Module Overview

The AMCI 5274A High Speed Analog Data Acquisition Module is designed to read scaled analog data at a programmed sample rate, the minimum value is every 50µs, and report the data to the ControlLogix input registers. Each channel can have its own sample rate.

The module consists of the following I/O:

4 analog inputs
4 digital inputs
4 digital outputs

The 5274A module can capture and report up to 128 samples for every RPI update of the module. The 128 samples are evenly divided among the four channels.

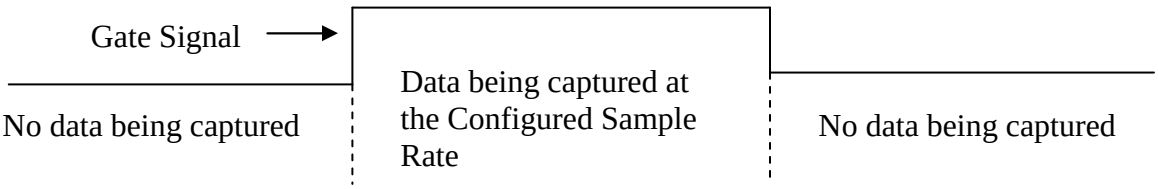
Configured Number of Channels	Maximum number of Samples per channel
1	128
2	64
3	42
4	32

The module also reports the number of analog values that have been captured in the current read cycle, allowing the user to build a larger table in the PLC's memory. A status bit in the input registers will indicate when the number of captured analog values exceeds the internal table maintained by the 5274A module.

The 5274A module will perform the capturing operation whenever a Gate Signal is active. This Gate Signal can be in the form of a bit in the output registers or one of the module's four digital inputs. The Gate Signal is level triggered.

Level Update Gate Signal

The Gate Signal can be either a backplane bit or one of the 5274A module's digital inputs. DIN0 controls Channel 0, DIN1 controls Channel 1, etc.



Another feature of the 5274A module is the ability to latch a digital output when the measured analog value is inside or outside of a programmed range. If the Low Value is less then the High Value, then the output will be on if the analog value is within the programmed range. If the Low Value is greater than the High Value, then the output will be latched if the analog value is outside of the programmed range.

The 5274A module does not contain any non-volatile memory and will have to be programmed at every power up.

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.

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

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ADVANCED MICRO CONTROLS, INC. warrants that all equipment manufactured by it will be free from defects, under normal use, in materials and workmanship for a period of [18] months. Within this warranty period, AMCI shall, at its option, repair or replace, free of charge, any equipment covered by this warranty which is returned, shipping charges prepaid, within one year from date of invoice, and which upon examination proves to be defective in material or workmanship and not caused by accident, misuse, neglect, alteration, improper installation or improper testing. The provisions of the "STANDARD WARRANTY" are the sole obligations of AMCI and excludes all other warranties expressed or implied. In no event shall AMCI be liable for incidental or consequential damages or for delay in performance of this warranty.

Returns Policy

All equipment being returned to AMCI for repair or replacement, regardless of warranty status, must have a Return Merchandise Authorization number issued by AMCI. Call (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) 585-1254. 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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Configuring the ControlLogix System

1. Open RSLogix 5000 and the project in which you want to install the AMCI 5274A 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 = 1756-MODULE
   Description = Generic 1756 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* (must be changed from the default Data DINT to Data-INT)
   Slot: *location of 5274A module*

7. Enter the Connection Parameters from the following table. You can select if the 5274A module will be used as a one, two, three, or four channel module.

Parameter	Owner Controller		Listen Only	
	Assembly Instance	Size in 16 bit words	Assembly Instance	Size in 16 bit words
	1 Channel			
INPUT	100	131	111	131
OUTPUT	194	3	195	1
CONFIGURATION	232	0	2	0
	2 Channel			
INPUT	101	133	111	133
OUTPUT	194	3	195	1
CONFIGURATION	232	0	2	0
	3 Channel			
INPUT	102	133	111	133
OUTPUT	194	3	195	1
CONFIGURATION	232	0	2	0
	4 Channel			
INPUT	103	137	111	137
OUTPUT	194	3	195	1
CONFIGURATION	232	0	2	0

8. Click on Next >
9. Set the RPI (Rate Packet Interval) Time to the desired value. To reduce the PLC scan, the recommended RPI time is 5ms. However, the minimum value for the 5274A module is 0.5ms.
10. Click on Finish >>

The module should now appear in the project tree. The Input data will be referenced as Local:X.I.Data[Y] and the output data will be referenced as Local:X.O.Data[Y] where "X" is the slot number and "Y" is the word number

An EDS file for the 5200 module is available and can be downloaded from the following page of our website. http://www.amci.com/driverfiles.asp

Module Specifications

Backplane Current Draw	610mA @ 5Vdc The module can be removed and inserted under power in accordance with ASA guidelines
Minimum Acquisition Time:	50 µS
Data Types	2's complement Integer
Scaling	User- Defined
Alarms	High / Low Alarms
Calibration	On-board Offset and Gain
Environmental Conditions	Operating Temperature: 0 to 60° C Relative Humidity: 5 to 95% without condensation Storage Temperature: -40 to 85°

Analog Inputs

Four analog inputs with 30 VDC over-voltage protection.

All inputs are capable to operate in one of four user-selectable ranges: +/- 10V, 0 – 10V, 0 – 5V, and 0-20mA. The ranges are selectable on per channel basis. The voltage inputs additionally can be selected as either single ended or differential. The current inputs can only be used as single ended inputs.

Each channel provides 14 bit resolution over a –10.25/+10.25V span. This yields 16,384 counts for the –10.25/+10.25V range, 8,192 counts for the 0-10.25V and 0-21mA range, and 4096 counts for the 0- 5.125V range. Regardless of the range selected, the user will realize a LSB change for every 1.25mV of input change.

Digital Inputs

The module provides four digital inputs, labeled DIN0 to DIN3. The inputs are jumper selectable for 5V/24Vdc operation. There is one dedicated input per channel. That is, DIN0 is used with channel 0, DIN1 is used with channel 1, DIN2 is used with channel 2, and DIN3 is used with channel 3.

