ADAM 4000

Data Acquisition Modules
User's Manual

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1.1 Overview

The ADAM Series is a set of intelligent sensor-to-computer interface modules containing built-in microprocessor. They are remotely controlled through a simple set of commands issued in ASCII format and transmitted in RS-485 protocol. They provide signal conditioning, isolation, ranging, A/D and D/A conversion, data comparison, and digital communication functions. Some modules provide digital I/O lines for controlling relays and TTL devices.

Software Configuration and Calibration

ADAM modules contain no pots or switches to set. By merely issuing a command from the host computer, you can change an analog input module to accept several ranges of voltage input, thermocouple input or RTD input. All the module's configuration parameters including I/O address, speed, parity, HI and LO alarm, calibration parameters settings may be set remotely. Remote configuration can be done by using either the provided menu-based software or the command set's configuration and calibration commands.

By storing configuration and calibration parameters in a nonvolatile EEPROM, modules are able to retain these parameters in case of power failure.

Watchdog Timer

A watchdog timer supervisory function will automatically reset the ADAM modules in the event of system failure. Maintenance is thus simplified.

Power Requirements

Although the modules are designed for standard industrial unregulated 24 V_{DC} power supply , they accept any power unit that supplies power within the range of +10 to +30 V_{DC}. The power supply ripple must be limited to 5 V peak-to-peak, and the immediate ripple voltage should be maintained between +10 and +30 V_{DC}.

Connectivity and Programming

ADAM modules can connect to and communicate with all computers and terminals. They use RS-485 transmission standards, and communicate with ASCII format commands. The command set for every module type consists of approximately ten different commands.

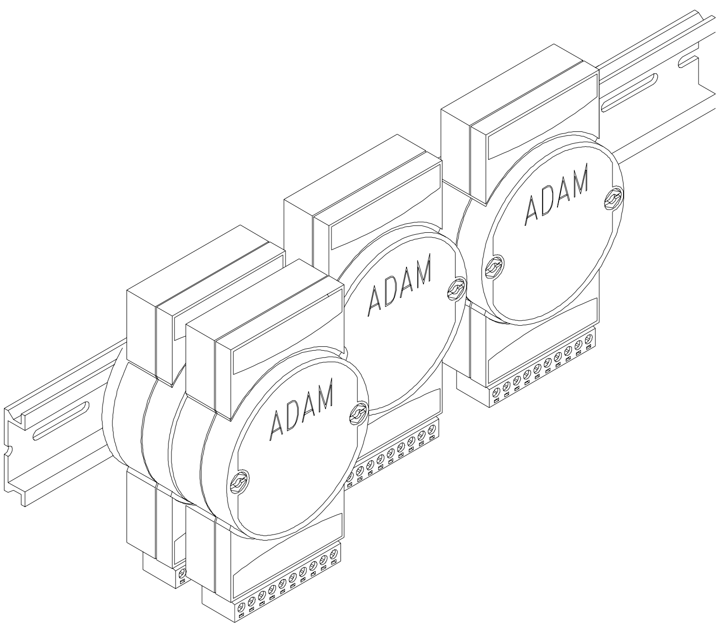
The command set for input modules is larger because it incorporates alarm functions. All communications to and from the module are performed in ASCII, which means that ADAM modules can be programmed in virtually any high-level language.

RS-485 Network

The RS-485 network provides lower-noise sensor readings, as modules can be placed much closer to the source. Up to 256 ADAM modules may be connected to an RS-485 multi-drop network by using the ADAM RS-485 repeater, extending the maximum communication distance to 4,000 ft. The host computer is connected to the RS-485 network with one of its COM ports through the ADAM RS-232/RS-485 converter.

To boost the network’s throughput, the ADAM RS-485 repeaters use a logical RTS signal to manage the repeater’s direction. Only two wires are needed for the RS-485 network: DATA+ and DATA-. Inexpensive shielded twisted pair wiring is employed.

Panel/DIN Rail mounting



ADAM modules mount on any panel, on provided brackets, on DIN rails or may be stacked together.

The RS-485 network, together with screw-terminal plug connectors, allows for system expansion, reconfiguration and repair without disturbing field wiring.

Protection against the environment

Hardened plastic packing forms the outer shell of every module. Since all configuration is controlled by software, the module is not designed to be opened. This greatly enhances resistance against corrosive materials, moisture and vibration. ADAM modules' low power requirements help them to operate in temperatures from 0 to 70°C, and in humidities from 0 to 95% (non-condensing). They're built compactly using automated SMT technology so you can pack them into water-tight and explosion-proof industrial enclosures.

1.2 Applications

- Remote data acquisition
- Process monitoring
- Industrial process control
- Energy management
- Supervisory control
- Security systems
- Laboratory automation
- Building automation
- Product testing
- Direct digital control

This chapter provides guidelines to what is needed to set up and install an ADAM network. A quick hookup scheme is provided that lets you configure modules before they are installed in a network.

