi-word transfers are not supported.

Front Panel



Module LED
Solid Green: Module Owned, two-way communication

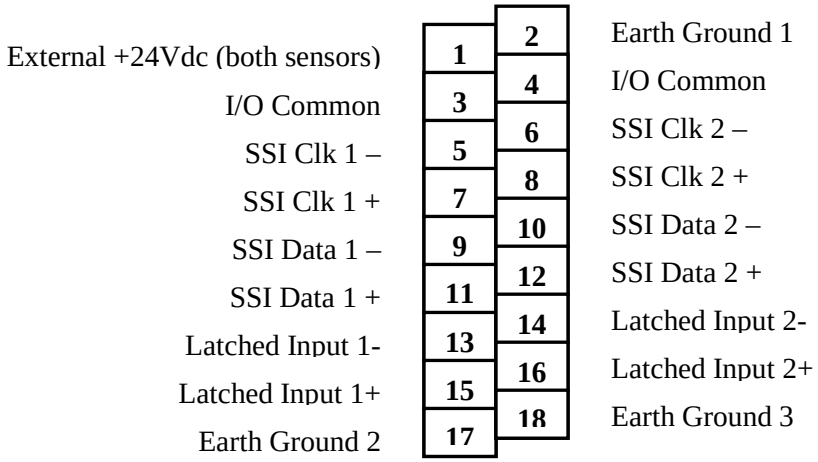
Status 1 & 2 LEDs *(for SSI sensor 1 and 2)*

LED Pattern	Meaning
ON	Latch Input active, no motion
OFF	Latch Input inactive, no motion
Blinking ON/OFF =5/1	Latch Input active, SSI data changing
Blinking ON/OFF =1/5	Latch Input inactive, SSI data changing

Note: Blinking 5/1 means that the LED will be On five times longer than it is Off.
Blinking 1/5 means that the LED will be Off 5 times longer than it is On.

Connector Pinout

The input and sensor signals are brought into the 7662 module through an 18-pin connector, which is shipped with the module. Please note that pin 1 is located in the upper left hand corner when installed in the 7662 module.

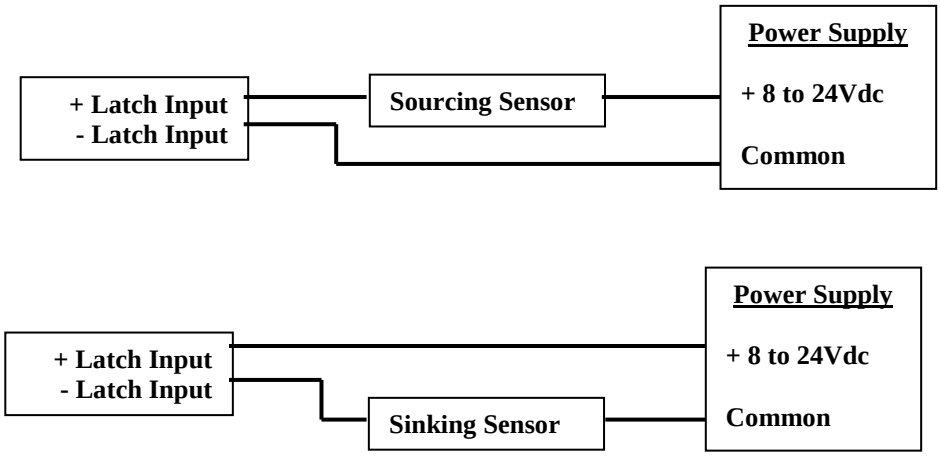


Wiring Notes

- Use the information provided by the sensor's manufacture to determine the type and maximum length of cable that should be used to connect the sensor to the 7662 module.
- When plugged into the 7662 module, pin 1 is located in the upper left hand corner.
- Pin 1 is not connected to the PC board. It is intended as a convenient place to connect the +24Vdc external supply to the SSI sensors. Only consider the sensor(s) current requirements when sizing this power supply as the 7662 module does not use and is not connected to the external +24Vdc supply.
- SSI Clk 1, SSI Data 1 and Latched Input 1 represent channel 1; SSI Clk 2, SSI Data 2 and Latched Input 2 represent channel 2
- I/O Common (pins 3 and 4) are internally connected together and must be connected to the common of the external power supply used to power the SSI sensors.
- Earth Grounds 1, 2, and o 3 (pins 2, 17, and 18) are internally connected together. The cable shields should be connected to these terminals.
- The 7662 module can be tested by removing the sensor's cable and wiring +Clock to +Data and –Clock to –Data. This will cause the Actual SSI input data to be equal to zero. With the Clock and Data signals open, the Actual SSI input data will be equal to $(2^{(\text{number of clock bits})} - 1)$.
- Transducer signals are generally low voltage, low power signals. 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.
- Like all signal and communication cable, the transducer cable should be shielded. These shields must be grounded only at one end of the cable. Because the rack cabinet is typically better grounded than the machine, AMCI recommends that the cable shields be terminated at the 7662 module.
- If a junction must be made in the signal cable, treat the shield as a signal-carrying conductor. Do not connect the shield to ground at any junction box or the transducer.
- If the signal cable must cross power feed lines, it should do so at right angles.
- Route the cable at least five feet from high voltage enclosures, or sources of "rf" radiation.