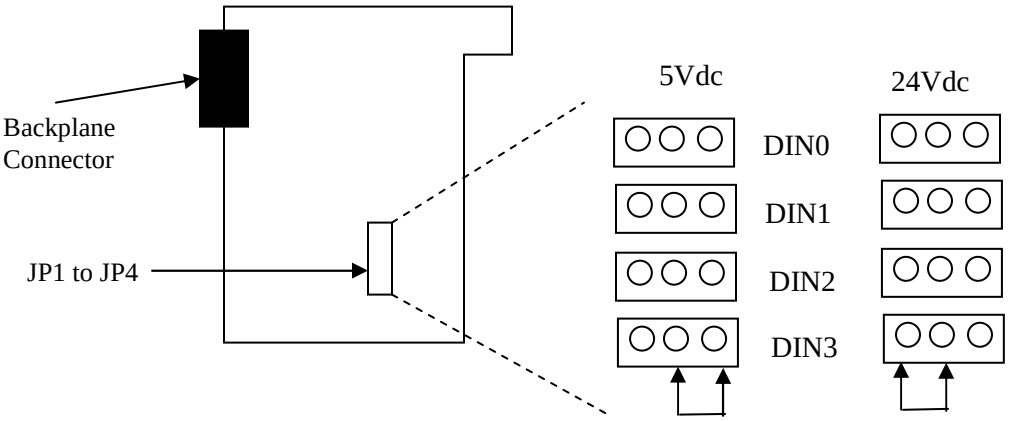
Configured for 24Vdc operation
Voltage Range: 0 to 26.4Vdc
On State ≥ 10Vdc
Off State ≤ 2Vdc
Current Draw = 25mA @24Vdc
Default Setting of all Digital Inputs

Configured for 5Vdc operation
Voltage Range: 0 to 7.5Vdc
On State ≥ 3.5Vdc
Off State ≤ 1Vdc
Current Draw = 15mA @5Vdc

Digital Inputs that are active when the module is switched from Configuration to Run Mode will be ignored.

Changing the Digital Input Voltage Level

1. Place the unit on the bench so that the board side of the unit is closer to the bench.
2. Remove the two screws holding the side panel to the unit.
3. Locate jumpers JP1 to JP4.



WARNING

The module will be damaged if 24Vdc is applied when the inputs are configured for 5Vdc

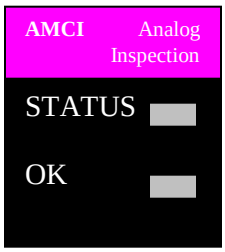
4. Place the jumper straps in the desired location. For 5Vdc inputs, place the jumper strap on the right two pins, those closer to the Removable Terminal Block, and for 24Vdc inputs, place the jumper strap on the left two pins, those farther from the removable terminal block.
5. Replace the side panel and the screws.

Digital Outputs

The module provides 4 digital outputs (DOUT0 – DOUT3). These outputs are capable of sourcing up to 0.5A each output and require a 5-24V external power supply. The outputs are optically isolated from the back plane. The outputs are pre-assigned to the corresponding analog input channels (i.e. DOUT0 is assigned to AIN0, DOUT1 is assigned to AIN1, etc.).

- The Digital Outputs are disabled at power up and will not turn on until the channel is configured.
- The outputs are sourcing and need to be loaded to function correctly.
- The Digital Outputs are used for an external indication that the analog signal is outside of a pre programmed range.
- Once on, the output will remain on until a command to reset them is received from the output registers.

Front Panel



Status LED

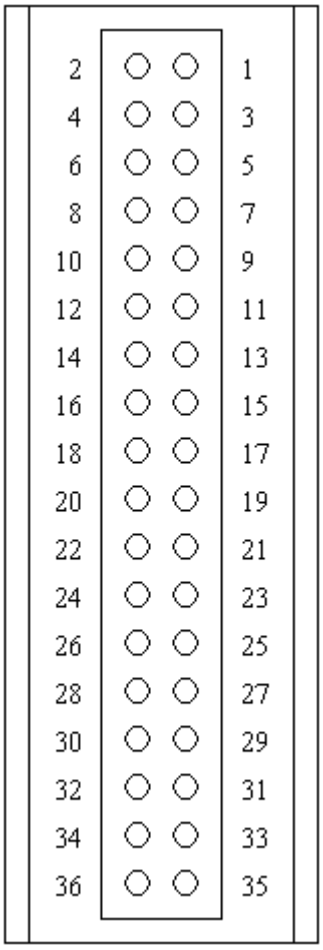
Steady RED	Module Fault
Blinking RED	Calibration Mode
Blinking GREEN	Configuration Mode
Steady GREEN	Data Acquisition (RUN) Mode

OK LED

Solid Green	Module Owned, two way communication
Blinking Green	PLC in Program Mode
Blinking Red	Communication between module and PLC Interrupted

Connector Pin-Out

The input connector consists of a Removable Terminal Block with the Rockwell Automation Part Numbers 1756-TBCH (36 position cage clamp) or 1756-TBS6H (36 position spring clamp). **The terminal block is <u>not</u> supplied with the 5274A module.**



+Analog input 1(voltage input)	2		1	+Analog input0 (voltage input)
+Analog input 1(current input)	4		3	+Analog input 0(current input)
-Analog input1	6		5	-Analog input 0
+Analog input 3(voltage input)	8		7	+Analog input 2 (voltage input)
+Analog input 3(current input)	10		9	+Analog input 2(current input)
-Analog input3	12		11	-Analog input2
Analog1/3Common	14		13	***Analog0/2Common***
Not Used	16		15	Not Used
+Digital Input0	18		17	+Digital Input1
-Digital Input0	20		19	-Digital Input1
+Digital Input2	22		21	+Digital Input3
-Digital Input2	24		23	-Digital Input3
Not Used	26		25	Not Used
Not Used	28		27	Not Used
Vdc	30		29	Vdc
Digital Output 1	32		31	Digital Output0
Digital Output3	34		33	Digital Output2
Vcom	36		35	Vcom

Vdc Pins 29 and 30 are connected internally
Vcom Pins 35 and 36 are connected internally
The Digital Outputs are sourcing and need to be loaded to function correctly

Analog Common Pins 13 and 14 are connected internally

Wiring Methods

The 5274A module support four wiring methods.

- Differential Voltage Wiring Method
- Single Ended Voltage Wiring Method
- Current Input Wiring
- Calibration Wiring

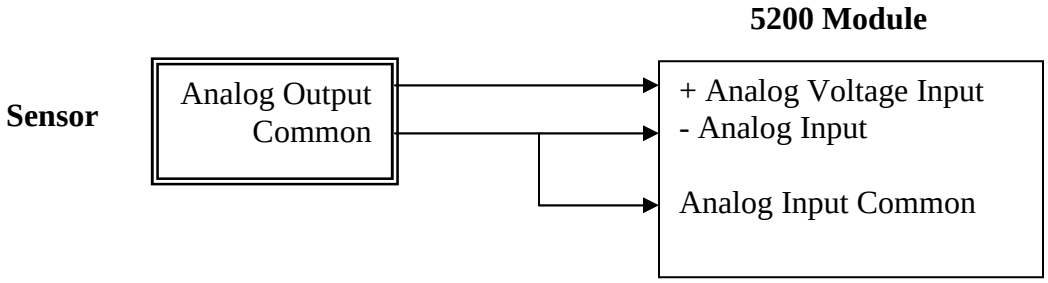
You will have to configure each of the module's four channels with your selected wiring method. This parameter is located in the Channel Configuration Programming block.

