

32-Channel Analog Input Module

(Cat. No. Quantum Automation Series 140 AxI 05x 00sc)

Installation Instructions

Input Module Catalog Number:

140 ACI 052 00sc

Selectable Current or Voltage
with Time Stamp

PREFACE

- ☞ Note: Power, input and output (I/O) wiring must be in accordance with Class I, Division 2 wiring methods [Article 501-4 (b) of the National Electrical Code, NFPA 70] and in accordance with the authority having jurisdiction.”
- ☞ Note: Peripheral equipment must be suitable for the location in which it is used.



WARNING

ELECTROSTATICALLY SENSITIVE COMPONENTS

EXPLOSION HAZARD

Substitution of components may impair suitability for Class I, Division 2.



WARNING

EXPLOSION HAZARD

Do not disconnect equipment unless power has been switched off or the area is known to be non hazardous.



WARNING

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, and D or non-hazardous locations only.

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WARNING

EXPLOSION HAZARD

When in hazardous locations, turn off power before replacing or wiring modules.

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Chapter 1 OVERVIEW

The Time Stamp is one out of a series of four modules. The differentiation between the four different modules is shown in the table below.

* 140 ACI 050 00sc	current only
* 140 AVI 050 00sc	voltage only
* 140 ACI 051 00sc	current or voltage combination
140 ACI 052 00sc	current or voltage combination with time and date stamping

* These modules are covered in a separate manual (Publication #0300169).

Each module will accept 32 single ended analog inputs. The inputs will be divided into four groups of eight inputs each. Each group will have 15V isolation to the other groups. Analog inputs within a group will have 0V of isolation channel-to-channel. All inputs will have 500V ac isolation channel-to-backplane.

The module has been designed for projects that include large quantities of analog inputs. Process control and data acquisition applications for industries such as utilities, waste water, oil and gas, food and beverage, and building automation are ideally suited for this module. The time and date stamp feature is perfect for remote terminal unit (RTU) applications or for supervisory control and data acquisition (SCADA) applications requiring programmable alarm levels.

Input channels include over voltage circuit protection, over and under range detection and active notch filtering. The voltage mode of the module handles four different voltage ranges and the current mode handles two current ranges. You can configure the module to provide data in one of four data formats. Set up of the module is very simple through the use of configuration and status registers using Concept, Modsoft or Taylor programming software.

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1.1 Inputs

The 32 channels are separated into four groups of eight. Each group can be configured for a different voltage or current range. The ranges available are as follows:

Current Ranges

- 4-20 mA, 0-20 mA

Voltage Ranges:

- $\pm 10\text{VDC}$, 0-10VDC, 0-5VDC, 1-5VD

The module can provide data to the PLC in the following formats:

- 12 bit (0 to 4095)
- signed 15 bit (-32768 to +32767)
- unsigned 16 bit (0 to 65535)
- DVM (0 to 10000)

1.2 LEDs

The module has a front LED panel that includes 35 LEDs:

Ready LED -

1 Green LED indicates module's self test has passed and is ready to communicate.

Active LED -

1 Green LED indicates BUS communication is established between the module and the rack.

Fault LED -

1 Red LED indicates a module self test error, or fatal H/W error. A blink code will indicate the type of self test error. Count the number of blinks before a pause to determine the error code in the table below.

Fault LED Blink Code

Blink #	Fault
3	DPM Test Error
4	CPU Error
5	Watchdog Timer Error
6	RAM Error
7	Flash EPROM CRC Error
8	Calibration EEPROM Error

Channel LED -

32 Green LEDs indicates the channel is enabled and a valid input signal level is present. The LED is off if the channel is disabled. A blinking LED indicates

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1.3 Related Publications

- *Modicon Modsoft Programmer User Manual.* 890 USE 115 00
- *Modicon TSX Quantum Automation Series Hardware Reference Guide.* 840 USE 100 00
- IEEE Std 518- 1977, *Guide for the Installation of Electrical Noise Inputs to Controllers from External Sources*
- IEEE Std 142- 1982, *Recommended Practice for Grounding of Industrial and Commercial Power Systems*
- *Noise Reduction Techniques in Electronic Systems*, by Henry W. Ott; published by Wiley-Interscience of New York in 1976

Chapter 2

MODULE SETUP FOR MODSOFT

2.1 General Information

Six steps must be performed in order to fully configure the Quantum system in preparation for using the ACI 052 00sc:

- Step 1: Modsoft programming software must be updated so that the 140 ACI 052 00sc is recognized in the software (see Section 2.2).
- Step 2: Select the appropriate slot location using the Modsoft I/O map. Choose the first 3x and 4x level registers to be used in the system for the module's data, configuration and status information (see Section 2.3).
- Step 3: Zoom screens for the module must be set to match application requirements (see Section 2.4).
- Step 4: The 4x configuration register must be set to meet application requirements (see Section 4.1).
- Step 5: Module status information is available to you. The various options must be understood and chosen to meet your application requirements (see Section 4.2 and Section 4.3).
- Step 6: Ladder rungs must be written to demultiplex the incoming 8 data registers to 32 user selected data registers (see Section 6.3).

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2.2 Installation of new run time files

If you are using the Modsoft programming software version 2.4 or 2.5, it is necessary to update the following runtime files in order for Modsoft to recognize your module. Versions prior to 2.4 are not supported. Version 2.6 and newer already include these updates.

LMSFDT.SYS	Zoom screens
GCNFTCOP.SYS	I/O Map module definitions
QUANTUM.SYS	Quantum help screens

This may be accomplished by first identifying the pathname where you have installed your Modsoft programming software and the drive letter of the floppy drive from which you intend to install. A typical pathname assuming installation of the C: drive is as follows:

```
C:\MODSOFT
```

The new runtime files required to use all versions of this module are supplied on the 3.5 inch MSDOS formatted floppy disk titled:

“Quantum Runtime Files,” Spectrum Controls, Inc Part Number: 20500121-xx

To install these files, operate your PC in MSDOS mode, perform the following command:

```
C:>XCOPY A:*.SYS C:\MODSOFT\RUNTIME
```

+ Note: This assumes you are installing from drive A: and that you have previously installed Modsoft in the directory C:\MODSOFT. If not, you must make the appropriate substitutions.

2.3 General information on data register usage and terminology:

A total of nine 3x level and nine 4x level registers are used by the 140 ACI 052 00sc. After you have completed the runtime file installation, you can go to the I/O Map screen and choose the 140 ACI 052 00sc by selecting the desired slot, pressing <Shift + ?> which will display the modules available for configuration into that slot. For module specific help, press <ALT + H>. After selecting the module, you must set the first 3x and 4x level registers to be used. This will then automatically capture nine consecutive 3x level and nine 4x level registers for use by the module. The architecture for this 32-channel module is as follows:

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4x	Configuration Word
4x+1	*Time of Day Clock Control Word
4x+2	Day of Week (Sun+1 Mon+2 etc.)
4x+3	Month (1-12)
4x+4	Day of Month (1-31)
4x+5	Year (00-99)
4x+6	Hour (00-23)
4x+7	Min (00-59)
4x+8	Sec (00-59)

3x + 0	Data Input Word 1
3x + 1	Data Input Word 2
3x + 2	Data Input Word 3
3x + 3	Data Input Word 4
3x + 4	Data Input Word 5
3x + 5	Data Input Word 6
3x + 6	Data Input Word 7
3x + 7	Data Input Word 8
3x + 8	Status Word

*Bit 2 of Time of day clock control word must be set or the PLC will not read clock values definitions specified. Write either a 4000hex or 6000hex into the first location allocated for the PLC time of day clock. Refer to the MODSOFT programming manual for more information on the time of day clock usage.

Note: The PLC time of day clock is read once at power up from registers 4x+1 through 4x+8. The module's internal clock chip is synchronized with the PLC clock at this time. After power up, the module clock is synchronized with the PLC clock at least once a day. (See Section 4.2 for more details.)

The ACI 052 00sc multiplexes 32 channels of data into four groups of eight channels. Each group can be selected through the 4x Configuration Word or can automatically sequence through all four groups channels.

3x + 0	Data Input Word 1	}	Group 1	Chn 1-8
3x + 1	Data Input Word 2		Group 2	Chn 9-16
3x + 2	Data Input Word 3		Group 3	Chn 17-24
3x + 3	Data Input Word 4		Group 4	Chn 25-32
3x + 4	Data Input Word 5			
3x + 5	Data Input Word 6			
3x + 6	Data Input Word 7			
3x + 7	Data Input Word 8			

2.4 Zoom Screen Configuration

For Zoom Screen operation, please refer to Modicon's Modsoft Programmer User Manual.

+ Note: To enter zoom screens from the I/O map menu, highlight the module entry and press the keys <ALT - Z>.

Most of the module set up will be done through the Modsoft zoom screens. The zoom screen set up establishes the following parameters:

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- Calibration rate
- Filter Frequency Selection
- Input Data Format
- Input Range
- Differential Mode

The primary zoom screen for this module is shown in Figure 2.1. By selecting a particular parameter, you will be given the options associated with that parameter. Note that some parameters are set only once for the entire module, and others are set once for each group of eight inputs.

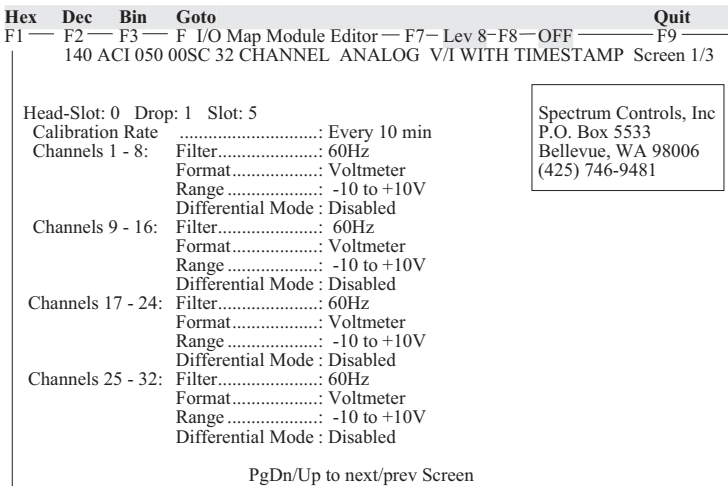


Figure 2.1

- **Calibration rate:** The Quantum module performs an on board system calibration at power up. The system calibration corrects for temperature drift of the Analog to Digital Converter (ADC) and related circuitry. System calibration can be performed periodically based on the calibration rate selected below. This can affect the update time for the module. For installations where the ambient temperature surrounding the I/O rack can change relatively quickly, the user might consider going to a more frequent calibration selection in order to improve the accuracy of the reading being taken. The autocalibration schedule rate may be selected from the following:

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Once at power up only
Every 1 min
Every 10 min [default]
Every 30 min

Selecting an autocalibration schedule rate is an exercise in tradeoffs. Performing autocalibration more frequently may result in greater accuracy due to variations caused by environmental factors such as temperature. This accuracy has a cost in the burden imposed by performing the calibration. The calibration time is a function of the filter frequency. Calibration times are listed below. The system cannot update the channel data while performing calibration. In addition, if multiple filter frequencies are selected, calibrations for each frequency and the execution time is cumulative. The worst case calibration time is when all filter frequencies are enabled (10, 50, 60 and 1000 Hz). The time is then the total for all four times listed below. Also, note that the channel enables have no effect on the auto calibration feature. If a filter frequency is enabled via the zoom screens, then the autocalibration is performed for the frequency.