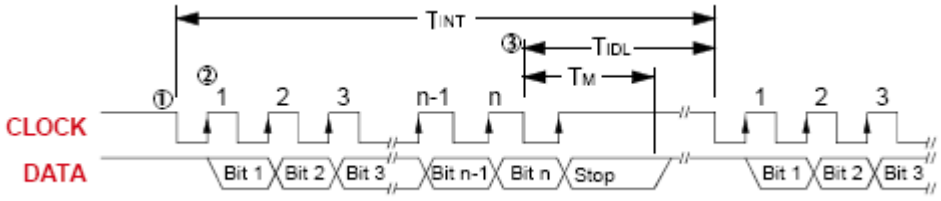
Latching Inputs Wiring

The following two diagrams show how to wire the 7662 module's opto-coupler latching inputs to either sourcing or sinking sensors.



SSI Protocol

The following figure shows how a 7662 reads data from a SSI transducer. Note that the formal SSI definition allows for twenty-four bits of data and a twenty-fifth stop bit. However, AMCI is aware of some transducers that transmit more or less than twenty-five bits. To accommodate these transducers, the 7662 can be programmed to accept up to thirty-two bits in the SSI bit stream.



"n" = Number of bits in the SSI data. Range of 1 to 32. Default of 24.

1. The first falling edge of the clock signal latches the SSI data. Note: Some transducers latch the data at the end of the previous interrogation.
2. The next "n" rising edges of the clock shift out the "n" data bits.
3. TINT is the time between interrogations and is equal to (((1/clock frequency) * # of SSI bits) + 120µS) for the 7662. TM is the time that the Stop bit is valid, which is typically 12 to 20 µS. TIDL is the time between the end of the last interrogation and the start of the next and is fixed at 120µS. The transducer must have new data available within the TIDL Time period if the system is to work properly.

FLASH Memory

The 7662 module's parameter values are stored in a non-volatile Flash memory. This memory type can store parameter values in the absence of power for over twenty years, but you can only write to it a limited number of times before it will be damaged. The Flash Memory that AMCI uses is guaranteed for a minimum of 10,000 write cycles.

Chapter 3: Programmable Parameters

The 7662 is configured by programming its Programmable Parameters. These parameters are broken down into three groups, Module Setup, SSI Setup, and Data Setup parameters.

Module Setup Parameters

Display Format: The 7662 module has the ability to send a Data Value, a Velocity value, a Latched Value, and the Actual SSI Value for both channels to the PLC's input registers. However, because both the CompactLogix and MicroLogix PLCs only allow a maximum of eight input words to be transferred, not all of the data can be transferred at one time. The Display Format parameter solves this problem by allowing you to select which two of the four available values are appropriate for your application. It is also possible to change the Display Format at any time. The available options for the display format are listed below.

- Data Value and Velocity (default)
- Data Value and Zero
- Velocity and Actual SSI Value
- Latched Value and Actual SSI Value
- Data Value and Latched Value
- Velocity and Latched Value
- Data Value and Actual SSI Value

To ensure that the 7662 module's Flash Memory is not depleted simply by changing what data is being displayed, the Display Parameter is typically not saved in the 7662 module's Flash memory. However, by setting the *Save Format Bit*, (which is located in the *Control Word* along with the Display Format), it is possible to define what data the 7662 module will send to the PLC at power up

Disable Channel 2: This bit level parameter allows you to disable the second channel of the 7662 module. If only one sensor is being used, disabling the second channel is recommended because the module will stop all activities associated with channel two, thereby improving the throughput time. The 7662 is shipped with channel 2 disabled.

Latch Inputs: The 7662 module has two Latch Inputs, one for each channel, that allow you to capture and display the current Data Value whenever the input transitions. This parameter, which is composed of two bits, allows you to capture the input on the 0 to 1 transition, the 1 to 0 transition, or on both transitions. The function of the Latched Input will be disabled if neither bit is set.

The latched input must be On for a minimum of 300µs to be read by the 7662 module.

The 7662 module reports the status of the Latched input even if the function of the latched input has been disabled.

The Latched Value is not saved through power down. Therefore, the Latched Value displayed in the 7662 module's input registers at power up will be zero.

SSI Setup Parameters:

These parameters are used to extract the SSI Data Value from the bit stream. These parameters define the clock speed of the data transfer, the number of clock bits, the position and length of the SSI data within the bit stream, and the format of the data.

SSI Clock Frequency: This parameter allows you to set the SSI clock frequency to one of four values; 125kHz, 250kHz, 500kHz, or 1.0MHz. The default value of 125kHz value will work in all applications. Your sensor's user manual should contain information on what SSI Clock Frequency is appropriate for both the sensor and the type and length of cable used.

Number of SSI Data Bits: This parameter defines how many bits of the data stream make up the Data Value. This parameter has a range of 1 to 28.