NOTE

Wiring a Single Ended sensor into an Analog Input that has been configured to operate as a Differential Input will result in only half the scale being read. For example, the output of a 0 to 10Vdc sensor will be decoded as a 0 to 5Vdc sensor.

Single Ended Voltage Wiring Method

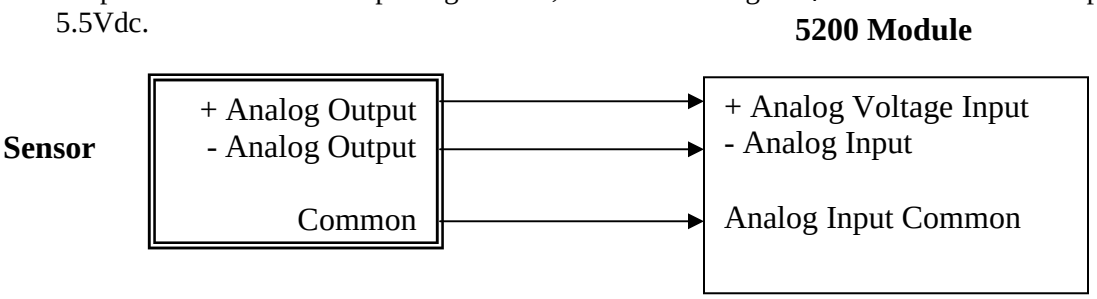
Single Ended wiring compares one side of the signal input to signal ground. This difference is used by the module in decoding the analog signal.



Differential Voltage Wiring Method

The differential wiring method is recommended for applications in which it is advantageous or required to have separate signal pairs or a common ground is not available. (However, the use of a common ground is recommended.) Differential wiring is also recommended for environments where additional noise immunity is needed.

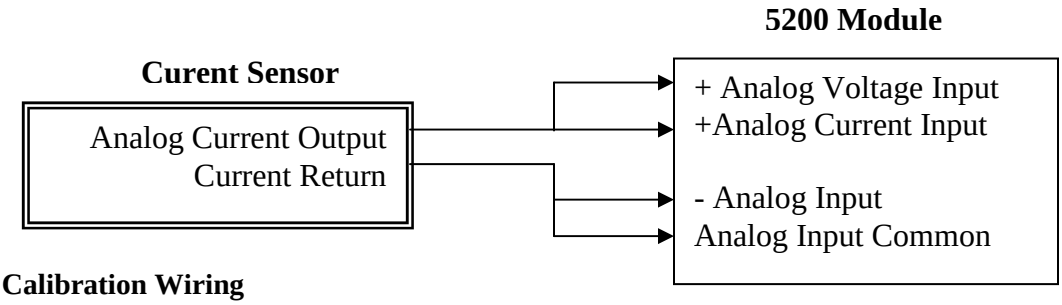
The differential output sensor will output two analog signals, one that it positive and one that is negative. For example, if your sensor is currently outputting a 5.5Vdc signal, than the +Analog Output terminal will be outputting 5.5Vdc, and the –Analog Output terminal will be outputting –5.5Vdc.



Current Input Wiring Method

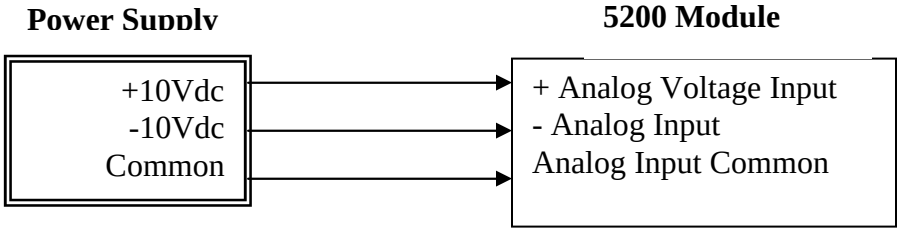
As shown in the following diagram, when wiring an Analog Current sensor to the 5274A module, the Analog Output must be wired to both the current and voltage inputs, and the Return must be wired to both the –Analog Input and the Input Common.

Current Inputs are always Single Ended, regardless of how the Input Type parameter has been programmed.



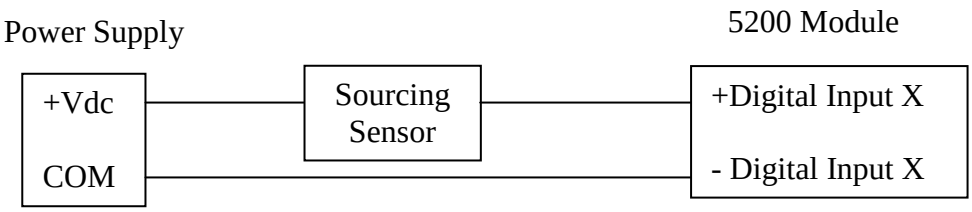
Calibration Wiring

The 5274A module will be calibrated before it leaves the factory. However, the following wiring can be used if it becomes necessary to calibrate it again. Please note that this wiring MUST be connected to each of the 5274A module's four channels.

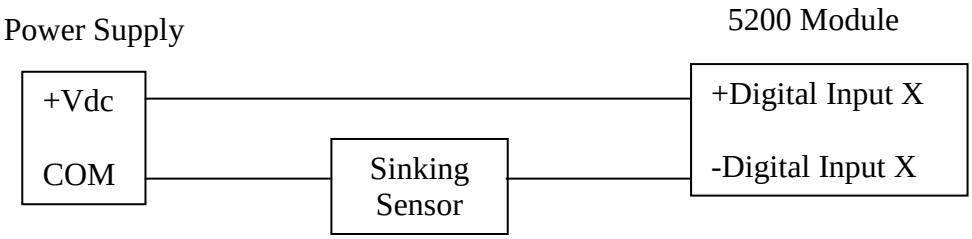


Input / Output Wiring

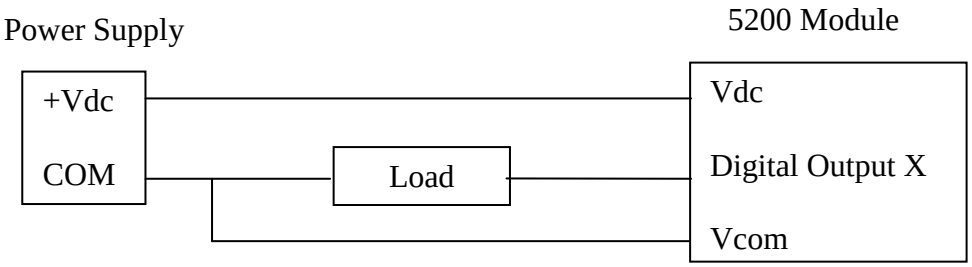
Sourcing Sensor Input Wiring



Sinking Sensor Input Wiring



Output Wiring



Operational Modes

The modules provides 3 operational modes:

- Calibration Mode
- Configuration Mode
- Measurement Mode

Calibration Mode

The module is delivered calibrated at the factory. Recalibration is done for the -10V/+10V input range by applying a known voltage reference to the analog inputs. The Calibration process is implemented through the output registers. All channels are calibrated at the same time.