10 Hz	1,420 msec
50 Hz	397 msec
60 Hz	260 msec
1000 Hz	45 msec

- ❑ **Filter Frequency Selection:** The Analog-to-Digital Conversion performs a filter function on the input signal. One of the following filter frequencies may be selected for each of the four groups of eight channels:

Filter:	10 Hz	
	50 Hz	
	60 Hz	[default]
	1000 Hz	

- ❑ **Input data format:** One of the following data formats may be selected for each of the four groups of eight channels:

Format:	16-bit Format	
	Voltmeter	[default]
	12-bit Format	
	15-bit plus sign Format	

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+ Note: The module's format selection must be compatible with the register format selected in Modsoft.

- **Input Range:** Module must support current input to select voltage or current. One of the following input ranges may be selected for each of the four groups of eight channels:

Range:	-10 to +10 V	[default Voltage or V/I Modules]
	1 to +5V	
	0 to +5V	
	0 to +10V	
	4 to 20mA	[default Current Modules]
	0 to 20mA	

- **Differential mode:** One of the following acquisition modes may be selected for each of the four groups of eight channels. Differential mode calculates the difference between two consecutive channel inputs and provides the data to the register assigned for the first channel in the pair. The second channel's output is zero. The data acquisition between the two channels is not synchronized so common mode noise on the signal pair may not be fully removed, however DC offsets should be compensated for correctly.

⚠ Note: The channel pairs are not being updated simultaneously, this could lead to an error in the actual differential value that is calculated. See figure 2.1

Differential Mode: Disabled [default]
Enabled

Hex	Dec	Bin	Goto	Quit
F1	F2	F3	F	F9
I/O Map Module Editor - F7 - Lev 8 - F8 - OFF				
140 ACI 050 00SC 32 CHANNEL ANALOG V/I WITH TIMESTAMP Screen 2/3				
Head-Slot: 0 Drop: 1 Slot: 5				Spectrum Controls, Inc P.O. Box 5533 Bellevue, WA 98006 (425) 746-9481
Alarm/Timestamp Mode.: Disabled				
Alarm/Timestamp Update: Scrolling Mode				
Alarm Limits (Channels 1 through 16)				
Assume same data format and range as used for the relevant channel pair.				
Channels	1 and 2	LOW = -10000	DEC	HIGH = 10000 DEC
Channels	3 and 4	LOW = -10000	DEC	HIGH = 10000 DEC
Channels	5 and 6	LOW = -10000	DEC	HIGH = 10000 DEC
Channels	7 and 8	LOW = -10000	DEC	HIGH = 10000 DEC
Channels	9 and 10	LOW = -10000	DEC	HIGH = 10000 DEC
Channels	11 and 12	LOW = -10000	DEC	HIGH = 10000 DEC
Channels	13 and 14	LOW = -10000	DEC	HIGH = 10000 DEC
Channels	15 and 16	LOW = -10000	DEC	HIGH = 10000 DEC
PgDn/Up to next/prev Screen				

Figure 2.2

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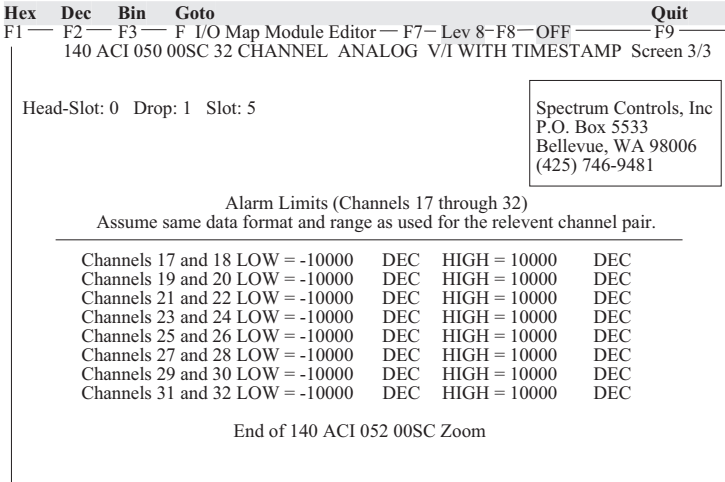


Figure 2.3

- **Alarm Enable:** The second zoom screen, shown in figure 2.2, allows the user to enable or disable alarms. Alarms are disabled by default. If enabled, the limits defined by the user are used to monitor input signals for alarm conditions and any alarm events will be captured along with a time stamp for that event. Otherwise, no alarms will be captured.

When an alarm occurs, the appropriate channel error flag for the appropriate group is set in the status word (4x bits 1 through 8). The user may then read each alarm in that group (up to 4 channels) by setting the mode select bits to the Read Time Stamp Output mode (see Chapter 4.1). If no alarm exists, all data will be 0.

When in the Read Time Stamp Output mode, the group select meaning is different than it is in Read data and Read Channel Status modes. Only two channels of information is available when reading time stamps. The time stamp read channel select settings are as follows (see Section 4.1 for more detail):

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Time stamp channel select (4x+0 bits 13-16)

0000 = Channels 1-2	1000 = Channels 17-18
0001 = Channels 3-4	1001 = Channels 19-20
0010 = Channels 5-6	1010 = Channels 21-22
01001 = Channels 7-8	1011 = Channels 23-24
0101 = Channels 9-10	1100 = Channels 25-26
0101 = Channels 11-12	1101 = Channels 27-28
0110 = Channels 13-14	1110 = Channels 29-30
0111 = Channels 15-16	1111 = Channels 31-32

The Time Stamp register format is:

$N = (\text{Channel Select} * 2) + 1$

3x+0	1 .. 16: Chan N..: Data word.
3x+1	1 .. 16: Chan N..: Timestamp: Secs/*SSC BCD.
3x+2	1 .. 16: Chan N..: Timestamp: Hour/Min BCD.
3x+3	1 .. 16: Chan N..: Time stamp: Month/Day BCD.
3x+4	1 .. 16: Chan N+1: Data word.
3x+5	1 .. 16: Chan N+1: Timestamp: Secs/*SSC BCD.
3x+6	1 .. 16: Chan N+1: Timestamp: Hour/Min BCD.
3x+7	1 .. 16: Chan N+1: Timestamp: Month/Day BCD.

* The Sub Seconds Count (SSC) field is not an even time period count such as seconds. Instead, it is a counter which increments whenever an alarm occurs at the same Hour/Min/Sec setting the previous alarm. This field insures unique time stamps for alarms detected within the same second.

- Alarm Timestamp Update Mode:** The alarm timestamp update mode may be set to scrolling or latched. In scrolling mode any new events will be captured and the time stamp will reflect the last time at which an alarm existed for that channel pair. If the channel pair moves out of an alarm condition, then the time stamp would reflect the exact time that this occurred. In latched mode only the first event will be captured and saved until the alarm is cleared. In either case, the alarm will be cleared by reading it.

 Note: Time Stamp data is stored in RAM and will be lost if system power is lost for any reason.

- Alarm Limits:** The second and third zoom screens (figured 2.2 and 2.3) allow the user to define sixteen unique alarm limits. Each alarm is defined with a high and low setpoint. Each limit applies to two adjacent channel The data format for the alarm must match the format for that channel's group as assigned in the first zoom screen. For example, if group 1 configured as a -10V to +10V range and DVM format, a low of -5000 and a high of 5000 will trigger alarms at voltages less than or equal to -5V and voltages above +5V respectively.

Chapter 3

MODULE SETUP FOR CONCEPT

3.1 General Information

Six steps must be performed in order to fully configure the Quantum system in preparation for using the ACI 052 00sc:

Step 1: Concept programming software (Version 2.1 or newer) must be updated so that the 140 ACI 052 00sc is recognized in the software (see Section 3.2).

Step 2: Select the appropriate slot location using the Concept I/O map editor. Choose the first 3x and 4x level registers to be used in the system for the module's data, configuration and status information (see Section 3.3).

Step 3: Parameters for the module must be set to match application requirements (see Section 3.4).

Step 4: The 4x configuration register must be set to meet application requirements (see Section 4.1).

Step 5: Module status information is available to you. The various options must be understood and chosen to meet your application requirements (see Section 4.2 and Section 4.3).

Step 6: Ladder rungs must be written to demultiplex the incoming 8 data registers to 32 user selected data registers (see Section 6.3).

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3.2 Installation of new run time files

The 140 ACI 052 00sc is manufactured by Spectrum Controls, Inc. Follow the Concept installation procedure for outsourced modules. This requires the install disk provided with your module, which includes the following files (assuming drive A:):

A:\CONCEPT\SPECTRUM.MDC	- Spectrum I/O for Quantum Module Definition file.
A:\CONCEPT\SPECTRUM.HLP	- Spectrum I/O for Quantum Help file.

To update the Concept database with a new Spectrum I/O module:

1. Insert the install disk into drive A:
2. Start the Concept Modconnect Tool (Modconf.exe).
3. Open the installation file "SPECTRUM.MDC"
4. Select the module to add or press the "Add All" button
5. Save the changes before exiting the Modconnect tool.

This will update the Concept database permanently unless you later undo the changes using the Modconnect Tool, or perform a new Concept software install.

3.3 General information on data register usage and terminology:

A total of nine 3x level and nine 4x level registers are used by the 140 ACI 052 00sc. After you have completed adding the modules the Concept installation using the Modconnect tool, you can add a module to a drop by using the Concept Configurator as follows:

1. Open an existing or create a new project.
2. Select the Configurator from the project pulldown menu.
3. Select Configure then select the I/O map menu.
4. On the I/O map menu, press the EDIT button for the appropriate drop.
5. Push the button in the module select column for the appropriate slot.
6. Select the desired module from the list of available modules.
7. Enter the starting 3x register address (InRef). Nine registers are automatically allocated.
8. Enter the starting 4x register address (OutRef). One register is allocated.
9. Press the parameters button.
10. Verify register values are correct for the desired behavior.