Most Significant Bit (MSB) Number: This parameter defines the bit location of the first bit of the Data Value in the data bit stream. This parameter has a range of 1 to 32.

Number of SSI Clock Bits: This value sets the number of bits that the 7662 will read from the SSI transducer per interrogation. This parameter has a range of 1 to 32 and must be greater than or equal to *(Most Significant Bit Number + (Number of SSI Data Bits – 1))*. The default value of 24 bits will work in most applications.

Example: You have a 12 bit single turn SSI encoder that outputs 25 SSI Clock bits. The single turn value is located in the least significant bits of the SSI data.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
0	0	0	0	0	0	0	0	0	0	0	0	0	X	X	X	X	X	X	X	X	X	X	X	X

MSB of SSI Clock Bits — MSB of Data Value — LSB of Data Value and Clock bits

In this example, the 7662 module would be setup using the following data.

Number of SSI Clock Bits = 25
Most Significant Bit number = 14
Number of SSI Data Bits = 12

Data Type: This parameter tells the 7662 module to interpret the SSI data either as a binary number or as a gray code number. The default value is binary.

WARNING

You must read all of the data bits from a Gray Code sensor. The data value will appear to count up and down if you use the MSB Number and Number of Data Bit parameters to read only some of the data bits.

Data Logic: This parameter is included to handle situations where the SSI data is reported with negative logic. If this parameter is set, the 7662 will invert the data bits before performing any scaling and decoding operations. When left in its default value of positive, the 7662 module will use the SSI data as it is from the sensor.

Data Setup Parameters:

Once the 7662 module has extracted the SSI data from the data stream, it uses the Data Setup Parameters to convert the raw SSI data into the Data Value it reports to the PLC.

Scalar Multiplier & Divisor: These two parameters are used to scale the SSI data. Both parameters have a default value of one and can range in value from 1 to 32,767. The Scalar Multiplier must be less than or equal to the Scalar Divisor. In other words, the ratio of Multiplier to Divisor CANNOT be greater than one.

Linear displacement transducers from Balluff and MTS have resolutions measured in µm/count. The 7662 module can easily convert this data into the more familiar US Customary system of inches. The table below shows the Multiplier and Divisor values needed to convert from various metric resolutions to US Customary resolutions. For example, to convert data from a LDT sensor with 5µm/count resolution to 0.0005inch/count resolution, use a Multiplier of 50 and a Divisor of 127.

LDT Resolution	Desired Resolution						
	0.00005”	**0.0001”**	**0.0002”**	**0.0005”**	**0.001”**	**0.002”**	**0.005”**
1µm	100/127	50/127	25/127	10/127	5/127	5/254	1/127
2µm		100/127	50/127	20/127	10/127	5/127	2/127
5µm			125/127	50/127	25/127	25/254	5/127
10µm				100/127	50/127	25/127	10/127
20µm					100/127	50/127	20/127
40µm						100/127	40/127

Use the following procedure to calculate your Scalar Multiplier and Divisor values if either your LDT Resolution or Desired Resolution does not appear in the above table

Conversion Factor: $\frac{\text{Desired Resolution (counts/inch)}}{\text{LDT Resolution (counts/inch)}}$

Step 1: Convert your LDT resolution from µm to inches. For example, you are using a sensor with 1µm resolution in your application.

$$1\ \mu m * \frac{1\ mm}{1000\ \mu m} * \frac{1\ inch}{25.4\ mm} = 0.00003937\ inches/count = 25400\ counts/inch$$

Step 2: Determine the number of counts per inch for the desired resolution. For example, 0.0001”.

0.0001 inch/count = 10000 counts/inch

Step 3: Determine the Scalar Multiplier and Divisor values.

$$\frac{\text{Desired Resolution (counts/inch)}}{\text{LDT Resolution (counts/inch)}} = \frac{\text{10000 counts/inch}}{\text{25400 counts/inch}} = \frac{100}{254} = \frac{50}{127}$$

Therefore, to use a sensor with 1µm resolution and get 0.0001 inches per count resolution, use a Scalar Multiplier of 50 and a Scalar Divisor of 127.

Preset Value: The zero position of the SSI encoder's Data Value may not match the zero position of your machine. The Preset Value parameter gives you the ability to offset the Data Value from the actual SSI data to a value that will be more useful for your application.

Programming the Preset Value parameter does not change the Data Value. It is stored in the 7662 module's memory until the module sees a zero to one transition of the Apply Preset bit.

Apply Preset: Offsetting the Data Value to the Preset Value is a two step operation. First, the Preset Value must be saved in the module's memory. Second, setting the Apply Preset bit will change the Data Value to the Preset Value. It is possible both program the Preset Value and Apply the Preset in one programming cycle.

Setting the Apply Preset bit causes the module to generate an internal offset value that is applied to the Data Value before it is reported to the PLC. This internal offset is saved in the 7662 module's Flash memory, so it is not necessary to home the module at every power up.

The 7662 module's Flash memory is guaranteed for 10,000 write cycles before writing to it will cause it to fault. Therefore continuously Applying the Preset should be avoided. If your application requires you to continuously Apply the Preset, consider calculating and Applying the Preset in your PLC program.