Calibration Procedure

1. For best results, allow the 5274A module to be powered up for 30 minutes before calibrating.
2. Wire the unit as shown in the previous diagram.
3. Place the module in Calibration Mode by writing a value of 16#8001 into output word 0.
4. Reset output word 0 to zero.
5. Calibrate the module at the +10Vdc level by writing a value of 16#8002 into output word 0. The module will display the current internal A to D converter value, approximately 32000, in each of the channel's status words.
6. Reset output word 0 to zero.
7. Reverse the + and – 10Vdc connections.
8. Calibrate the module at the -10Vdc level by writing a value of 16#8004 into output word 0. The module will display the current internal A to D converter value, approximately -32000, in each of the channel's status words.
9. Reset output word 0 to zero.
10. Save the calibration values to the 5274A module's flash memory by writing a value of 16#8008 into output word 0
11. Reset output word 0 to zero. .
12. Exit from Calibration Mode by writing a value of 16#8010 into output word 0.
13. Reset output word 0 to zero. The calibration procedure is now complete.

Configuration Mode

At power up, the module will be in Configuration Mode and each channel will set its Not Configured Status bit in the channel status words to indicate that it needs to be configured. Configuration data consists of the following

- Input Range: +/- 10Vdc, 0 to 10Vdc, 0 to 5Vdc, 0 to 20mA
- Input Type: Differential or Single Ended
- Gate Input Type: Backplane bit or Digital input
- Engineering Units: Scales the analog values to useful numbers
- Sample Rate: The time interval at which the analog data is sampled
- Low and High Pass Values: Sets and activates an output if the measured analog value is within or outside of the programmed range

The configuration data is sent to the 5274A module using a Message Instructions in the RSLogix5000 ladder diagrams. Each channel is configured with its own message instruction.

A separate message instruction can be used to read back the configuration data currently programmed into the 5274A module. Each channel has its own read message instruction.

Engineering Units

These two word level parameters are used to scale the Analog Signal into usable units.

- The Engineering Units have a range of –32768 to 32767.
- The Low Engineering Unit value must be less than the High Engineering Unit value
- When configured to read a Voltage Analog Signal, the maximum difference between the Low and High Engineering unit is equal to

  (Upper Analog Range – Lower Analog Range) * 1000

- When configured to read a Current Analog Signal, the maximum difference between the Low and High Engineering unit is equal to 5000.

  To read the current value in 0.01mA increments, set the Low Engineering Units to 0 and the High Engineering Units to 2000.

Sample Rate

This word level parameter defines the time interval at which the analog value will be measured. This parameter has a minimum value of 50µs and is configured in 50µs increments. The maximum value is 200 for a maximum sample time of 10ms. Each channel can be programmed with its own Sample Rate. A sample rate should be selected so that the number of analog samples per RPI update does not exceed the number of samples that can be transferred at one time.

Divide the 5274A's RPI update time by the sample time to determine if your number of captured analog samples will fit in the available number of words.

Example 1: Four Channel Module = 32 samples per channel maximum
RPI time = 4ms
5274A programmed sample rate = 10
5274A sample time = (50µs * 10) = 500µs = 0.5ms

Number of Samples = RPI time / Sample Time
Number of Samples = 4ms/ 0.5ms
Number of Samples = 8 samples / RPI update

Example 2: Four Channel Module = 32 samples per channel maximum
RPI time = 4ms
5274A programmed sample rate = 1
5274A sample time = (50µs * 1) = 50µs = 0.05ms

Number of Samples = RPI time / Sample Time
Number of Samples = 4ms/ 0.05ms
Number of Samples = 80 samples / RPI update

As shown in the following table, the 5274A will set the Sampling Overflow status bit after six RPI read cycles have occurred.

Cycle	New Samples	Total # of Samples	Total Samples Transferred	Samples Stored in 5274A's memory
1	80	80	32	48
2	80	160	64	96 = (160 – 64)
3	80	240	96	144 = (240 – 96)
4	80	320	128	192 = (320 – 128)
5	80	400	160	240 = (400 – 160)
6	80	480	192	288 = (480 – 192) > 256 Sampling Overflow status bit will be set.

Measurement Mode

The 5274A module enters Measurement Mode after its channels have been successfully configured. The 5274A module can capture up to 256 samples per channel. The module also reports the number of analog values that have been captured in the current read cycle, allowing the user to build a larger table in the PLC's memory. A status bit in the channel status registers will indicate if the number of captured analog values has exceeded 256. Any captured analog values above the 256 limit will be lost.

The 5274A module will perform the capturing operation whenever a Gate Signal is active. This Gate Signal can be in the form of a bit in the output registers or one of the module's four digital inputs. The Gate Signal is always level triggered.

Measurement Cycle

The following table illustrates how the 5274A module reports its captured analog data to the PLC. This table shows the module being updated three times at the configured RPI time. The first update contains seven analog values, the second contains ten analog values, and the third contains five analog values. Unused registers will contain whatever data was left from the previous RPI update and should be ignored. For simplicity, only channel 0 is illustrated. The remaining channels would be updated in a similar manner.

Input Word	Function	RPI update 1	RPI update 2	RPI update 3
0	Module Status	Module Status	Module Status	Module Status
1	Channel 0 Status	Channel 0 Status	Channel 0 Status	Channel 0 Status
2	Number of Values	7	10	5
3	Analog Value 1	Sample 1	Sample 1	Sample 1
4	Analog Value 2	Sample 2	Sample 2	Sample 2
5	Analog Value 3	Sample 3	Sample 3	Sample 3
6	Analog Value 4	Sample 4	Sample 4	Sample 4
7	Analog Value 5	Sample 5	Sample 5	Sample 5
8	Analog Value 6	Sample 6	Sample 6	Don't Care
9	Analog Value 7	Sample 7	Sample 7	Don't Care
10	Analog Value 8	Don't Care	Sample 8	Don't Care
11	Analog Value 9	Don't Care	Sample 9	Don't Care
12	Analog Value 10	Don't Care	Sample 10	Don't Care
13+	Analog Values 11+	Don't Care	Don't Care	Don't Care

Ladder Logic Sample

The rungs on the following page show one possible method of building a table of analog samples in the PLC's memory. Only logic for channel 0 is shown. The logic for the remaining channels would be similar.