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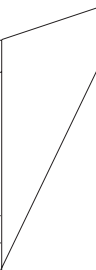
The register data formats are discussed in the following section.

4x	Configuration Word	3x + 0	Data Input Word 1
4x+1	*Time of Day Clock Control Word	3x + 1	Data Input Word 2
4x+2	Day of Week (Sun+1 Mon+2 etc.)	3x + 2	Data Input Word 3
4x+3	Month (1-12)	3x + 3	Data Input Word 4
4x+4	Day of Month (1-31)	3x + 4	Data Input Word 5
4x+5	Year (00-99)	3x + 5	Data Input Word 6
4x+6	Hour (00-23)	3x + 6	Data Input Word 7
4x+7	Min (00-59)	3x + 7	Data Input Word 8
4x+8	Sec (00-59)	3x + 8	Status Word

*Bit 2 of Time of day clock control word must be set or the PLC will not read clock values definitions specified. Write either a 4000hex or 6000hex into the first location allocated for the PLC time of day clock. Refer to the MODSOFT programming manual for more information on the time of day clock usage.

 Note: The PLC time of day clock is read once at power up from registers 4x+1 through 4x+8. The module's internal clock chip is synchronized with the PLC clock at this time. After power up, the module clock is synchronized with the PLC clock at least once a day. (See Section 4.2 for more details.)

The ACI 052 00sc multiplexes 32 channels of data into four groups of eight channels. Each group can be selected through the 4x Configuration Word or can automatically sequence through all four groups channels.

3x + 0	Data Input Word 1		Group 1	Chn 1-8
3x + 1	Data Input Word 2		Group 2	Chn 9-16
3x + 2	Data Input Word 3		Group 3	Chn 17-24
3x + 3	Data Input Word 4		Group 4	Chn 25-32
3x + 4	Data Input Word 5			
3x + 5	Data Input Word 6			
3x + 6	Data Input Word 7			
3x + 7	Data Input Word 8			

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3.4 Concept I/O Map Module Parameters:

Concept programming software does not implement zoom screens for ModConnect partner modules and allows only direct editing of the I/O configuration parameters using 16 bit hex values.

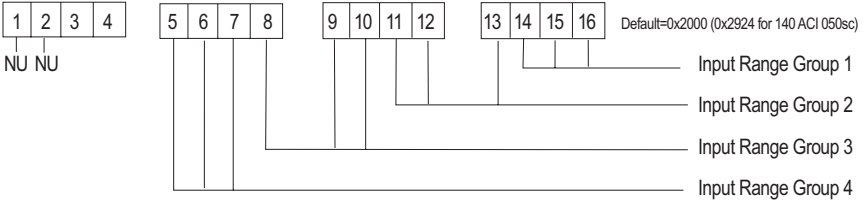
From the Concept main screen, highlight the “configure” pull-down menu and choose “I/O Map.” In the I/O Map screen insert the number for the correct “drop” and choose “edit.” Select the Spectrum Controls catalog number that you wish to use from the list presented. When the screen appears, representing the Spectrum module you have selected, highlight the parameters button. You must insert Hex values for registers #1, 2 and 3 to fully configure the module. The format that will instruct you how to create the I/O map parameters is listed below. For each of the parameters listed below we have provided a detailed explanation in Chapter 2. Please refer to detailed functional descriptions in the MODSOFT zoom screen discussions (Section 2.4). You must go through each of the options below to establish the correct pattern for each of these three registers. Once you have the bit pattern, then you can convert each to a four-digit Hex value that is used in the parameters screen.

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Selecting Input Ranges: Register 1



Range Selection Bit Pattern:

Range for Group 1				Range for Group 2			
Bit 14	Bit 15	Bit 16	Description	Bit 11	Bit 12	Bit 13	Description
*0	0	0	-10V to +10V	*0	0	0	-10V to +10V
0	0	1	+1V to +5V	0	0	1	+1V to +5V
0	1	0	0V to +5V	0	1	0	0V to +5V
0	1	1	0V to +10V	0	1	1	0V to +10V
*1	0	0	0 to 20mA	*1	0	0	0 to 20mA
1	0	1	4 to 20mA	1	0	1	4 to 20mA
1	1	0	Not valid	1	1	0	Not valid
1	1	1	Not valid	1	1	1	Not valid

Range for Group 3				Range for Group 4			
Bit 8	Bit 9	Bit 10	Description	Bit 5	Bit 6	Bit 7	Description
*0	0	0	-10V to +10V	*0	0	0	-10V to +10V
0	0	1	+1V to +5V	0	0	1	+1V to +5V
0	1	0	0V to +5V	0	1	0	0V to +5V
0	1	1	0V to +10V	0	1	1	0V to +10V
*1	0	0	0 to 20mA	*1	0	0	0 to 20mA
1	0	1	4 to 20mA	1	0	1	4 to 20mA
1	1	0	Not valid	1	1	0	Not valid
1	1	1	Not valid	1	1	1	Not valid

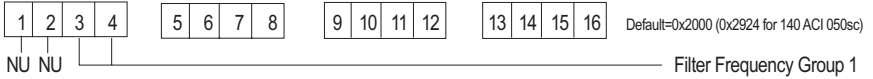
* The default range is 0 to 20 mA for the 140 ACI 050sc current only module. Otherwise it is -10V to +10V

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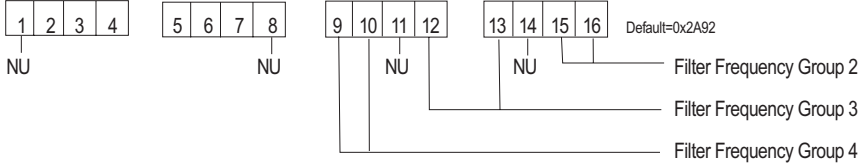
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Selecting Filter Frequencies: Register 1



Selecting Filter Frequencies: Register 2



Range Selection Bit Pattern:

Filter for Group 1			
Reg 1	Bit 3	Bit 4	Description
	0	0	10 Hz
	0	1	50 Hz
	*1	0	60 Hz
	1	1	1000 Hz

Filter for Group 2			
Reg 2	Bit 15	Bit 16	Description
	0	0	10 Hz
	0	1	50 Hz
	*1	0	60 Hz
	1	1	1000 Hz

Filter for Group 3			
Reg 2	Bit 12	Bit 13	Description
	0	0	10 Hz
	0	1	50 Hz
	*1	0	60 Hz
	1	1	1000 Hz

Filter for Group 4			
Reg 2	Bit 9	Bit 10	Description
	0	0	10 Hz
	0	1	50 Hz
	*1	0	60 Hz
	1	1	1000 Hz

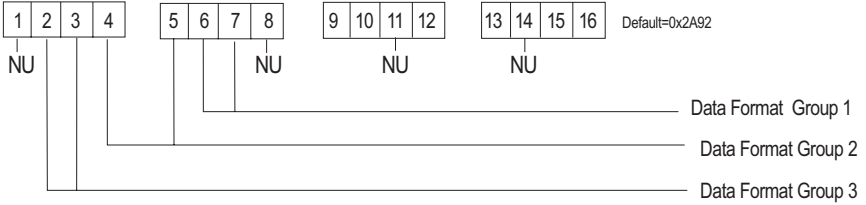
* The default filter frequency is 60 Hz.

Installation Instructions

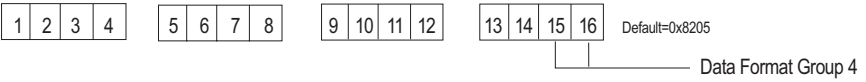
32-Channel Analog Input Module

Quantum Series 140 ACI 052 00sc

Selecting Data Format: Register 2



Selecting Data Format: Register 3



Range Selection Bit Pattern:

Data for Group 1

Reg 2	Bit 6	Bit 7	Description
	0	0	16 Bit
	*0	1	DVM
	1	0	12 Bit
	1	1	15 Bit

Range for Group 2

Reg 2	Bit 4	Bit 5	Description
	0	0	16 Bit
	*0	1	DVM
	1	0	12 Bit
	1	1	15 Bit

Range for Group 3

Reg 2	Bit 2	Bit 3	Description
	0	0	16 Bit
	*0	1	DVM
	1	0	12 Bit
	1	1	15 Bit

Range for Group 4

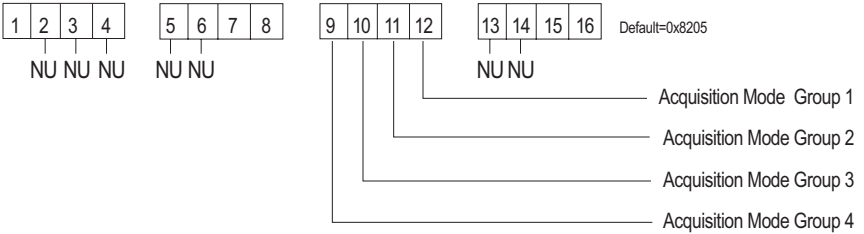
Reg 3	Bit 15	Bit 16	Description
	0	0	16 Bit
	*0	1	DVM
	1	0	12 Bit
	1	1	15 Bit

* The default data format is 10,000 DVM.

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Selecting Channel Acquisition Mode: Register 3



Acquisition Mode Bit Pattern:

Mode for Group 1

Reg 3	Bit 12	Description
	*0	Single Ended
	1	Differential Pairs

Mode for Group 2

Reg3	Bit 11	Description
	*0	Single Ended
	1	Differential Pairs

Mode for Group 3

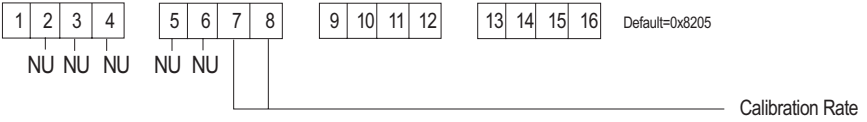
Reg 3	Bit 10	Description
	*0	Single Ended
	1	Differential Pairs

Mode for Group 4

Reg3	Bit 9	Description
	*0	Single Ended
	1	Differential Pairs

* The default channel acquisition mode is single ended inputs.

Selecting the Calibration Rate: Register 3



Calibration Rate:

Bit 7	Bit 8	Description:
0	0	Once at power up only.
0	1	Once every 60 seconds.
*1	0	Once every 10 minutes.
1	1	Once every 30 minutes.

* The default calibrate rate is once every 10 minutes.