Count Direction: This parameter is useful if your Data Value represents a linear position. It gives you the ability to reverse the direction of motion needed to increase the position count. For simplicity's sake, the two values for this parameter are called *Positive Direction* and *Negative Direction*. When this parameter is set to its default of *Positive*, the Data Value is not changed. When this parameter is set to Negative, the Data Value is multiplied by -1 before it is reported. For linear transducers, this has the effect of reversing the direction of motion needed to increase the count. When using LDT's and the Count Direction is set to *Positive*, the Data Value usually increases as the magnet moves away from the head of the LDT. When the Count Direction is set to *Negative*, the Data Value increases as the magnet moves towards the head of the LDT.

You will need to preset the Data Value after you program the Count Direction parameter.

If your Data Value represents a rotary position, you cannot change the count direction with this parameter. However, you can easily reverse the count direction with ladder logic shown in sample programs located on our website at;

http://www.amci.com/sampleprograms.asp

Velocity Update Time: The Velocity Update Time parameter sets the amount of time between Rate of Change information updates to the PLC. Its can be set to either 24 milliseconds or 160 milliseconds, with 160 milliseconds being the default. Decrease the time between updates for faster response to changes in this value. Increase the time between updates for better averaging of this value.

The Velocity data is measured in Counts/Second.

Chapter 4: Backplane Programming

A 7662 is programmed over the backplane through the input and output words assigned to it. Because these words are constantly updated, the unit implements a simple hand-shaking protocol to control when it accepts new programming data. This hand-shaking protocol is called a Programming Cycle.

Programming Cycle

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

1) Write the new programming data into the output data words with the Transmit Bit reset. This step insures that the correct data is in the output data words before the Programming Cycle begins.
2) Set the Transmit bit. A Programming Cycle is initiated when this bit makes a 0 to 1 transition.
3) Once the unit is done with the programming data, it will set any necessary error bits and the Acknowledge Bit in its input data words.
4) Once you see the Acknowledge Bit set, check for any errors. The error bits are only valid while the Acknowledge Bit is set.
5) Respond to any errors and reset the Transmit Bit.
6) The 7662 responds by resetting the Acknowledge Bit. The Programming Cycle is complete.

FLASH Parameter Memory

Parameter values are stored in a non-volatile Flash memory. This memory type can store parameter values in the absence of power for over twenty years, but you can only write to it a limited number of times before it will be damaged. The Flash Memory that AMCI uses is guaranteed for a minimum of 10,000 write cycles.

Every time you have the Apply Preset bit set during a programming cycle, the 7662 module calculates an offset and stores this value in the Flash Memory. If your application requires you to continuously Apply the Preset Value, consider doing this in the PLC instead of the 7662.

The 7662 sample programs show how to calculate and apply a preset value and are located at the following location on our website.

http://www.amci.com/sampleprograms.asp

Output Registers:

The 7662 module is configured through eight 16 bit words sent from the PLC to the module. If 7662 module was added to a CompactLogix system using the Generic Module Profile, these words will be defined as Local:X:O.data[0] to Local:X:O.data[7]. In a MicroLogix 1500 system, these words will be defined as O:X.0 to O:X.7. In both cases, the "X" indicates the slot number. The following table shows the layout of the output registers if the 7662 module was added to the CompactLogix I/O using the profile available in RSLogix 5000 V20 or above.

The functions of the output words are shown on pages 16 to 19.

Local:1:O	{...}	{...}		AM:1769_7662:O:0
+ Local:1:O.Control_Word	2#0000_00...		Binary	INT
Local:1:O.Display_Format_Ch1_0	0		Decimal	BOOL
Local:1:O.Display_Format_Ch1_1	0		Decimal	BOOL
Local:1:O.Display_Format_Ch1_2	0		Decimal	BOOL
Local:1:O.Save_Display_Format_Ch1	0		Decimal	BOOL
Local:1:O.Display_Format_Ch2_4	0		Decimal	BOOL
Local:1:O.Display_Format_Ch2_5	0		Decimal	BOOL
Local:1:O.Display_Format_Ch2_6	0		Decimal	BOOL
Local:1:O.Save_Display_Format_Ch2	0		Decimal	BOOL
Local:1:O.Program_Ch1	0		Decimal	BOOL
Local:1:O.Program_Ch2	0		Decimal	BOOL
Local:1:O.Apply_Preset_Ch1	0		Decimal	BOOL
Local:1:O.Apply_Preset_Ch2	0		Decimal	BOOL
Local:1:O.Reserved_12	0		Decimal	BOOL
Local:1:O.Disable_Ch2	0		Decimal	BOOL
Local:1:O.Clear_Errors	0		Decimal	BOOL
Local:1:O.Transmit	0		Decimal	BOOL
+ Local:1:O.Config_MSB_Number	0		Decimal	SINT
+ Local:1:O.Config_Bits	2#0000_0000		Binary	SINT
Local:1:O.Direction	0		Decimal	BOOL
Local:1:O.Velocity_Update	0		Decimal	BOOL
Local:1:O.Rising_Input	0		Decimal	BOOL
Local:1:O.Falling_Input	0		Decimal	BOOL
Local:1:O.Data_Logic	0		Decimal	BOOL
Local:1:O.Data_Type	0		Decimal	BOOL
Local:1:O.SSI_Frequency_LowBit	0		Decimal	BOOL
Local:1:O.SSI_Frequency_HighBit	0		Decimal	BOOL
+ Local:1:O.SSI_Number_Data_Bits	0		Decimal	INT
+ Local:1:O.SSI_Number_Clock_Bits	0		Decimal	INT
+ Local:1:O.SSI_Scalar_Multiplier	0		Decimal	INT
+ Local:1:O.SSI_Scalar_Divisor	0		Decimal	INT
+ Local:1:O.MSW_Preset_Value	0		Decimal	INT
+ Local:1:O.LSW_Preset_Value	0		Decimal	INT