The data from the 5274A module is updated asynchronously to the program scan at the RPI time, meaning that the data can change at any point in the program scan.

The following rung buffers the data from the 5274A module by using a Synchronous Copy Instruction to copy the data to internal tags, insuring that the data used by your program remains unchanged during the entire program scan.

A CPS instruction MUST BE USED because it prevents the copy operation from being interrupted by a RPI update of the module.

The length parameter shown in this example is for a 5274A configured for four channels. The length will be 131 for a 5274A configured for one channel, or 133 for a 5274A configured for two or three channels.

The 5274A module changes the state of the New Data Available Bit each time the module sends new data to the PLC.

The following rung sets a bit for one scan when the New Data Available bit transitions from 0 to 1. This one shot bit will then be used to add the most current analog samples to a table of analog samples.

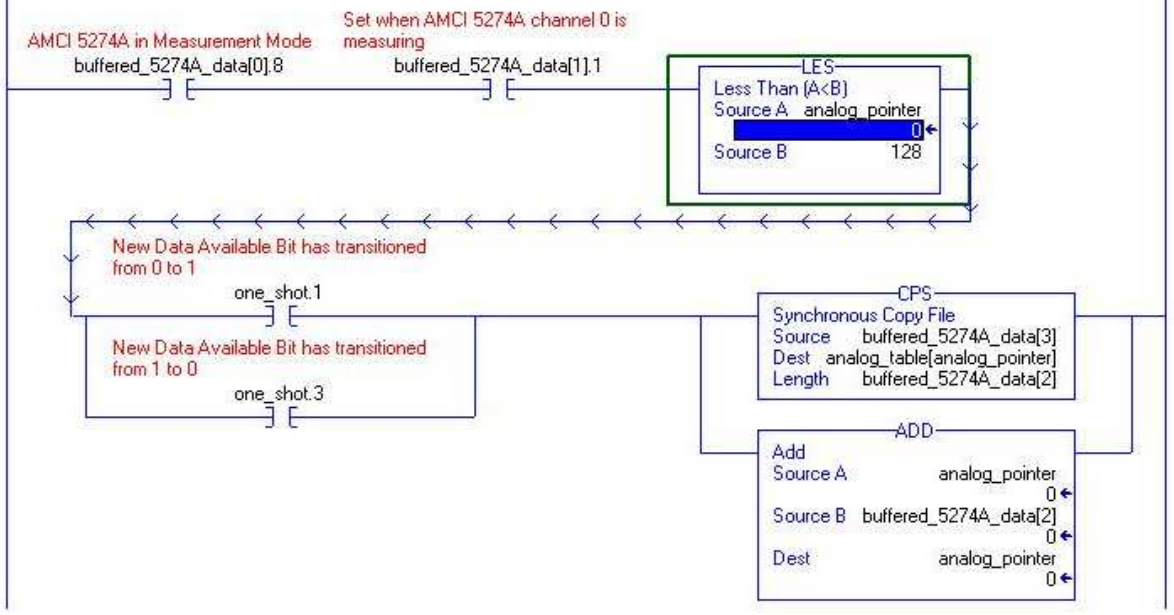
The 5274A module changes the state of the New Data Available Bit each time the module sends new data to the PLC.

The following rung sets a bit for one scan when the New Data Available bit transitions from 1 to 0. This one shot bit will then be used to add the most current analog samples to a table of analog samples.

If the 5274A is in measurement mode, if channel 0 is measuring, and if the New Data Available bit has changed state, use a CPS instruction to copy the current group of analog values from channel 0 of the 5274A module into the tag array that is being built in the PLC's memory. The number of analog values in the current RPI update of channel 0 is located in register buffered_5274A_data[1].

The PLC will fault if the value in analog_pointer exceeds the number analog values that can be stored in the destination tag array.

Also, use the number of analog values captured during the current RPI update of the module, buffered_5274A_data[1], to update the indirect address pointer that will be used to store the analog values reported during the next RPI update of the 5274A module.



Alarming:

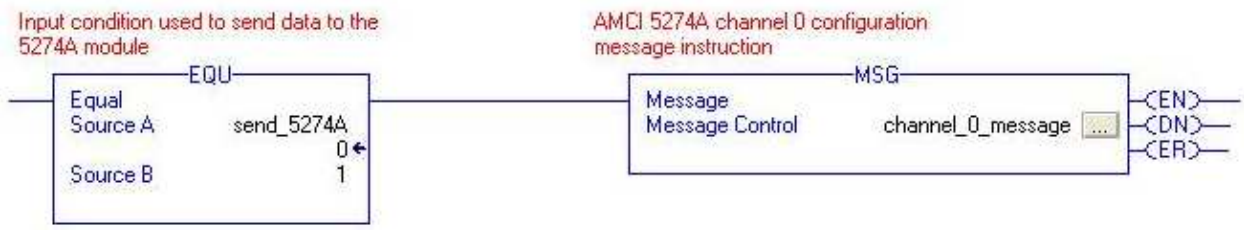
While in Measurement mode, the 5274A module will also check for both **UnderRange** and **Overrange** conditions on the Analog Inputs. The alarm condition will be indicated if the measured analog value is outside the expected range by more than 2.5%. The following table shows the maximum and minimum values based on the programmed Analog Input ranges.

Analog Input Range	UnderRange	OverRange
-10V to +10V	-10.25V	10.25V
0 to 10V	-0.25V	10.25V
0 to 5V	-0.125V	5.125V
0 to 20mA	-0.5mA	20.5mA

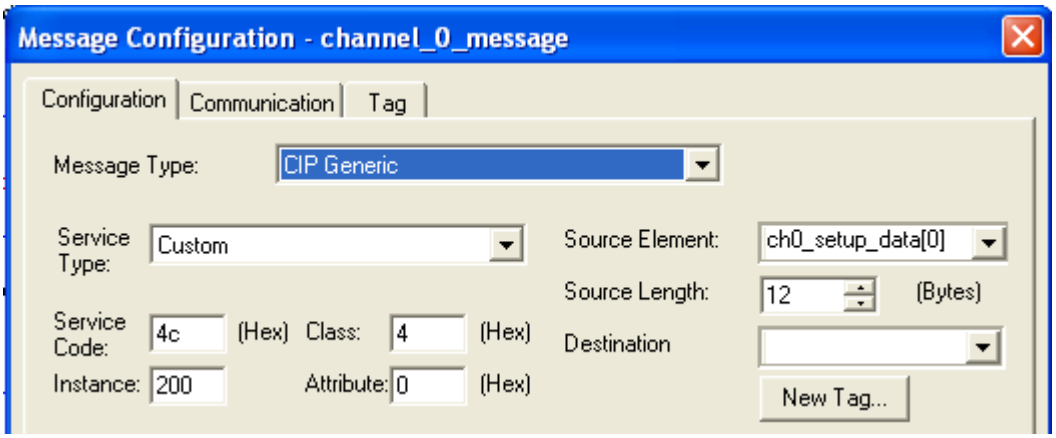
Under rage and Over range errors will be indicated by bits in the input registers.