To help you to connect ADAM modules with sensor inputs, several wiring examples are provided. Finally, you will find at the end of this chapter a programming example using the ADAM command set.

Be sure to carefully plan the layout and configuration of your network before you start. Guidelines regarding layout are given in Appendix E: RS-485 Network.

NOTICE: *Except for the communication modules (ex. ADAM-4520/4521/4522…etc.), which have on-board switches for their baud rate setting; ADAM modules should not be opened. There is no need to open the ADAM modules: all configurations are done remotely and there are no user serviceable parts are inside. Opening the cover will therefore void the warranty.*

2.1 System Requirements to set up an ADAM network

The following list gives an overview of what is needed to setup, install and configure an ADAM environment.

- ADAM modules
- A host computer, such as an IBM PC/AT compatible, that can output ASCII characters with an RS-232C or RS-485 port.
- Power supply for the ADAM modules (+10 to +30 V_{DC})
- ADAM Series Utility software
- ADAM Isolated RS-232/RS-485 Converter (optional)
- ADAM Repeater (optional)

Host computer

Any computer or terminal that can output in ASCII format over either RS-232 or RS-485 can be connected as the host computer. When only RS-232 is available, an ADAM RS-232/RS-485 Converter is required to transform the host signals to the correct RS-485 protocol. The converter also provides opto-isolation and transformer-based isolation to protect your equipment.

Power supply

For the ease of use in industrial environments the ADAM modules are designed to accept industry standard +24 V_{DC} unregulated power. Operation is guaranteed when using any power supply between +10 and +30 V_{DC}. Power ripples must be limited to 5 V peak to peak while the voltage in all cases must be maintained between +10 and +30 V_{DC}. All power supply specifications are referenced at module connector. When modules are powered remotely, the effects of line voltage drops must be considered.

All modules use on-board switching regulators to sustain good efficiency over the 10-30 V input range, therefore we can assume that the actual current draw is inversely proportional to the line voltage. The following example shows how to calculate the required current that a power supply should be able to provide.

Assume that a +24 V_{DC} will be used to power five ADAM-4011 Analog Input Modules. The distance from power supply to modules is not so big that significant line voltage drop will occur. One ADAM-4011 module consumes a maximum of 1.2 Watts. The total required power will equal 5 x 1.2 = 6 Watts. A power supply of +24 V_{DC} should therefore be able to supply a minimal current of 6 / 24 = 0.25 Amps.

Small systems may be powered by using wall-mounted modular power supplies. Also when modules operate on long communication lines (>500 feet) it is often more reliable to power the modules locally with modular power supplies. These inexpensive units can easily be obtained from any electronics retail store.

The power cables should be selected according to the number of modules connected and the length of the power lines. When using a network with long cables, we advise the use of thicker wire to limit the line voltage drop. In addition to serious voltage drops, long voltage lines can also cause interference with communication wires.

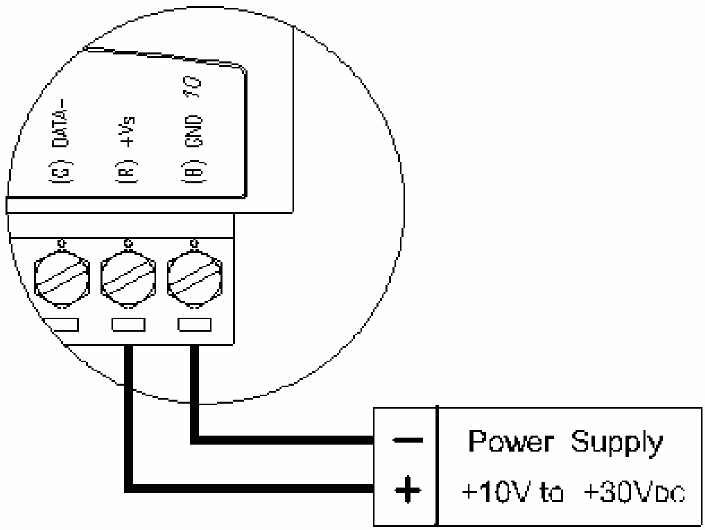


Figure 2-1 *Power Supply Connections*

We advise that the following standard colors (as indicated on the modules) be used for power lines:

+Vs	(R)	Red
GND	(B)	Black

Communication Wiring

We recommend that shielded-twisted-pair cables that comply with the EIA RS-485 standard be used with the ADAM network to reduce interference. Only one set of twisted-pair cables is required to transmit both Data and RTS signals. We advice that the following standard colors (as indicated on the modules) be used for the communication lines:

DATA+	(Y)	Yellow
DATA-	(G)	Green

ADAM Utility Software

A menu-driven utility program is provided for ADAM module configuration, monitoring and calibration. It also includes a terminal emulation program that lets you easily communicate through the ADAM command set. (See Appendix D, Utility Software)

ADAM Communication Speed

In ADAM series, the baudrate can be configured from 1200 bps to 38.4 Kbps. And the baudrate of all modules in an RS-485 network must be the same.