Generic Output Data

Output Word	Function	Range	Default
0	Control Word	See description below	
1	Configuration Word	See description below	
2	Number of SSI Data Bits	1 to 28	24
3	Number of SSI (Clock) Bits	1 to 32	24
4	Scalar Multiplier	1 to Scalar Divisor	1
5	Scalar Divisor	1 to 32767	1
6	MSW Preset Value (set bit 15 for a Negative Preset Value)	0000h to 0FFFh (Upper 12 bits of preset value)	0
7	LSW Preset Value	0000h to FFFFh (Lower 16 bits of preset value)	0

Word 0: Control Word

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 09	Bit 08	Bit 07	Bit 06	Bit 05	Bit 04	Bit 03	Bit 02	Bit 01	Bit 00
Transmit	Clear Error	Disable Channel 2	0	Apply Preset Channel 2	Apply Preset Channel 1	Program Channel 2	Program Channel 1	Save Display Format 2	Display Format 2			Save Display Format 1	Display Format 1		

Bits 2, 1, and 0 define the Channel 1 Display Format for Input Words 0 to 3

Bit 2	Bit 1	Bit 0	Function
0	0	0	No Change to the Current Format
0	0	1	Data Value in words 0 & 1, and Zero in Words 2 & 3
0	1	0	Velocity in words 0 & 1, and Actual SSI Value in Words 2 & 3
0	1	1	Data Value in words 0 & 1, and Velocity in Words 2 & 3 (default)
1	0	0	Latched Value in words 0 & 1, and Actual SSI Value in Words 2 & 3
1	0	1	Data Value in words 0 & 1, and Latched Value in Words 2 & 3
1	1	0	Velocity in words 0 & 1, and Latched Value in Words 2 & 3
1	1	1	Data Value in words 0 & 1, and Actual SSI Value in Words 2 & 3

Bit 3: *Save Display Format 1*. Set to define the Channel 1 Display Format, programmed with bits 2, 1, and 0, the power up default. (When bit 3 is set, bit combination 000 is not valid.)

Control Word (Continued)

Bits 6, 5, and 4 define the Channel 2 Display Format for Input Words 4 to 7.

Bit 6	Bit 5	Bit 4	Function
0	0	0	No Change to the Current Format
0	0	1	Data Value in words 4 & 5, and Zero in Words 6 & 7
0	1	0	Velocity in words 4 & 5, and Actual SSI Value in Words 6 & 7
0	1	1	Data Value in words 4 & 5, and Velocity in Words 6 & 7 (default)
1	0	0	Latched Value in words 4 & 5, and Actual SSI Value in Words 6 & 7
1	0	1	Data Value in words 4 & 5, and Latched Value in Words 6 & 7
1	1	0	Velocity in words 4 & 5, and Latched Value in Words 6 & 7
1	1	1	Data Value in words 4 & 5, and Actual SSI Value in Words 6 & 7

Bit 7: *Save Display Format 2*. Set to define the Channel 2 Display Format, programmed with bits 6, 5, and 4, the power up default. (When bit 7 is set, bit combination 000 is not valid.)

Bit 8: *Program Channel 1 Setup*. The 7662 module will only assign the data contained in output words 1 to 7 to channel 1 if this bit is set. All of the data in words 1 to 7 must be valid when this bit is set.

Bit 9: *Program and Enable Channel 2 Setup*. The 7662 module will only assign the data contained in output words 1 to 7 to channel 2 if this bit is set. If channel 2 had been disabled, setting this bit will also enable the channel. All of the data in words 1 to 7 must be valid when this bit is set.

Bit 10 *Apply Preset Value to Channel 1*

Bit 11 *Apply Preset Value to Channel 2*

Bit 12: Reserved for future use, must be reset to zero

Bit 13: *Disable Channel 2.* (The 7662 module is shipped with channel 2 disabled. Enable channel 2 by setting bit 9, the Program and Enable Channel 2 Setup bit, and having valid setup data in output words 1 to 7.)

1: Disables Channel 2 (Bits 4, 5, and 6 must also be zero when disabling channel 2)

0: Channel 2 will stay in its current state, either enabled or disabled, when this bit is reset to zero.

Bit 14: *Clear Program Errors*

Bit 15: *Transmit Bit* (The module only acts on the data in the output registers on the 0 to 1 transition of this bit. The data in the Output Registers is ignored at all other times.)