Message Instruction Setup

Message Instructions are used to both program the 5274A module parameters, and to read and configuration data from the module. The format of this instruction is shown below.



1. A different message instruction is needed for each channel of the 5274A module.
2. The message instruction sends data to or reads data from the 5274A module only when the rung transitions from false to true.
3. The Message Control tag, channel_o_message in this example, used for Message Instruction Control must have the MESSAGE data type.
4. Clicking on the button in the Message Instruction opens the Message Configuration Window, an example of which is shown below. Enter the appropriate data for the operation being performed. When finished, click on the Apply button to accept the new data.



Message Type: CIP Generic
Service Type: Must be Custom
Service Code: 4C to write data to the 5274A module, 4B to read data from the 5274A module
Class: Must be equal to 4.
Instance: Determined by the type of data being transferred, see the table below.
Attribute: Must be set to zero.
Source Element: If the Message Instruction is being used to send data to the 5274A module, then the source parameter will be the first tag of the array that contains the data to be sent to the 5274A module.

If the Message Instruction is being used to read data from the 5274A module, than the source parameter must be left blank.

Source Length: If the Message Instruction is being used to send data to the 5274A module, then the Source Length parameter must be equal to the value shown in the following table.

If the Message Instruction is being used to read data from the 5274A module, then the Source Length Parameter must be set to zero.

Destination: If the Message Instruction is being used to send data to the 5274A module, then the Destination Parameter must be left blank.

If the Message Instruction is being used to read data from the 5274A module, then the Destination Parameter must be set to the first tag of the array where the data will be placed.

The Message Instruction is used with the following information to send data to the 5274A module.

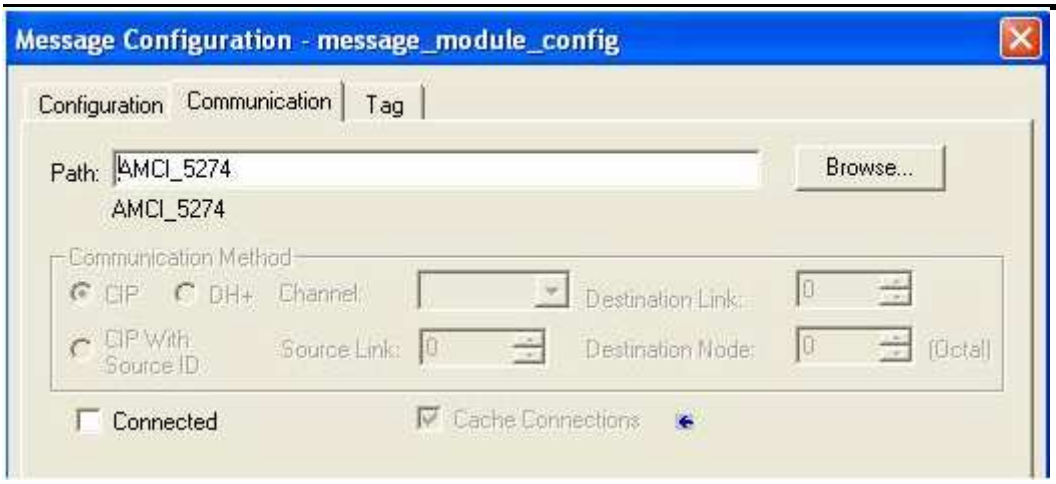
Function	Message Instruction Setup Information				Length in Bytes
Configure Channel 0	Service Code	4C	Class	4	12
	Instance	200	Attribute	0	
Configure Channel 1	Service Code	4C	Class	4	12
	Instance	201	Attribute	0	
Configure Channel 2	Service Code	4C	Class	4	12
	Instance	202	Attribute	0	
Configure Channel 3	Service Code	4C	Class	4	12
	Instance	203	Attribute	0	

The Message Instruction is used with the following information to read data from the 5274A module.

Function	Message Instruction Setup Information				Length in Words
Read Channel 0 Configuration	Service Code	4B	Class	4	6 words
	Instance	200	Attribute	0	
Read Channel 1 Configuration	Service Code	4B	Class	4	6 words
	Instance	201	Attribute	0	
Read Channel 2 Configuration	Service Code	4B	Class	4	6 words
	Instance	202	Attribute	0	
Read Channel 3 Configuration	Service Code	4B	Class	4	6 words
	Instance	203	Attribute	0	

Message Configuration – (Communication Tab)

When the Configuration window shown above is completed, click on the Communication tab. The following window will open. Click on the Browse button and set the path parameter to the slot where the 5274A module is located. All of the remaining Communication parameters can remain at their default settings.



Configuration Data

Module Configuration Data:

Word	Function	Range	Units
0	Configuration Word	See description on the next page	
1	Low Engineering Units	-32768 to 32767*	
2	High Engineering Units	(Low Units + 1) to 32767*	
3	Sample Rate	0 to 200	50µs
4	Low Setpoint	Low Engineering Units to High Engineering Units	
5	High Setpoint	Low Engineering Units to High Engineering Units	

Sample Rate

The sample rate is programmed in 50µs increments. A value of 0 or 1 will result in the Analog Value being sampled every 50µs. A value of 200 will result in the Analog Value being sampled every 10ms (50µs * 200 = 10,000µs or 10ms), the maximum time.

Engineering Units

- When configured to measure voltage, the maximum difference between the Low and High Engineering Units is equal to (Upper Analog Range – Lower Analog Range) * 1000
- When configured to measure current, the maximum difference between the Low and High Engineering Units is equal to 5000. To read the current value in 0.01mA increments, set the Low Engineering Units to 0 and the High Engineering Units to 2000.

CAUTION

Using a message instruction to send configuration data to any of the 5274A's channels will cause the module to exit measurement mode and enter configuration mode. The 5274A module does not send analog data to the PLC when it is in configuration mode.