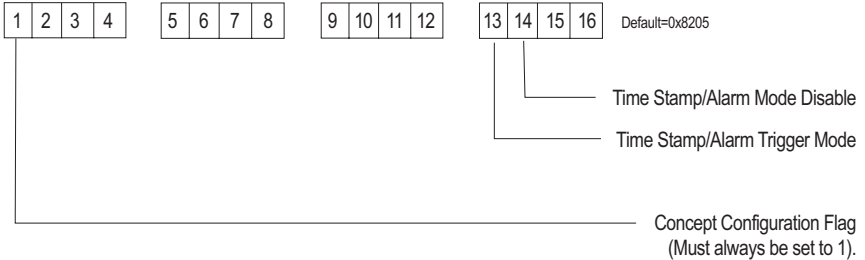
Once you have established the correct bit pattern for each of these three registers, you can convert each to a four digit Hex value that is used in the parameters screen. A Hex conversion table follows:

0	0	0	0	=	0
0	0	0	1	=	1
0	0	1	0	=	2
0	0	1	1	=	3
0	1	0	0	=	4
0	1	0	1	=	5
0	1	1	0	=	6
0	1	1	1	=	7
1	0	0	0	=	8
1	0	0	1	=	9
1	0	1	0	=	A
1	0	1	1	=	B
1	1	0	0	=	C
1	1	0	1	=	D
1	1	1	0	=	E
1	1	1	1	=	F

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Selecting the Calibration Rate: Register 3



Bit 14	Timestamp Disable:
0	Timestamp Alarm Mode Enabled
*1	Timestamp Alarm Mode Disabled

Bit 13	Timestamp Trigger:
*0	Scroll (Store most recent event)
1	Latch (Save first event only)

*The default for the timestamp mode is disable = TRUE.

Setting the Alarm Limits: Registers 4-19

The default for the timestamp trigger is scroll (trigger on all events to save most recent). The Concept Configuration Flag must be set to a “1” when using Concept software. Registers 4-19 are used to set alarm limits. Each alarm is defined with a high and low setpoint. Each limit applies to four channels.

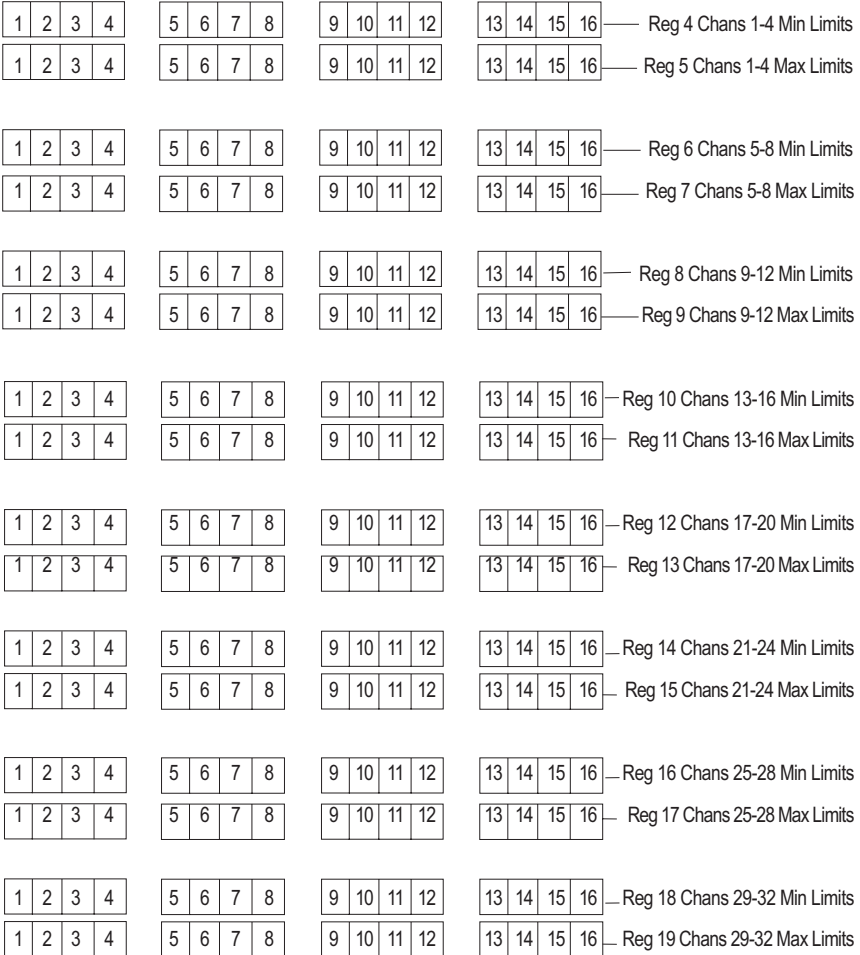
ⓘ Note: The Concept time stamp alarm values apply to groups of four input channels. Modsoft zoom screens allow for alarm values to be set for groups of two input channels.

The data format for the alarm must match the format for that channel’s group as assigned in the first zoom screen. For example, if group 1 configured as a -10V to +10V range and DVM format, a low of -5000 and a high of 5000 will trigger alarms at voltages less than or equal to -5V and voltages above +5V respectively.

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The default for min setpoints is -10,000 (D8F0 hex) and for max setpoints is 10,000 (2710 hex). The setpoint values must be in the same format as specified for its respective channel data format and input range. For example, the default setpoints assume an input range of -10V to +10V and a data format of DVM.

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3.5 Spectrum I/O Configuration Utility

“SCIOCFG.EXE” is a utility provided on the install disk under the typical pathname “A:\CONCEPT\SCIOCFG.EXE”. “SCIOCFG.EXE” is intended to help users configure Spectrum I/O when using Concept. This tool is intended to make the configuration of I/O modules supplied by Spectrum Controls easy to accomplish when using Concept.

Version 2.1 of the Concept programming software introduced the tool for importing ModConnect module definition files into the Concept database. This allows Concept users to configure ModConnect I/O such as the 140 AxI 05x 00sc. However, Concept V2.1 does not provide a means for ModConnect I/O developers to design their own I/O configuration menus. Instead, Concept provides a generic interface where the user must enter configuration parameters in hexadecimal values. The Spectrum I/O modules are designed to be feature rich with an efficient use of registers. This requires the user to be intimately aware of the initialization parameters structure in order to perform simple I/O configuration changes. Simply stated, users can calculate the correct hexadecimal values for the configuration parameters but it is a tedious task, SCIOCFG is designed to relieve the user of this burden.

SCIOCFG presents the user with user friendly selection lists using standard Windows interfaces. SCIOCFG also automatically constrains all parameters to legal values during the data entry process.

SCIOCFG may be run in one of two modes, stand alone mode, or synchronous mode. In the stand alone mode, the user configures the data for a given module as desired. SCIOCFG then presents the parameters in hexadecimal values so the user may then manually transfer this data to Concept at a later time.

In the synchronous mode, SCIOCFG runs in the background waiting for the user to select the generic I/O parameters configuration menu for any one of the modules supported. When this occurs, SCIOCFG reads the data from the Concept generic I/O parameter configuration menu, and activates the appropriate I/O parameter configuration menu. When the user clicks on the SCIOCFG OK button, the new data is sent back to Concept.

3.6 SCIOCFG.EXE Installation:

SCIOCFG.EXE is a 32-bit Windows program requiring Windows 95 or newer. Installation of SCIOCFG.EXE is simple. Copy the SCIOCFG.EXE file from the installation disk to the desired directory. Then you may add a shortcut to the windows desktop or add the program to the windows taskbar using standard windows techniques.


e.g. From a DOS window:

```
C:\>MD C:\SCIOCFG
```

```
C:\> COPY A:\CONCEPT\SCIOCFG.EXE C:\SCIOCFG
```

To add a shortcut: 1. Place the mouse cursor on an open area of the windows desktop.

2. Click the right mouse button.
3. Select the "New" option.
4. Select the "Shortcut" option.
5. Enter the full install pathname. E.G. C:\SCIOCFG\SCIOCFG.EXE

 **Note** :The user may optionally configure SCIOCFG to always run in either the stand alone mode or the synchronous mode. To do this, place a space in one of the following strings immediately after the full pathname:

```
NO_SYNC
```

```
SYNC_WITH_CONCEPT
```

```
E.G. C:\SCIOCFG\SCIOCFG.EXE SYNC_WITH_CONCEPT
```

6. Name as desired.
7. Activate the "Finish" button.

To add to Windows Programs Selections or a Folder:

1. Click and hold the left mouse button on the taskbar start button.
2. Select "Settings, "Taskbar" and release the mouse button.
3. Select the "Start Menu Programs" tab index.
4. Press the Add button.
5. Choose an existing folder (perhaps the Concept programming folder) or create a new folder to hold SCIOCFG.EXE.
6. Add SCIOCFG.EXE as described for adding shortcuts step 5.

SCIOCFG EXE is ready to run.

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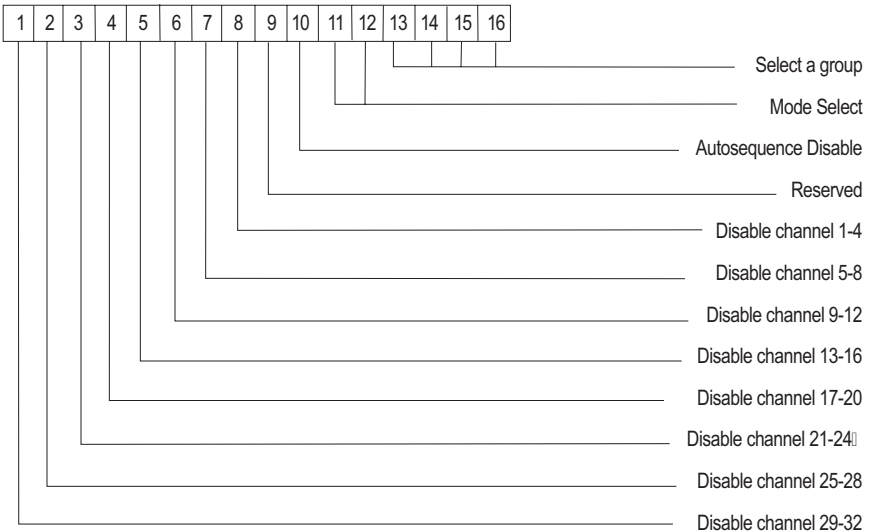
The SCIOCFG.EXE should be running as a background task, whenever Concept software is being used to change the configuration registers of the 140 AxI 05x 00sc series of modules. Start SCIOCFG.EXE by double clicking on the SCIOCFG.EXE icon, then start Concept software.

Chapter 4

MODULE CONFIGURATION AND STATUS

The 140 ACI 052 00sc uses a total of nine 3x level and nine 4x level registers. After Modsoft (Section 2.3) or Concept (Section 3.3) software is installed, additional configuration and status registers are set as follows:

4.1 Configuration word format (Register 4x)



4x Group Channel Disable: Bits 1-8

These bits are used to fine tune the response time of your system. They enable data acquisition on eight groups of four channels each. A “0” enables the group, a “1” disables the group. Disabling groups of channels improves system response time.