Word 1: Configuration Word

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 09	Bit 08	Bit 07	Bit 06	Bit 05	Bit 04	Bit 03	Bit 02	Bit 01	Bit 00
SSI Frequency		Data Type	Data Logic	Falling Input	Rising Input	Velocity Update	Direction	MSB Number							

Bits 07 to 00: *MSB Number* (binary values 1 to 32, default = 1)
Bit 8: *Direction*, (0 = Positive, 1 = Negative)
Bit 9: *Velocity Update Time* (0 = 160ms, 1 = 24ms)
Bit 10: *Rising Input* (Set this bit to have the latch input capture the Data Value on the Off to On transition of the Latch Input.) This bit can be set at the same time as bit 11.
Bit 11: *Falling Input* (Set this bit to have the latch input capture the Data Value on the On to Off transition of the Latch Input.) This bit can be set at the same time as bit 10.
Bit 12: Data Logic (0 = Positive, 1 = Negative)
Bit 13: Data Type (0 = Binary, 1 = Gray Code)
Bits 15 & 14: *SSI Clock Frequency* (00=125kHz, 01=250kHz, 10=500kHz, 11=1MHz)

Output Programming Notes

1. The 7662 module only acts on the data in the output registers on the 0 to 1 transition of the Transmit Bit, output word 0 bit 15.
2. The data in words 1 to 7, the Channel Setup Parameters, is only read when either Control Word bit 8 or Control Word bit 9 is set. The data contained in words 1 to 7 is ignored at all other times.
3. Attempting to simultaneously program channels 1 and 2, by setting both bits 8 and 9, is not allowed and will generate a Programming Error.
4. Attempting to both program and disable channel 2, by simultaneously setting bits 9 and 13, is not allowed and will generate a Programming Error.
5. If channel 2 is not enabled, then setting bit 11 (Apply Preset 2) or any of the bits 4 to 7 (any change to the channel 2 display format) is not allowed and will generate a Programming Error.
6. The Preset Value has a range of ±268,435,455 (28 bits) and is divided into two words. The lower word, the LSW, contains the lower 16 bits of the value and the upper word (the MSW, contains the upper 12 bits and the sign. For example:

   Desired Preset = 567,890
   LSW = -21934 (AA52h)
   MSW = 8 (8h)

   Desired Preset = -567,890
   LSW = -21934 (AA52h)
   MSW = -32760 (8008h)

The Internal Offset generated by an Apply Preset operation will be reset to zero when the channel's setup parameters are programmed.

7. It is possible to both program the module and change the Display Format with one programming cycle.
8. It is possible to program the 7662 module to capture the Data Value on both the Off to On and On transitions of the Latch Input.

Sample Data

The following table shows sample setup data for channel 1 of the 7662 module.

Output Word	Value	Function
0	-32499 (810dh)	Bit 15 (Transmit Bit) set Bit 8 (Program Channel 1) set Bits 3, 2, and 0 set (Display format set for Data Value and Latch Value, saved on power down)
1	9221 (2405h)	Bits 15 and 14 reset, **SSI Frequency = 125kHz** Bit 13 set, **Data Type = Gray Code** Bit 12 reset, **Data Logic = Positive** Bit 11 reset, **Latch Input not active on Falling edge** Bit 10 set, **Latch Input active on Rising edge** Bit 9 set, **Velocity Update = 24ms** Bit 8 reset, **Direction = Positive** Bits 7 to 3 and 1 reset, bits 0 and 2 set, **MSB = 5**
2	20	Number of SSI Data bits = 20
3	24	Number of SSI Clock bits = 24
4	1	Scalar Multiplier = 1
5	1	Scalar Divisor = 1
6	0	Preset Value = 0
7	0	

Input Registers

The 7662 module uses eight 16 bit words to reports its data to the PLC. If 7662 module was added to a CompactLogix system using the Generic Module Profile, these words will be defined as Local:X:I.data[0] to Local:X:I.data[7]. In a MicroLogix system, these words will be defined as I:X.0 to I:X.7. In both cases, the "X" indicates the slot number. The following table shows the layout of the input registers if the 7662 module was added to the CompactLogix I/O using the profile available in RSLogix 5000 V20 or above.

The functions of the input words are shown on pages 21 to 24.