Using a message instruction to read setup data from the 5274A will not cause the module to exit measurement mode.

Channel 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
0	0	0	0	0	0	0	0	0	0	0	0	0=backplane bit gate 1-digital input gate	Input Type 0 = differential 1= single ended	Analog Input Range	

Analog Input Range

Bit 1	Bit 0	Function
0	0	-10Vdc to +10Vdc
0	1	0Vdc to +10Vdc
1	0	0Vdc to +5Vdc
1	1	0 to 20mA

Extended Error Codes

The Message Instructions used to communicate with the 5274A module have an error register that can be used to obtain diagnostic information from the module. This register's address is *user_tag*.exerr. The following table shows the values that will be displayed in this register if the data sent to the 5274A module is not valid.

Extended Error Codes	Meaning
1	One or more of the unused bits in the configuration words are set
2	Invalid Engineering Units • Set if the difference between the Low and High Engineering units are outside the following ranges Voltage Span = (Upper Analog Range – Lower Analog Range) * 1000 Current Span = 5000 • Set if the Low and High Engineering Units are equal
3	Set if the any of the channels Sample Rate values are outside the range of 0 to 200.
4	Invalid Low / High Setpoints, • Set if the Low / High setpoints are outside the range of the programmed Low / High Engineering Units. • If the Low / High Setpoints are equal, including if both are zero
5	
6	
7	Trying to program, both read and write, an undefined channel.

- These error codes are only valid when register address *user_tag.err* is equal to F.
- The Message Instructions Error bit and the Extended Error Code can only be cleared by sending valid data to the 5274A module.

Input Data: (Data sent from the 5274A module to the PLC)

The data consists of between 131 and 137 sixteen bit input words, depending on the number of configured channels, and is read by the PLC at the RPI time.

One Channel Configuration Input Data

Word	Channel	Function	Units
0	all	Module Status	See Description Below
1	0	Channel 0 Status	See Description Below
2	0	Number of Values	
3	0	Analog Value 1	Scaled Counts
4	0	Analog Value 2	Scaled Counts
5	0	Analog Value 3	Scaled Counts
6 to 130	0	Analog Values 4 to 128	Scaled Counts

Two Channel Configuration Input Data

Word	Channel	Function	Units
0	all	Module Status	See Description Below
1	0	Channel 0 Status	See Description Below
2	0	Number of Values	
3	0	Analog Value 1	Scaled Counts
4	0	Analog Value 2	Scaled Counts
5	0	Analog Value 3	Scaled Counts
6 to 66	0	Analog Values 4 to 64	Scaled Counts
67	1	Channel 1 Status	See Description Below
68	1	Number of Values	
69	1	Analog Value 1	Scaled Counts
70	1	Analog Value 2	Scaled Counts
71	1	Analog Value 3	Scaled Counts
72 to 132	1	Analog Values 4 to 64	Scaled Counts

Three Channel Configuration Input Data

Word	Channel	Function	Units
0	all	Module Status	See Description Below
1	0	Channel 0 Status	See Description Below
2	0	Number of Values	
3	0	Analog Value 1	Scaled Counts
4	0	Analog Value 2	Scaled Counts
5	0	Analog Value 3	Scaled Counts
6 to 44	0	Analog Values 4 to 42	Scaled Counts
45	1	Channel 1 Status	See Description Below
46	1	Number of Values	
47	1	Analog Value 1	Scaled Counts
48	1	Analog Value 2	Scaled Counts
49	1	Analog Value 3	Scaled Counts
50 to 88	1	Analog Values 4 to 42	Scaled Counts
89	2	Channel 2 Status	See Description Below
90	2	Number of Values	
91	2	Analog Value 1	Scaled Counts
92	2	Analog Value 2	Scaled Counts
93	2	Analog Value 3	Scaled Counts
94 to 132	2	Analog Values 4 to 42	Scaled Counts

Four Channel Configuration Input Data

Word	Channel	Function	Units
0	all	Module Status	See Description Below
1	0	Channel 0 Status	See Description Below
2	0	Number of Values	
3	0	Analog Value 1	Scaled Counts
4	0	Analog Value 2	Scaled Counts
5	0	Analog Value 3	Scaled Counts
6 to 34	0	Analog Values 4 to 32	Scaled Counts
35	1	Channel 1 Status	See Description Below
36	1	Number of Values	
37	1	Analog Value 1	Scaled Counts
38	1	Analog Value 2	Scaled Counts
39	1	Analog Value 3	Scaled Counts
40 to 68	1	Analog Values 4 to 32	Scaled Counts
69	2	Channel 2 Status	See Description Below
70	2	Number of Values	
71	2	Analog Value 1	Scaled Counts
73	2	Analog Value 2	Scaled Counts
74	2	Analog Value 3	Scaled Counts
75 to 102	2	Analog Values 4 to 32	Scaled Counts
103	3	Channel 3 Status	See Description Below
104	3	Number of Values	
105	3	Analog Value 1	Scaled Counts
106	3	Analog Value 2	Scaled Counts
107	3	Analog Value 3	Scaled Counts
108 to136	3	Analog Values 4 to 32	Scaled Counts

Module Status 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
Acknowledge bit	New Data Available	0	0	0	In Calibration Mode	In Configuration Mode	In Measurement Mode	Digital Input 3 status	Digital Input 2 status	Digital Input 1 status	Digital Input 0 status	Error Codes 0001 = Invalid Command 0010 = Invalid Mode 0011 = Not Calibrated 0100 = Not Configured 0101 = Invalid Calibration Polarity 0110 = Save in Flash error 0111 = reserved 1XXX = reserved			

Notes

1. The 5274A module will always power up in Configuration Mode, bit 9 set. Attempting to enter measurement mode before using message instructions to configure all of the available channels will cause an Error Code of 0100. This error will remain until all of the available channels have been configured.
2. A 5274A module that has not been calibrated will power up in Calibration Mode.
3. **Input Status bits 4 to 7** will always report the status of the Digital Inputs, regardless of operating mode, if the channel is available, or if the channel has been configured to use the digital input.

Channel Status Word (Each channel has its own status 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	0	0	0	0	0	0	0	0	Digital Output active	Over range alarm	Under range alarm	Analog value is outside the programmed Low / High range	Sampling Overflow	Measurement Operation occurring	Not Configured

Not Configured: (bit 0) Set when the specified channel has not been configured. The 5274A will set this bit at power up to indicate that it needs to be configured.

Measurement Operation Occurring: (bits1) Set when the analog value is being measured and being reported to the input registers.

Sampling Overflow: (bit 2) Set when the number of analog values captured on a channel exceeds 256. Each channel has an internal buffer of 256 values.