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32-Channel Analog Input Module Quantum Series 140 ACI 052 00sc

- Bit 8: Channels 1-4
- Bit 7: Channels 5-8
- Bit 6: Channels 9-12
- Bit 5: Channels 13-16
- Bit 4: Channels 17-20
- Bit 3: Channels 21-24
- Bit 2: Channels 25-28
- Bit 1: Channels 29-32

4x Reserved: Bit 9

Bit 9 is reserved. Bit 9 should be set to a “0.”

4x Autosequence Disable: Bit 10

When Autosequence Disable is active (Bit 10=1), the module reads only the eight channels identified by the Group Select Bits. If Autosequence Disable is inactive (Bit 10=0), the Autosequence mode will be in effect. When in autosequence mode, the module ignores the channel group select in the 4x+0 configuration word, and instead sequences through all four groups automatically.

The values in the eight data registers belong to the group identified in the status word group ID (3x+9 bits 15 and 16). The user must set aside 32 registers as a permanent image of the channel data. During run time, the ladder need only determine the current group for the eight data registers (3x+0 through 3x+7) in order to determine where the data should be copied into the 32 register channel image.

When autosequence is disabled, the user must manually increment the group select in the configuration word and the module sends back only the data requested.

Sample ladder logic for both techniques is provided in section 6.3.

4x Data Input Mode: Bits 11, 12

The module continuously outputs a group of eight registers worth of data. The data for a given group can be paged between three modes. These are the standard channel input data, channel status data or Time stamp data.

Bit 1	Bit 2	Input Modes
0	0	Data
0	1	Status
1	0	Time Stamp

4x Group Select: Bits 13, 14, 15, 16

These four bits are used to select a desired group of channels when the Auto Sequence mode is not used. The group selection is used when autosequence is disabled to allow ladder to control which group of the module's input data, status data, and time stamp data is being read from the module. The channel Status Mode disables the normal data input mode and reports the status on the selected group of eight channels. The channel status bits echo back the selected input range data format and error status. See description under "Status Mode operation."

Date and Channel Status:

Bit 13	Bit 14	Bit 15	Bit 16	Group
0	0	0	0	Channels 1-8
0	0	0	1	Channels 9-16
0	0	1	0	Channels 17-24
0	0	1	1	Channels 25-32

Time Stamp Alarms:

Bit 13	Bit 14	Bit 15	Bit 16	Group
0	0	0	0	Channels 1-2
0	0	0	1	Channels 3-4
0	0	1	0	Channels 5-6
0	0	1	1	Channels 7-8
0	1	0	0	Channels 9-10
0	1	0	1	Channels 11-12
0	1	1	0	Channels 13-14
0	1	1	1	Channels 15-16
1	0	0	0	Channels 17-18
1	0	0	1	Channels 19-20
1	0	1	0	Channels 21-22
1	0	1	1	Channels 23-24
1	1	0	0	Channels 25-26
1	1	0	1	Channels 27-28
1	1	1	0	Channels 29-30
1	1	1	1	Channels 31-32

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4.2 Time of Day Configuration (Register 4x+1 to 4x+8)

4x	Configuration Word	3x + 0	Data Input Word 1
4x+1	*Time of Day Clock Control Word	3x + 1	Data Input Word 2
4x+2	Day of Week (Sun+1 Mon+2 etc.)	3x + 2	Data Input Word 3
4x+3	Month (1-12)	3x + 3	Data Input Word 4
4x+4	Day of Month (1-31)	3x + 4	Data Input Word 5
4x+5	Year (00-99)	3x + 5	Data Input Word 6
4x+6	Hour (00-23)	3x + 6	Data Input Word 7
4x+7	Min (00-59)	3x + 7	Data Input Word 8
4x+8	Sec (00-59)	3x + 8	Status Word

*Bit 2 of Time of day clock control word must be set or the PLC will not read clock values definitions specified. Write either a 4000hex or 6000hex into the first location allocated for the PLC time of day clock. Refer to the MODSOFT programming manual for more information on the time of day clock usage.

 Note: The PLC time of day clock is read once at power up from registers 4x+1 through 4x+8. The module's internal clock chip is synchronized with the PLC clock at this time. After power up, the module clock is synchronized with the PLC clock at least once a day.

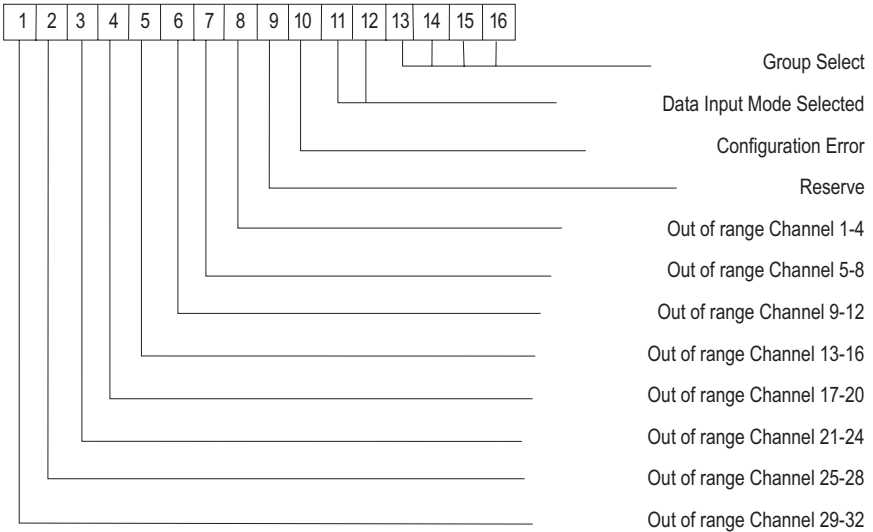
To configure the time of day clock in Modsoft, start the Configuration Overview menu and tab to the Overview, Specials selections. Cursor to the Time of Day Clock and map the first register to the second 4x register of the module. For example, if the module is mapped to 400001-400009, map the time of day clock to 400002-400009.

To configure the time of day clock in Concept, select the project Configurator, then select Configure Specials. Cursor to the Time of Day Clock and map the first register to the second 4x register of the module. For example, if the module is mapped to 400001-400009, map the Time of Day Clock to 400002-400009.

Either method maps the Time of Day Clock to overlay one module. If more than one module is installed in the system, you must reserve additional registers and use ladder to copy the Time of Day Clock values into the additional module's 4x register set. All eight registers must be copied. For example, if an additional module were mapped to 40010-40019, ladder would need to be added to copy 40002-40009 to 40012-40019.

4.3 Module status information (Register 3x+8)

The information provided in this register is generic information about this module. Bits 1-8 and 10 provide error status information. Bits 11-16 indicate what information is present in the current inputs registers.



3x+8 Out of Range Error: Bits 1-8

These eight bits indicate that an over or under range condition or an alarm condition exists on at least one channel within the group. Bits 1-8 correspond to eight groups of four channels each. When an Out of Range Flag is set, the Channel Status mode (see Section 4.3) can be enabled to report which channel is out of range.

Note: An over range error indicates that a channel input is a value greater than or equal to the maximum for the range selected for that channel group. An under range error indicates that a channel input is a value less than or equal to the minimum for the selected range.

3x+8 Reserved: Bit 9

Bit 9 should always respond with a “0.”

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3x+8 Configuration Error: Bit 10

An illegal configuration was attempted. When this occurs configuration will not be accepted by the module and this flag will be set. By using 4x register bits 1 and 2 to set the module to “status” individual channels flags can be checked to determine which channel or group is incorrect.

3x+8 Data Input Mode: Bits 11, 12

The module continuously outputs a group of eight registers worth of data. The data for a given group can be paged between three modes. These are the standard channel input data, channel status data or Time stamp data.

Bit 11	Bit 12	Input Modes
0	0	Data
0	1	Status
1	0	Time Stamp

3x+8 Group Select: Bits 13-16

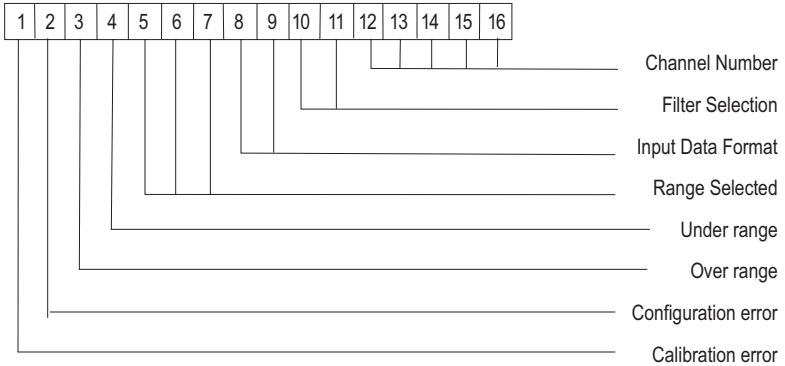
These four bits are used to indicate which group of channels you have chosen in the 4x configuration word.

Bit 13	Bit 14	Bit 15	Bit 16	Group
0	0	0	0	Channels 1-8
0	0	0	1	Channels 9-16
0	0	1	0	Channels 17-24
0	0	1	1	Channels 25-32

4.4 Channel Status (Registers $3x+0$ through $3x+7$)

As described in Section 2.5, register $4x$ bits 1 and 2 can be set to allow monitoring of individual channel status (set to “0” and “1” respectively). You will then be displaying eight channels of status information. As described below, bits 1-4 provide four different pieces of error information specific to that input channel. Bits 5-11 merely confirm what setup has been created for that feature in configuration register $4x$. Bits 12-16 will indicate what channel’s status is being displayed.

Channel Status Register:



$3x+0 \dots 7$ Calibration Error Flag: Bit 1

The calibration error flag is a fatal error. When the flag is set to “1” the ADC cannot calibrate within specifications.

$3x+0 \dots 7$ Configuration Error Flag: Bit 2

The configuration error flag is a fatal error. When the flag is set to “1” there is a configuration mismatch. Configuration errors include any illegal configuration, such as the selection of an unsupported format or filter option, or configurations that must be the same for all channels within a group of channels.

$3x+0 \dots 7$ Over Range Flag: Bit 3

This is a nonfatal over range flag. The bit is set to “1” when an input value is read within one count of the maximum range value. When the input value is within normal limits the flag is automatically reset to “0.”

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3x+0 . . . 7 Under Range Flag: Bit 4

This is a nonfatal under range flag. The bit is set to “1” when an input value is read within one count of the minimum range value. When the input value is within normal limits the flag is automatically reset to “0.”

3x+0 . . . 7 Range & Mode Selection: Bit 5-7

These three bits confirm which range and mode selection was set in the zoom screen for each group of eight inputs. See 4x register set-up. Range select works in conjunctions with the mode select.