Local:1:I	{...}	{...}		AM:1769_7662:I:0
+ Local:1:I.Fault	0		Decimal	DINT
+ Local:1:I.Ch1_MSW_Value1	0		Decimal	INT
Local:1:I.Ch1_Sign	0		Decimal	BOOL
Local:1:I.Ch1_Motion_Direction	0		Decimal	BOOL
Local:1:I.Ch1_Velocity_at_Zero	0		Decimal	BOOL
Local:1:I.Acknowledge	0		Decimal	BOOL
+ Local:1:I.Ch1_LSW_Value1	0		Decimal	INT
+ Local:1:I.Ch1_MSW_Value2	0		Decimal	INT
Local:1:I.Ch1_Sign_OR_SSI_28	0		Decimal	BOOL
Local:1:I.Ch1_InputStatus_OR_SSI_29	0		Decimal	BOOL
Local:1:I.Ch1_MemoryError_OR_SSI_30	0		Decimal	BOOL
Local:1:I.Message_Ignored_OR_SSI_31	0		Decimal	BOOL
+ Local:1:I.Ch1_LSW_Value2	0		Decimal	INT
+ Local:1:I.Ch2_MSW_Value1	0		Decimal	INT
Local:1:I.Ch2_Sign	0		Decimal	BOOL
Local:1:I.Ch2_Motion_Direction	0		Decimal	BOOL
Local:1:I.Ch2_Velocity_at_Zero	0		Decimal	BOOL
Local:1:I.Programing_Error	0		Decimal	BOOL
+ Local:1:I.Ch2_LSW_Value1	0		Decimal	INT
+ Local:1:I.Ch2_MSW_Value2	0		Decimal	INT
Local:1:I.Ch2_Sign_OR_SSI_28	0		Decimal	BOOL
Local:1:I.Ch2_InputStatus_OR_SSI_29	0		Decimal	BOOL
Local:1:I.Ch2_MemoryError_OR_SSI_30	0		Decimal	BOOL
Local:1:I.Limit_Error_OR_SSI_31	0		Decimal	BOOL
+ Local:1:I.Ch2_LSW_Value2	0		Decimal	INT

Generic Input Data

16 bit Word	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 09	Bit 08	Bit 07	Bit 06	Bit 05	Bit 04	Bit 03	Bit 02	Bit 01	Bit 00
0	Status Bits 1				MSW Channel 1 Value 1											
	Acknowledge	Ch 1 Velocity at Zero0	Ch 1Motion Direction	Sign Ch 1 Value 1												
1	LSW Channel 1 Value 1															
2	Status Bits 2*				MSW Channel 1 Value 2											
	Message Ignored	Ch 1 Memory Error	Ch 1 Input Status	Ch 1 Value 2 Sign												
3	LSW Channel 1 Value 2															
4	Status Bits 3				MSW Channel 2 Value 1											
	Programming Error	Ch 2 Velocity at zero	Ch 2 Motion Direction	Sign Ch 2 Value 1												
5	LSW Channel 2 Value 1															
6	Status Bits 4*				MSW Channel 2 Value 2											
	Limit Error	Ch 2 Memory Error	Ch 2 Input Status	Ch 2 Value 2 Sign												
7	LSW Channel 2 Value 2															

* Because the Actual SSI requires 32 bits of Input Data, the Status Bits located in Input Words 2 and 6 WILL NOT be present if the Display Format of Value 2 has been programmed to show Actual SSI data.

Channel 1, Value 1: words 0 (MSW) and 1 (LSW)

Depending on the *DISPLAY FORMAT*, these values reflect the Data Value, the Velocity or the Latched Value for the respective channel. They are limited to 268,435,455 (28 bits).

Channel 1, Value 2: words 2 (MSW) and 3 (LSW)

Depending on the *DISPLAY FORMAT*, these values reflect the Velocity, the Latched Value or the Actual SSI Data for the respective channel. The Velocity and the Latched Value are limited to 268,435,455 (28 bits). The Actual SSI data requires 32 bits to display. In this case, status bits 2 will not be displayed.

Channel 2, Value 1: words 4 (MSW) and 5 (LSW)

Depending on the *DISPLAY FORMAT*, these values reflect the Data Value, the Velocity or the Latched Value for the respective channel. They are limited to 268,435,455 (28 bits).

Channel 2, Value 2: words 6 (MSW) and 7 (LSW)

Depending on the *DISPLAY FORMAT*, these values reflect the Velocity, the Latched Value or the Actual SSI Data for the respective channel. The Velocity and the Latched Value are limited to 268,435,455 (28 bits). The Actual SSI data requires 32 bits to display. In this case, status bits 4 will not be displayed.

Status Bits 1 in Word 0

Bit 12: *Channel 1, Value 1 Sign.* Set when Channel 1 Data Value 1 is negative.

Bit 13: *Channel 1 Motion Direction.* Set when the Channel 1 Data Value is decreasing. The bit remains in the last state when there is no motion.

Bit 14: *Channel 1 Velocity at Zero.* Set when there has been no motion for a period of time equal to the Velocity Update Time.

Bit 15: *Acknowledge Bit.* Set when the *Transmit Bit* in the *Control Word* is set. Reset when the *Transmit Bit* is reset.

Status Bits 2 in Word 2 (Not present when the Channel 1 Value 2 is the Actual SSI Data)

Bit 12: *Channel 1, Value 2 Sign.* Set when Channel 1 Value 2 is negative.

Bit 13: *Channel 1 Input Status*. Set when the latching input for channel 1 is active. This bit will be set if the input is active, even if the function of the input has been disabled in the channel 1 programming.

Bit 14: *Channel 1 Memory Error*. Set when the flash memory area for the Channel 1 parameters contains corrupt data. If this bit is set, the 7662 module must be returned to AMCI for repair.