Analog value is outside the programmed Low / High range: (bit 3) Set when the measured analog value is inside or outside of the programmed Low / High range. If the Low Value is less then the High Value, then this bit will be on if the analog value is within the programmed range. If the Low Value is greater than the High Value, then this bit will be on if the analog value is outside of the programmed range. This bit, and the output, will remain on until the **Reset Out of Range Condition** bit is set in the Output Control Registers during a programming cycle.

Under Range Alarm: (bit 4) Set to indicate that the Analog Signal is below the valid level for the programmed Analog Input Range. The most likely cause is a broken sensor cable. This bit is cleared using the Reset Under / Over Range Command. The Analog Data will be stop changing when the Under Range Alarm bit is set.

Over Range Alarm: (bit 5) Set to indicate the Analog Signal is above the valid level for the programmed Analog Input Range. The most likely cause is a broken sensor cable. This bit is cleared using the Reset Under / Over Range Command. The Analog Data will be stop changing when the Over Range Alarm bit is set.

Digital Output Active (bit 6) Set to indicate that the channel's Digital Output is active. The output will be active under the same conditions as bit 3, the analog value is outside the programmed Low / High Range, above.

New Data Available:(bit 14) This bit will change state, 0 to 1 or 1 to 0, each time the 5274A module sends new data to the PLC, giving you the ability to create logic that only occurs when this bit changes state, or to create an Event Driven Task that runs when this bit changes state.

Acknowledge Bit: (bit 15) This bit is set whenever the Transmit Bit in the Output Registers is set and indicates that the 5274A module has received the new programming data. The 5274A module will reset this bit when it detects that the Transmit Bit has been reset, and the module is ready to accept new commands and or programming data from the PLC.

Input Data Notes

1. The data from the 5274A module is updated at the RPI time asynchronously to the program scan. AMCI recommends that the input data be buffered before it is used by the ladder logic program.
2. The 5274A module maintains its own internal table of 256 captured analog values per channel.

   If the number of captured analog values exceeds the number of samples that can be transmitted at one time, for example 128 samples for a 5274A configured as a one channel module or 32 samples for a 5274A module configured as a four channel module, then the extra values will be stored in the 5274A's internal table and will be transmitted as the first value(s) at the beginning of the next RPI update of the 5274A module.

3. The 5274A module will set the Sampling Overflow bit if the number of internally stored analog values exceeds 256. Any extra analog values will be lost.

Output Data (Data Sent from the PLC to the 5274A at the RPI time)

The 5274A module supports a limited number of real-time commands. .

Word	Name	Function	Range
0	Command Word		See description below
1	Control Word 1	Control Word for channels 0 & 1	See description below
2	Control Word 2	Control Word for channels 2 & 3	See description below

Command 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 bit	0	0	0	0	0	0	0	0	0	0	Exit Calibration Mode	Save Calibration in Flash Memory	Calibrate at -10Vdc	Calibrate at +10Vdc	Calibration Mode

Control Word 1

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	0	0	Ch 1 Reset under / over range errors	Ch 1 Reset sampling overflow	Ch 1 Reset out of range condition	Ch 1 Blackplane gate bit	0	0	0	0	Ch 0 Reset under / over range errors	Ch 0 Reset sampling overflow	Ch 0 Reset out of range condition	Ch 0 Blackplane gate bit

Control Word 2

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	0	0	0	Ch 3 Reset under / over range errors	Ch 3 Reset sampling overflow	Ch 3 Reset out of range condition	Ch 3 Blackplane gate bit	0	0	0	0	Ch 2 Reset under / over range errors	Ch 2 Reset sampling overflow	Ch 2 Reset out of range condition	Ch 2 Blackplane gate bit

Output Data Notes:

1. The 5274A module is programmed with a programming cycle consisting of a Transmit Bit and an Acknowledge Bit. The module will only accept commands, and act on the state of the bits in Control Words 1 and 2, on the 0 to 1 transition of the Transmit Bit.
2. The following is a list of valid data that can be written into the Command Word

   16#8000 = Real Time command, causing the 5274A module to act on the data in Control Words 1 and 2
   16#8001 = Enter Calibration Mode
   16#8002 = Calibrate at +10Vdc
   16#8004 = Calibrate at -10Vdc
   16#8008 = Save Calibration in Flash Memory
   16#8010 = Exit Calibration Mode

   All other combinations will cause an invalid command error

3. All unused bits will be considered "don't cares."
4. To have the 5274A module constantly report the analog values without the use of inputs, use a message instruction to configure the gate type to be Backplane Bit, set the Backplane Gate bit in the output registers to 1, and set the Transmit Bit as part of a programming cycle.
5. Once an Out Of Range condition has been detected, it will remain latched until the channel detects that the **Reset Out of Range Condition bit** has transitioned from 0 to 1 during a programming cycle. This command will also reset the channel's associated Digital Output.
6. The **Reset Sampling Overflow** resets all of the captured Analog values currently stored in the 5274A module.

   If the gate signal remains active, the module will report however many analog values have been captured between receiving this command and when the module is next updated at the RPI time.

7. Once the Over range and Under range condition has bee detected, it will remain latched unit the channel detects that the **Reset Under / Over range bit** has transitioned from 0 to 1 during a programming cycle.
8. The backplane gate bit will be ignored if the channel's digital input has been selected as the gate signal.

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.

a. 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.
b. Set the Transmit bit. A Programming Cycle is initiated when this bit makes a 0 to 1 transition.
c. 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.
d. Once you see the Acknowledge Bit set, check for any errors.
e. Respond to any errors and reset the Transmit Bit.
f. The 5274A module responds by resetting the Acknowledge Bit. The Programming Cycle is complete.

Specification / Manual Revision History

Revision 0.0 was released on 7/15/10 and was the first preliminary version released.

Revision 1.0 was released on 7/22/10. The following changes were made.

- Removed the edge triggering
- Added different assembly instances for different number of channels
- Added that each channel has an internal buffer of 256 values
- Added programming cycle with a Transmit Bit and an Acknowledge Bit
- Added Calibration Mode register

Revision 1.1 was released on 4/13/11. The following changes were made.

- Changed the specifications so that it is always a maximum of 128 samples divided out over the four channels.

Revision 1.2 was released on 2/4/2015. The following changes were made.

- Changed the title from Specifications to Manual.
- Added an overall module status word.
- Changed the structure of the output words so that the first word is command and the next two words are control words.
- Modified and Corrected errors in the Assembly instance table.
- Added Digital Input Status bits to the module status input word.
- Added New Data Available toggling bit.
- Increased the maximum sample rate from 40 to 200, 2ms to 10ms