ADAM Isolated RS-232/RS485 Converter (optional)

When the host computer or terminal has only a RS-232 port, an ADAM Isolated RS-232/RS-485 Converter, connected to the host's RS-232 port, is required. Since this module is not addressable by the host, the baud rate must be set using a switch inside the module. The factory default setting is 9600 baud.

ADAM Repeater (optional)

When communication lines exceed 4000 ft (1200 meter) or the number of ADAM modules connected is more than 32, a repeater should be connected to expand the first segment. Up to 8 Repeater modules can be connected allowing connection of up to 255 ADAM modules. As with the Converter module, the Repeater module is not addressable by the host and the baud rate must be set by changing the switch inside the module. The factory default setting is 9600 baud.

2.2 Basic configuration and hook-up

Before placing a module in an existing network, the module should be configured. Though all modules are initially configured at the factory, it is recommended to check that the baud rate is set correctly.

Default Factory Settings

Baud rate: 9600 Bit/sec.
Address: 01 (hexadecimal)

The basic hook-up for module configuration is shown below.

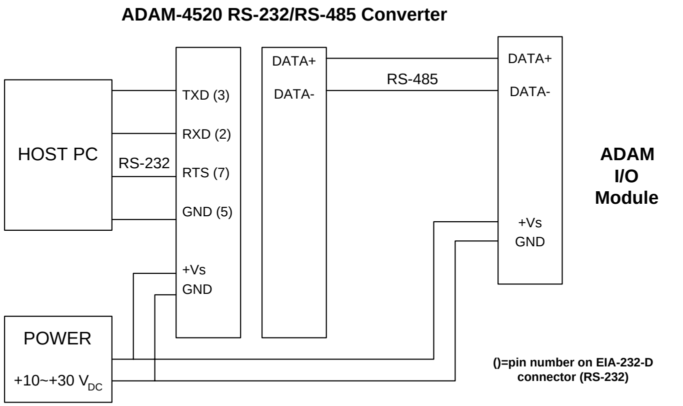


Figure 2-2 ***Basic Hook-up of ADAM Module to Host Switches***

The following items are required to configure a module: an ADAM converter module, a personal computer with RS-232 port (baud rate set to 9600) and the ADAM utility software.

Configuration with the ADAM Utility Software

The easiest way to configure the ADAM module is by using the ADAM utility software: an easy-to-use menu-structured program will guide you through every step of the configuration. (See Appendix D, Utility Software)

Changing the protocol from ADAM ASCII to Modbus

Some ADAM-4000 modules support both ADAM ASCII protocol and Modbus protocol . The factory default setting of these modules is ADAM ASCII protocol. If you would like to configure the modules to Modbus protocol, please refer to Appendix H which describes how to change the protocol in ADAM utility.

Configuration with the ADAM command set

ADAM modules can also be configured by issuing direct commands from within a terminal emulation program that is part of the ADAM utility software.

The following example guides you through the setup of an analog input module. Assume that an ADAM-4011 Analog Input module still has its default settings (baud rate 9600 and address 01h). Before the module is reconfigured, it is first requested to send its default settings.

NOTICE: *An analog input module requires a maximum of 7 seconds to perform auto calibration and ranging after it is rebooted or powered on. During this time span, the module can not be addressed to perform any other actions.*

Example:

Make sure that the module is properly connected as shown in section 2-5. Power up all the connected devices, start the terminal emulation program, and issue the following command:

```
$012(cr)
```

requests that module with address 01 send its configuration status

```
!01050600
```

Module at address 01 responds that it is configured for an input range of +/-2.5 V, baud rate 9600, integration time of 50 ms (60 Hz), engineering units and no checksum checking or generation.

To change the configuration setting of the analog input module, the following command is issued:

%01070F0600(cr)

% = change configuration

01 = target module at address 00 to:

07 = change address to 07 hexadecimal

0F = set input range to Type K thermocouple

06 = set baud rate to 9600

00 = set integration time to 50 ms (60 Hz)
disable checksum
set data format to engineering units

(See Chapter 4, Command Set for a full description of the syntax of the configuration command for an analog input module)

When the module received the configuration command it will respond with its new address:

!07(cr)

Wait 7 seconds to let the new configuration settings take effect before issuing a new command to the module.