Range & Mode Selection Bits

Bit 5	Bit 6	Bit 7	Mode	Range
0	0	0	Voltage	±10 V
0	0	1	Voltage	+1 to +5V
0	1	0	Voltage	0 to +5V
0	1	1	Voltage	0 to +10V
1	0	0	Current	0-20 mA
1	0	1	Current	4-20 mA
1	1	0	Current	Not used
1	1	1	Current	Not used

3x+0 . . . 7 Input Data Format: Bits 8-9

These two bits indicate the data format selection that was set in the zoom screen.

One of three input data formats is selected for each of the four groups.

Input Data Format Selection Bits

Bit 8	Bit 9	Data Format
0	0	16 bit unsigned integer
0	1	10,000 Count DVM
1	0	12 bit unsigned integer
1	1	15 bit signed integer

3x+0 . . . 7 Filter Selection: Bits 10-11

These two bits indicate the filter frequency selection that was set in the zoom screen. One of four filter selections from 10 Hz, 50 Hz, 60 Hz, 1000 Hz is programmed per group of eight inputs. The filter frequency selection will effect channel update time.

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Filter Selection Bits

Bit 10	Bit 11	-3db	Filter Frequency
0	0	2.62 Hz	10 Hz Notch Filter
0	1	13.1 Hz	50 Hz Notch Filter
1	0	15.72 Hz	60 Hz Notch Filter
1	1	262 Hz	1000 Hz Notch Filter

3x+0 ... 7 Channel Number: Bit 12-16

These five bits indicates which of the 32 channels is reporting its status.

Bit 12	Bit 13	Bit 14	Bit 15	Bit 16	Chan	Bit 12	Bit 13	Bit 14	Bit 15	Bit 16	Chan
0	0	0	0	0	1	1	0	0	0	0	17
0	0	0	0	1	2	1	0	0	0	1	18
0	0	0	1	0	3	1	0	0	1	0	19
0	0	0	1	1	4	1	0	0	1	1	20
0	0	1	0	0	5	1	0	1	0	0	21
0	0	1	0	1	6	1	0	1	0	1	22
0	0	1	1	0	7	1	0	1	1	0	23
0	0	1	1	1	8	1	0	1	1	1	24
0	1	0	0	0	9	1	1	0	0	0	25
0	1	0	0	1	10	1	1	0	0	1	26
0	1	0	1	0	11	1	1	0	1	0	27
0	1	0	1	1	12	1	1	0	1	1	28
0	1	1	0	0	13	1	1	1	0	0	29
0	1	1	0	1	14	1	1	1	0	1	30
0	1	1	1	0	15	1	1	1	1	0	31
0	1	1	1	1	16	1	1	1	1	1	32

4.5 Time Stamp Status (Registers 3x+0 through 3x+7)

The alarm data setup by the user is described in section 2.4 (Modsoft) and 3.4 (Concept). Alarm data for a given channel is stored in volatile memory until power is lost. New alarm data is continuously updated in scrolling mode. In Latched mode the first alarm data is stored until the data is read by the user. Latched updates are not overwritten with new data until the user reads the channel alarm data. Refer to section 4.1 for information on how to place the module in time stamp read mode and selecting a channel group.

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The time stamp data is stored in eight registers. Each group of eight registers contains the information for two channels. The format of the time stamp data is shown below:

Time Stamp Event Data (Input Mode 10):

1 2 3 4				5 6 7 8				9 10 11 12				13 14 15 16				
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3X+0 Chan N.: Data word
s	s	s	s	s	s	s	s	m	m	m	m	m	m	m	m	3X+1 Chan N.: Time Stamp: Secs/ *SSC BCD.
h	h	h	h	h	h	h	h	n	n	n	n	n	n	n	n	3X+2 Chan N.: Time Stamp: Hour/Min BCD.
M	M	M	M	M	M	M	M	d	d	d	d	d	d	d	d	3X+3 Chan N.: Time Stamp: Month/Day BCD.
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3X+4 Chan N+1: Data word.
s	s	s	s	s	s	s	s	m	m	m	m	m	m	m	m	3X+5 Chan N+1: Time Stamp: Secs/ *SSC BCD.
h	h	h	h	h	h	h	h	n	n	n	n	n	n	n	n	3X+6 Chan N+1: Time Stamp: Hour/Min BCD.
M	M	M	M	M	M	M	M	d	d	d	d	d	d	d	d	3X+7 Chan N+1: Time Stamp: Month/Day BCD.

* The Sub Seconds Count (SSC) field is not an even time period count such as seconds. Instead, it is a counter which increments whenever an alarm occurs at the same Hour/Min/Sec setting the previous alarm. This field insures unique time stamps for alarms detected within the same second.

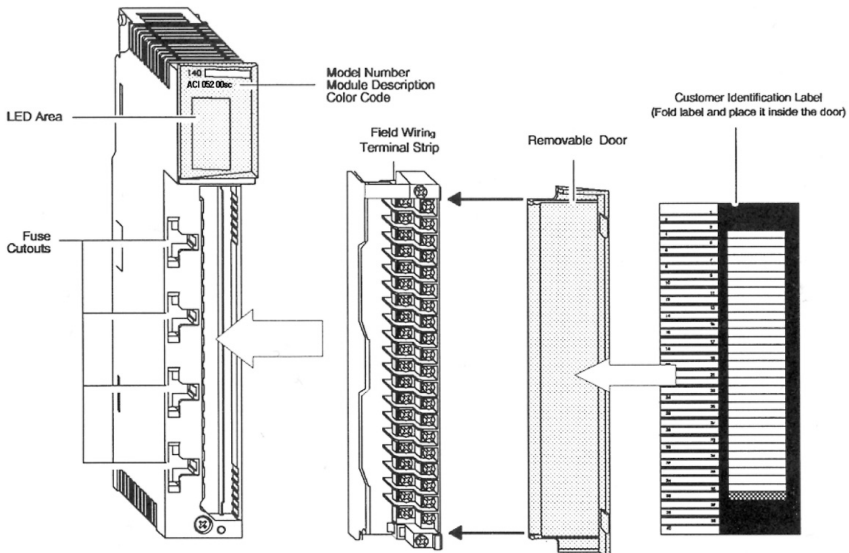
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Chapter 5

INSTALLATION



- ☞ Note: When field wiring the I/O modules, the maximum wire size that should be used is 1-14 AWG or 2-16 AWG; the minimum size is 20 AWG.
- ☞ Note: The field wiring terminal strip (Modicon # 140 XTS 002 00) or the 140 CFA040 00 40 pin Cablefast Terminal block must be ordered separately. (The terminal strip includes the removable door label.)
- ☞ Note: Power, input and output (I/O) wiring must be in accordance with Class I, Division 2 wiring methods [Article 501-4 (b) of the National Electrical Code, NFPA 70] and in accordance with the authority having jurisdiction.”
- ☞ Note: Peripheral equipment must be suitable for the location in which it is used.

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WARNING

ELECTROSTATICALLY SENSITIVE COMPONENTS

EXPLOSION HAZARD

Substitution of components may impair suitability for Class I, Division 2.



WARNING

EXPLOSION HAZARD

Do not disconnect equipment unless power has been switched off or the area is known to be non hazardous.



WARNING

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, and D or non-hazardous locations only.



WARNING

EXPLOSION HAZARD

When in hazardous locations, turn off power before replacing or wiring modules.

Before installing the module, you should:

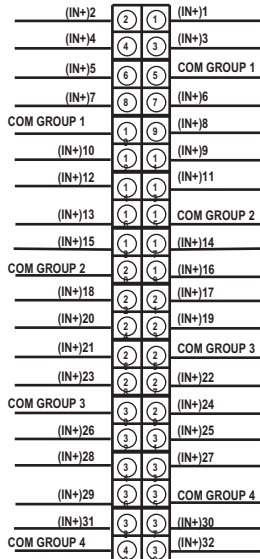
- Configure all of the appropriate zoom screen, configuration and other necessary set up according to Chapter 2.
- Field wire the module’s terminal block for your application.

For field wiring, use shielded, twisted-pair cable (such as Belden 9418 for voltage and current applications), and ground each cable’s shield wire at one end only. At the opposite end of each cable, tape the exposed shield wire to insulate it from electrical contact. A good shield wire ground is a rack assembly mounting bolt or stud.

5.1 Field Wiring

Note: In the process of wiring the modules, route all signal wires as far as possible from potential sources of electrical noise, such as motors, transformers, etc., (especially ac devices). As a general rule, allow 15.2 cm (6 in) of separation for every 120V of power. Signal wires must never share the same conduit with ac wiring. Also, when you must route signal wires past ac wiring, do so at right angles.

Single Ended Field Wiring



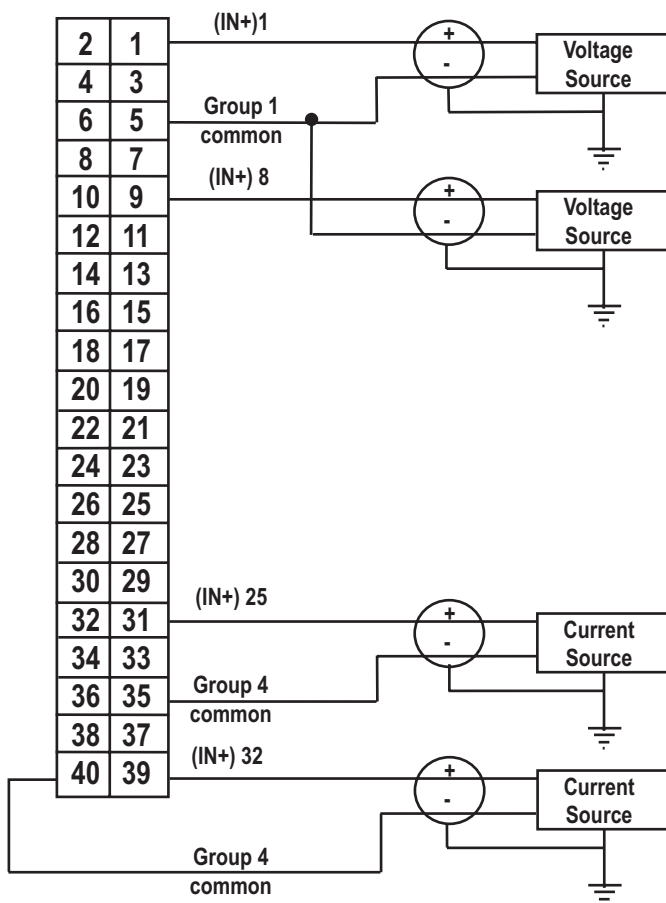
140 ACI 052 00sc Wiring Diagram

Installation Instructions

32-Channel Analog Input Module


Quantum 140 ACI 052 00sc

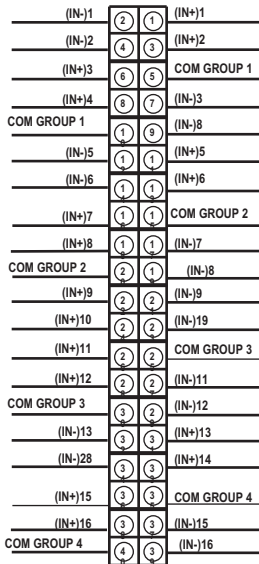
5.2 Single Ended Field Wiring Example




5.3 Differential Field wiring

Differential mode performs a software difference of two consecutive channel inputs, and reports the data on the first channel register of the pair. The second channel's output is zero. The data acquisition between the two channels is not synchronized so common mode noise on the signal pair may not be fully removed, however DC offsets should be compensated for correctly.