Bit 15: *Message Ignored*. Set if attempt is made to change a parameter on a channel when an error already exists on the other channel. This bit will also be set if an attempt is made to Apply the Preset to a channel when an error exits.

Status Bits 3 in Word 4

Bit 12: *Channel 2, Value 1 Sign.* Set when Channel 2 Value 1 is negative.

Bit 13: *Channel 2 Motion Direction.* Set when the Channel 2 Data Value is decreasing. The bit remains in the last state when there is no motion.

Bit 14: *Channel 2 Velocity at Zero.* Set when there has been no motion for the last portion of the Velocity Update Time.

Bit 15: *Programming Error*. Set when invalid data has been transferred to the *Output Registers.* Programming errors can be cleared using the Clear Error Command or by programming valid data on the channel with the error.

A Programming Error will be set under the following conditions.

- If any of the parameters are outside of their valid ranges. (In this case, the Limit Error bit (Input Word 6 bit 15) will also be set.
- Setting the Transmit Bit without setting any of the other bits in the Control Word.
- If unused bit 12 in the Control Word is set.
- Trying to program both channels in one programming cycle.
- Setting the Save Display Format bit without changing the Display Format. That is, if the Save Display Format bit is set and all three of the Display Format bits are reset.
- Attempting to apply the preset to a disabled channel 2.
- Attempting to change the Display Format on a disabled channel 2.

Status Bits 4 in Word 6 (Not present when the Channel 2 Value 2 is the Actual SSI Data)

Bit 12: *Channel 2, Value 2 Sign.* Set when Channel 2 Value 2 is negative.

Bit 13: *Channel 2 Input Status*. Set when the latching input for channel 2 is active. This bit will be set if the input is active, even if the function of the input has been disabled in the channel 2 programming.

Bit 14: *Channel 2 Memory Error*. Set when the flash memory area for the Channel 2 parameters contains corrupt data. If this bit is set, the 7662 module must be returned to AMCI for repair.

Bit 15: *Limit Error*. Set together with the *Programming Error* bit when one or more of the setup parameters are outside of their valid ranges.

A list of valid ranges is shown below.

- If the Most Significant Bit outside of the range of 1 to 32.
- If the Number of SSI Data bits outside of the range of 1 to 28.
- If the Number of SSI Clock bits outside of the range of 1 to 32
- If the Number of SSI Clock bits is less than *(Most Significant Bit Number + (Number of SSI Data Bits – 1))*.
- If the Scalar Multiplier is outside of the range of (1 to Scalar Divisor).
- If the Scalar Divisor is outside of the range of 1 to 32767.
- If the Most Significant Word of the Preset Value is greater than 4095 (FFFh). Bit 15 in this word can be set to indicate a negative Preset Value.
- Changing the display format of channel 1 when also enabling channel 2.

Input Data Notes:

1. When Channel 2 is disabled, Value 1 and 2 in Input Words 4 to 7 will always be zero.
2. If the Display Format has been programmed for velocity, than the Sign Status bit will used to indicate when the Velocity data has exceeded 268,435,455 (28 bits).
3. The velocity data is measured in units of Counts/Second.
4. Because the PLC uses bit 15 for the sign bit, it is possible that the Least Significant words of the transferred data will be shown as negative, even though the value itself is positive.
5. All of the bits in the actual SSI Data will be set if either no sensor is attached to the module or if the sensor is not powered.

Chapter 5: Manual Revision History

Revision 0.0 was created on 10/08/04 and was the initial release of the specifications.

Revision 1.0 was released on 12/22/04. The following changes were made.

- The 5Vdc power requirements were changed from 450mA to 375mA
- A time specification of the latch input
- Valid ranges were added to the Programming Parameters in chapter 3
- Details were added to the functions of some of the programming bits
- Sample programming data was added to the output data
- Reasons that Programming Errors might be generated were added
- Reasons that Limit Errors might be generated were added

Revision 1.1 was released on 1/4/05. The following changes were made.

- The AMCI logo was placed in the header
- The General Information was moved from page 3 to page 2.
- Some of the MicroLogix references were changed to MicroLogix 1500
- The fact that the 7662 module is shipped with channel 2 disabled was emphasized with underlining and bolding.

Revision 1.2 was released on 6/16/08. The following changes were made.

- A note was added that the 7662 module must be within 7 modules of the power supply.
- The Environmental Specifications were added.
- Information that the status LEDs are tied to the function of the Latch Inputs was added.
- The name of the GND terminals was changed to I/O common.
- The information on the Scalar Multiplier and Divisor was expanded to include sensors with 1µm resolution, as was information on how to calculate the scalar values.
- Information that you must read all of the data bits from a Gray Code encoder was added

Revision 1.3 was released on 4/13/11. The following changes were made.

- Changed the name from Specifications to Manual
- Added Latch Input wiring diagrams.
- Added more detail on how channel 2 can be enabled and disabled.

Revision 1.4 was released on 3/6/2013. The following changes were made.

- Added information for adding the 7662 module to the I/O using the profile available in RSLogix 5000 V20 or higher.
- Added a wiring note that the 7662 module can be tested by wiring the clock and data signals together.