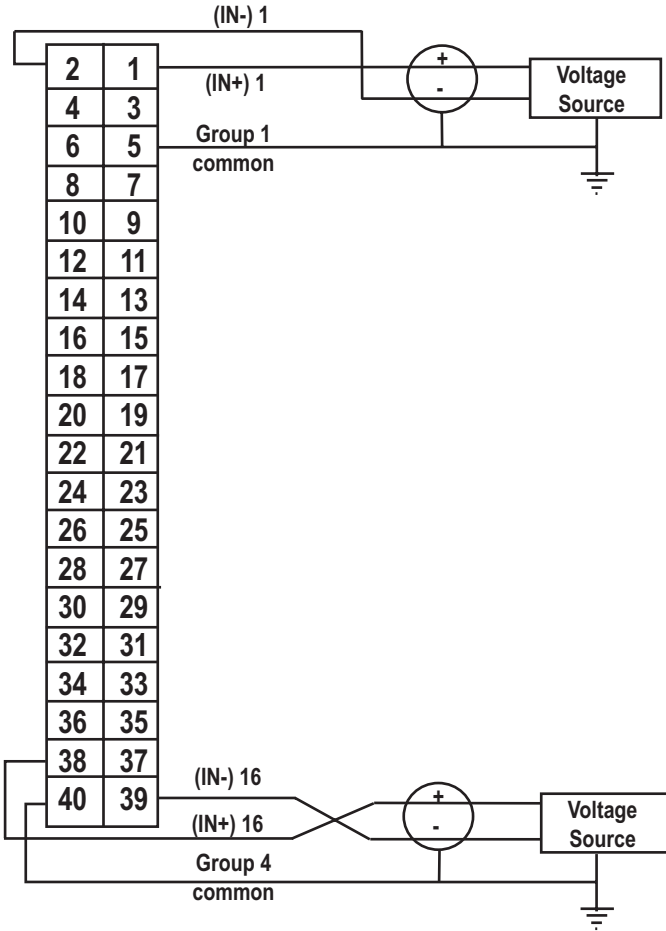
 Note: The channel pairs are not being measured simultaneously, this could lead to an error in the actual differential value that is calculated.



 Note: Differential mode only applies to voltage inputs.

Installation Instructions
32-Channel Analog Input Module
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5.4 Differential Field Wiring Example



Chapter 6

APPLICATION NOTES

6.1 General Application Tips

The following is a list of do's and don'ts that should be observed in your applications.

- Select the appropriate 140 ACI 052 00sc from the I/O map selection screen.
- Configure the module using the zoom screen selections and make appropriate use of Configuration and Status registers as outlined in Chapter 2 through 4.
- Ensure correct units of measure are selected for data type.
- Use the lowest filter frequency setting possible for your application, this ensures the most stable and accurate readings.
- Configure the 4x Register.
- Check that the Green Ready LED is lit when the module is powered up and has completed its self test.
- Check that the Green Active LED is lit when data is being transferred to the Quantum CPU.

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32-Channel Analog Input Module

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6.2 Demultiplexing Channel Data - Autosequence Mode

The autosequence mode of operation is intended to simplify the demultiplexing of channel data from the eight input registers into storage for the 32 channels. The autosequence mode is enabled under the following conditions:

- Input Mode = Data Mode (Configuration Word Bits 11 & 12 = 0)
- Autosequence Disable is not active (Configuration Word Bit 10 = 0)

In the autosequence mode, the group select bits in the configuration word are ignored. Instead, the module samples channel data in groups of eight (8), presents the data to the PLC and then scans the next group automatically. The ladder logic then reads the status word to determine which data is being presented and copies the data to the appropriate storage locations for those channels.

The module update rate is determined by the number of channels enabled and the filter frequencies selected. For example, if all 32 channels are enabled and the filter frequency for all groups is 60 Hz, then the cycle time for a full set of 32 channels is 32×58 msec or 1.856 seconds.

It takes four ladder logic scans of the eight registers to see all 32 channels. These four scans must be completed at least twice as fast as the module update time to ensure no data is missed. In the example above the ladder scan time would need to run at $1.856 \text{ sec}/8$ or 232 msec or faster to ensure no data is missed.

Refer to Section 4.4 Channel Update Rate for channel update times.

6.3 Using ladder to move data to a block of 32 consecutive registers

The following ladder logic shows how to move data from the 8 multiplexed input words to a block of 32 output words starting at location 400101 with the autosequence mode disabled. This example file for use only with Modsoft programming software can be found on the install disk shipped with your module. The file is under the A:\Programs subdirectory. To install:

1. Insert the install disk into drive A:
2. Copy A:\Programs\QAI32_AC.* C:\Modsoft\Programs
3. Select File QAI32_AC under Modsoft to run.

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The I/O map is as follows: (Manual Mode)

Rack Slot	Module	Input Ref	Output Ref	Description
1	03	ACI 051 00SC	3000001-3000009 4000001-4000001	ACI05100 AN IN 32CH

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">300009 NCBT #00011</td> <td style="text-align: center;">300009 NCBT #00012</td> <td style="text-align: center;">300009 NCBT #00015</td> <td style="text-align: center;">300009 NCBT #00016</td> </tr> </table>	300009 NCBT #00011	300009 NCBT #00012	300009 NCBT #00015	300009 NCBT #00016			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">300001 400101 BLKM #00008</td> </tr> <tr> <td style="text-align: center;">400001 RBIT #00015</td> <td style="text-align: center;">400001 SBIT #00016</td> </tr> </table>	300001 400101 BLKM #00008	400001 RBIT #00015	400001 SBIT #00016
300009 NCBT #00011	300009 NCBT #00012	300009 NCBT #00015	300009 NCBT #00016							
300001 400101 BLKM #00008										
400001 RBIT #00015	400001 SBIT #00016									
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">300009 NCBT #00011</td> <td style="text-align: center;">300009 NCBT #00012</td> <td style="text-align: center;">300009 NCBT #00015</td> <td style="text-align: center;">300009 NOBT #00016</td> </tr> </table>	300009 NCBT #00011	300009 NCBT #00012	300009 NCBT #00015	300009 NOBT #00016			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">300001 400109 BLKM #00008</td> </tr> <tr> <td style="text-align: center;">400001 SBIT #00015</td> <td style="text-align: center;">400001 RBIT #00016</td> </tr> </table>	300001 400109 BLKM #00008	400001 SBIT #00015	400001 RBIT #00016
300009 NCBT #00011	300009 NCBT #00012	300009 NCBT #00015	300009 NOBT #00016							
300001 400109 BLKM #00008										
400001 SBIT #00015	400001 RBIT #00016									
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">300009 NCBT #00011</td> <td style="text-align: center;">300009 NCBT #00012</td> <td style="text-align: center;">300009 NOBT #00015</td> <td style="text-align: center;">300009 NCBT #00016</td> </tr> </table>	300009 NCBT #00011	300009 NCBT #00012	300009 NOBT #00015	300009 NCBT #00016			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">300001 400117 BLKM #00008</td> </tr> <tr> <td style="text-align: center;">400001 SBIT #00015</td> <td style="text-align: center;">400001 SBIT #00016</td> </tr> </table>	300001 400117 BLKM #00008	400001 SBIT #00015	400001 SBIT #00016
300009 NCBT #00011	300009 NCBT #00012	300009 NOBT #00015	300009 NCBT #00016							
300001 400117 BLKM #00008										
400001 SBIT #00015	400001 SBIT #00016									
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">300009 NCBT #00011</td> <td style="text-align: center;">300009 NCBT #00012</td> <td style="text-align: center;">300009 NOBT #00015</td> <td style="text-align: center;">300009 NOBT #00016</td> </tr> </table>	300009 NCBT #00011	300009 NCBT #00012	300009 NOBT #00015	300009 NOBT #00016			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">300001 400125 BLKM #00008</td> </tr> <tr> <td style="text-align: center;">400001 RBIT #00015</td> <td style="text-align: center;">400001 RBIT #00016</td> </tr> </table>	300001 400125 BLKM #00008	400001 RBIT #00015	400001 RBIT #00016
300009 NCBT #00011	300009 NCBT #00012	300009 NOBT #00015	300009 NOBT #00016							
300001 400125 BLKM #00008										
400001 RBIT #00015	400001 RBIT #00016									

Installation Instructions

32-Channel Analog Input Module

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The following ladder logic shows how to move data from the 8 multiplexed input words to a block of 32 output words starting at location 400101 using the autosequence mode. This example file for use only with Modsoft programming software can be formed on the install disk shipped with your module. The file is under the A:\Programs subdirectory. To install:

1. Insert the install disk into drive A:
2. Copy A:\Programs\QAI32_GI.* C:\Modsoft\Programs
3. Select File QAI32_GI under Modsoft to run. The I/O map is as follows:

Rack Slot	Module	Input Ref	Output Ref	Description
1	03 ACI 051 00SC	3000001-3000009	4000001-4000001	ACI05100 AN IN 32CH

300009 NCBT #00011	300009 NCBT #00012	300009 NCBT #00015	300009 NCBT #00016	300001 400101 BLKM #00008
300009 NCBT #00011	300009 NCBT #00012	300009 NCBT #00015	300009 NOBT #00016	300001 400109 BLKM #00008
300009 NCBT #00011	300009 NCBT #00012	300009 NOBT #00015	300009 NCBT #00016	300001 400117 BLKM #00008
300009 NCBT #00011	300009 NCBT #00012	300009 NOBT #00015	300009 NOBT #00016	300001 400125 BLKM #00008

6.4 Channel Update Rate

The module's channel update rate is determined by the filter frequency selection.

A lower filter frequency takes longer to update each channel. The following table shows the single channel update rate and 32 channel update rate for each filter frequency.

Installation Instructions

32-Channel Analog Input Module

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<u>Filter Frequency</u>	<u>-3db Frequency</u>	<u>1 channel Update Time</u>	<u>32 channel Update time</u>
10 Hz	2.62 Hz	308 ms	9.9 sec
50 Hz	13.1 Hz	68 ms	2.2 sec
60 Hz	15.7 Hz	58 ms	1.9 sec
1K Hz	262 Hz	12 ms	384 ms

☞ Note: Channel update time is the time required for the module to acquire an input sign and update the module's data registers. The scan rate of the Quantum system will vary with application ladder and system configuration.

☞ Note: Periodic system calibration will also effect channel update times for one scan cycle.

6.5 System Resolution and Accuracy

The system resolution listed below is the smallest input signal change that the ADC can detect. The resolution level is affected by the filter frequency selected.

<u>Filter Frequency</u>	<u>ADC Resolution</u>	<u>Voltage Resolution</u>	<u>Current Resolution</u>
10 Hz	22.5 Bits	3 μ V	3 NA
50 Hz	20 Bits	19 μ V	19 NA
60 Hz	20 Bits	19 μ V	19 NA
1K Hz	10.5 Bits	14 mV	14 μ A

The resolution levels for the voltage mode and current mode apply to the full scale input ranges.

System accuracy is the total error between an actual input signal level and the module output data value. System accuracy is effected by external wiring, signal noise, filter frequency, calibration, temperature, and output data formats. The table below lists that system accuracy verses temperature.

Temp	Voltage Mode		Current Mode	
	25°C Typical	$\pm 0.03\%$	± 6 mV	$\pm 0.05\%$
60°C Max	$\pm 0.5\%$	± 10 mV	$\pm 0.10\%$	± 20 μ A

☞ Note: Accuracy calculations are based on the full scale current and voltage input range. These are 0 to 20 mA and ± 10 V respectively.

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6.6 Range and Data Format Selection

Each of the module's input ranges can be viewed in one of the four data in formats below. The table shows the minimum and maximum values are equal to the under range and over range trip points.

Format:	Range:	Min:	Max:
Signed 15 Bit	-10 to +10V	-32,767	+32,767
Signed 15 Bit	0 to +10V	0	+32,767
Signed 15 Bit	+1 to +5V	0	+32,767
Signed 15 Bit	+0 to +5V	0	+32,767
Signed 15 Bit	+0 to +20mA	0	+32,767
Signed 15 Bit	+4 to +20mA	0	+32,767
<hr/>			
Unsigned 16 Bit	-10 to +10V	0	+65,535
Unsigned 16 Bit	0 to +10V	0	+65,535
Unsigned 16 Bit	+1 to +5V	0	+65,535
Unsigned 16 Bit	+0 to +5V	0	+65,535
Unsigned 16 Bit	+0 to +20mA	0	+65,535
Unsigned 16 Bit	+4 to +20mA	0	+65,535
<hr/>			
Unsigned 12 Bit	-10 to +10V	0	+4,095
Unsigned 12 Bit	0 to +10V	0	+4,095
Unsigned 12 Bit	+1 to +5V	0	+4,095
Unsigned 12 Bit	+0 to +5V	0	+4,095
Unsigned 12 Bit	+0 to +20mA	0	+4,095
Unsigned 12 Bit	+4 to +20mA	0	+4,095
<hr/>			
10,000 Count DVM	-10 to +10V	-10,000	+10,000
10,000 Count DVM	0 to +10V	0	+10,000
10,000 Count DVM	+1 to +5 V	+1,000	+5,000
10,000 Count DVM	+0 to +5V	0	+5,000
10,000 Count DVM	+0 to +20mA	0	+2,000
10,000 Count DVM	+4 to +20mA	+400	+2,000

Chapter 7 TROUBLESHOOTING

7.1 General Information

Review of the Module Setup Procedures in Section 2.1 is recommended prior to following the troubleshooting steps below to help isolate the problem. The troubleshooting guide lists a variety of possible problems. Step through each item on the list and verify whether or not the module is working. If a particular step is not working, follow the corrective action listed.

STEP 1: Check module power and self test.

VERIFY: The controller module's READY and RUN LED's are on.

CORRECTIVE ACTION:

- Insure that the rack's power supply is connected properly and its PWR OK LED is on.
- Place the controller in run mode by using the Modsoft Start Command.
- If the rack's power will not come up, or the system will not go into run mode, refer to the Quantum Automation Series Hardware Reference Guide for more information.

STEP 2: Check module power and self test.

VERIFY: The module's green READY LED is on. This indicates that the module has power and has completed its functional self test.

CORRECTIVE ACTION:

- Check rack power, and reinstall the module in the rack.

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STEP 3: Check the module's fault LED.

VERIFY: The module's red FAULT LED is off. This LED indicates a module hardware error.

CORRECTIVE ACTION:

- The module has a fatal hardware error. Contact your local distributor or Spectrum Controls Customer Satisfaction Group listed at the back of this manual.

The module has a front LED panel that includes 35 LEDs:

Ready LED -

1 Green LED indicates module's self test has passed and is ready to communicate.

Active LED -

1 Green LED indicates BUS communication is established between the module the rack.

Fault LED -

1 Red LED indicates a module self test error, or fatal H/W error. A blink code will be defined that will indicate the type of self test error. Count the number of blinks before a pause to determine the error code in the table below.

Fault LED Blink Code

Blink #	Fault
3	DPM Test Error
4	CPU Error
5	Watchdog Timer Error
6	RAM Error
7	Flash EPROM CRC Error
8	Calibration EEPROM Error

Channel LED -

32 Green LEDs indicates the channel is enabled and a valid input signal level is present. The LED is off if the channel is disabled. A blinking LED indicates that the channel has exceeded a range limit.

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STEP 4: Check the module's communication status.

VERIFY: The module's green ACTIVE LED is on. This indicates that the module is communicating properly with the rack.

CORRECTIVE ACTION:

- Set the rack into run mode.
- Reinstall the module in the rack.

STEP 5: Check the module's health status.

VERIFY: The module is reported as healthy in the Modsoft I/O map Screen. Check to make sure that the module description, slot location, and register assignments are correct. Also, verify that the module is recognized and reported as healthy. If an asterisk is present before the module's name, then the module is not recognized by the rack.

CORRECTIVE ACTION:

- Reinstall the module in the rack.
- Reselect the module in the I/O Map using the <Shift + ?> key. If the module is not listed, install the Modsoft Runtime files included with your module.

STEP 6: Check the module's register operation.

VERIFY: The 4X configuration word and the 3X+8 Status word are setup properly. As a quick check, disable all ladder programming and set the 4X register to 0000 Hex and verify that the 3X+8 Status register cycles through the values 0000, 0001, 0010, and 0011 Hex.

CORRECTIVE ACTION:

- Check steps 1 through 6 above and then call Spectrum Controls Customer Satisfaction at (425) 746-9481.

Installation Instructions

32-Channel Analog Input Module

Quantum 140 ACI 052 00sc

Chapter 8

SPECIFICATIONS

Number of Channels	32
Input Registers Required	9
Output Registers Required	1
Input Configuration	32 inputs configured in groups of 8 channels per common
LEDs	35 - One each for Ready (Green), Active (Green), Fault (Red), 32 Channel (Green)
Voltage Range	$\pm 10\text{VDC}$, 0 to 10VDC, 0 to 5VDC, 1 to 5VDC
Current Range	4 to 20mA, 0 to 20mA
Impedance, input	Voltage Mode: 10 Megohms, min. Current Mode: 350 ohms
Fault Detection	Over & under range status bits, for all current and voltage modes.
CMRR	90 dB
Power Requirements	630 mA @ 5 V maximum
Max Input Current	50 mA continuous
Max Input Voltage	$\pm 20\text{VDC}$ continuous
Agency Approvals	UL, CUL Class I Div II, CE, FCC Class A
Accuracy	Note: Accuracy is dependent on the filter frequency selection, range selection, data format, and input noise.
Voltage Typ	$\pm 0.03\%$ of full scale typical @ 25°C.
Voltage Max	$\pm 0.05\%$ of full scale Maximum @ 0 to 60°C.
Current Typ	$\pm 0.05\%$ of full scale typical @ 25°C
Current Max	$\pm 0.10\%$ of full scale maximum @ 0 to 60°C
Miscellaneous	
Display format	12 bit integer, 16 bit integer, 15 bit signed integer, 10000 count DVM

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Engineering units	mV, mA
Resolution	10 bits to 22 bits (frequency dependent)
Input Filter	10Hz, 50Hz, 60Hz, 1KHz Digital Notch Filter, Programmable in groups of 8 inputs.
Channel Update Time	
Single Channel	12 ms to 308 ms (frequency dependent)
Isolation	
Channel to Rack	500 VAC Continuous Optical & magnetic
Channel to Channel	0 volts, non-isolated within a group
Group to Group	±15V
Time Stamp	
Data Format	Month, Day, Hour, Min, sec, msec sequence
Timer Resolution	±100 msec (frequency dependent)
Timer Drift	5 sec per day, reset on demand
Alarm Accuracy	same as System Accuracy

Notice

The products and services described in this publication are useful in a wide variety of applications. Therefore, the user and others responsible for applying the products and services described herein are responsible for determining their acceptability for each application. While efforts have been made to provide accurate information within this publication, Spectrum Controls assumes no responsibility for the accuracy, completeness, or usefulness of the information contained herein. Under no circumstances will Spectrum Controls be responsible or liable for any damages or losses, including indirect or consequential damages or losses, arising out of either the use of any information contained within this publication or the use of any product or service referenced herein. No patent liability is assumed by Spectrum Controls with respect to the use of any of the information, products, circuits, programming, or services referenced herein. The information contained in this publication is subject to change without notice.

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Declaration Of Conformity

<h1>Declaration of Conformity</h1>	
<i>Application of Council Directive(s)</i>	89/336/EEC Electromagnetic Compatibility
<i>Standard(s) to which Conformity is Declared</i>	EN50081-2:1993, EN61000-6-2:1999, EN61010-1:1993, EN61131-2:1995
<i>Manufacturer's Name</i>	Spectrum Controls Inc.
<i>Manufacturer's Address</i>	2700 Richards Road Southeast Bellevue, Washington 98005 U.S.A.
<i>Importer's Name</i>	Spectrum Controls Inc.
<i>Importer's Address</i>	2700 Richards Road Southeast Bellevue, Washington 98005 U.S.A.
<i>Type Of Equipment</i>	Schneider Automation TSX Quantum
<i>Model No.</i>	140 Series
<p>I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s)</p>	
<i>Date Of Issue:</i> 7/2/02	
<i>Place:</i> Bellevue, Washington U.S.A.	Bruce M. Wanta (Name)
	Chairman (Position)
SPN: 0300170-02 Rev B.0	

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