NOTICE: *All reconfiguration except changing of baud rate and checksum values can be done dynamically, i.e. the modules need not to be reset. When changing the baud rate or checksum, these changes should be made for all connected devices. After reconfiguration, all modules should be powered down and powered up to force a reboot and let the changes take effect. See the next page for a strategy for changing baud rate and or checksum for an entire network.*

2.3 Baud rate and Checksum

Adam modules contain EEPROMs to store configuration information and calibration constants. The EEPROM replaces the usual array of switches and pots required to specify baud rate, input/output range etc. All of the ADAM modules can be configured remotely through their communication ports, without having to physically alter pot or switch settings.

Since there is no visual indication of a module's configuration status, it is impossible just by looking at it what the baud rate, address and other settings are. It might not be possible to establish communications with a module whose baud rate and address are unknown. To overcome this problem, every module has an input terminal labeled INIT*. By booting the module while connecting the INIT* terminal with the module's GND terminal, the modules configuration is forced into a known state. This state is called the INIT* state.

INIT* state defaults:
Baud rate: 9600
Address: 00h
Checksum: disabled

Forcing the module in the INIT* state does not change any parameters in the module's EEPROM. When the module is in the INIT* state with its INIT* and GND terminals shorted, all configuration settings can be changed and the module will respond to all other commands normally.

Changing Baud rate and Checksum

Baud rate and checksum settings have several things in common:

- They should be the same for all modules and host computer.
- Their setting can only be changed by putting a module in the INIT* state.
- Changed settings can only take effect after a module is rebooted

To alter baud rate or checksum settings you must perform the following steps:

- Power on all components except the ADAM Module.
- Power the ADAM module on while shorting the INIT* and GND terminals (See Figure 2-3).

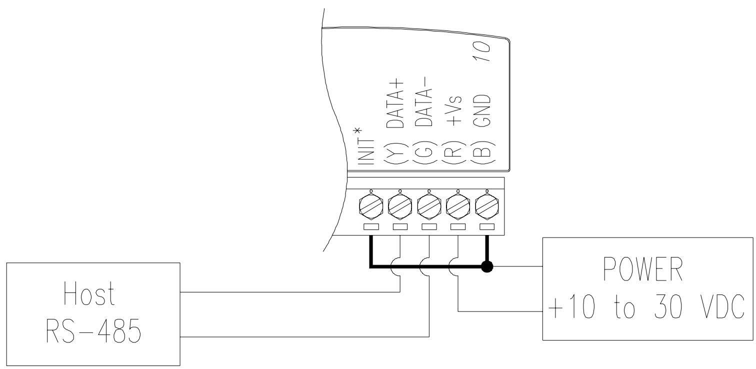


Figure 2-3 ***Grounding the INIT* Terminal***

- Wait at least 7 seconds to let self calibration and ranging take effect.
- Configure the checksum status and/or the baud rate.
- Switch the power to the ADAM Module OFF.
- Remove the grounding of the INIT* terminal and power the module on.
- Wait at least 7 seconds to let self calibration and ranging take effect.
- Check the settings (If the baud rate has changed, the settings on the host computer should be changed accordingly).

2.4 Multiple Module Hookup

The Figure below shows how ADAM modules are connected in a multiple module example:

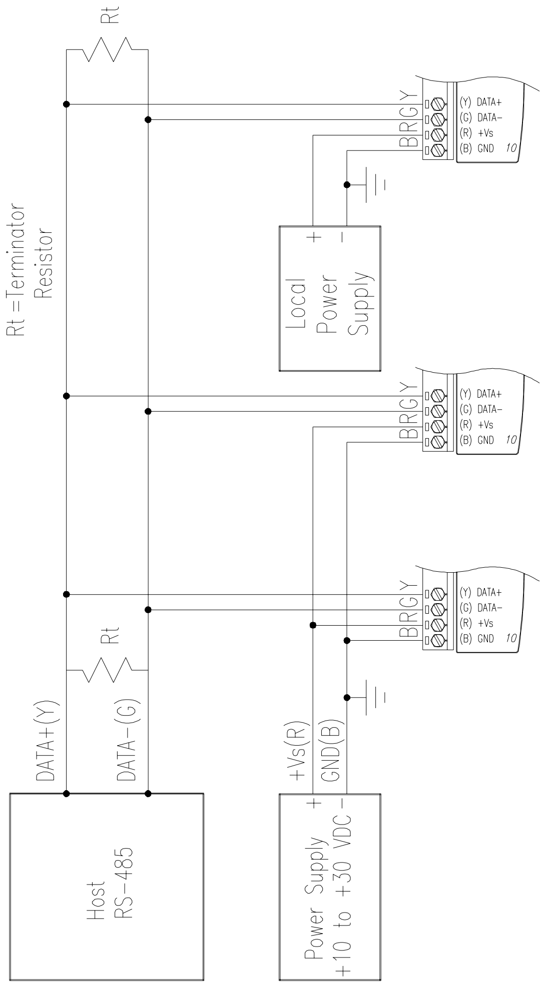
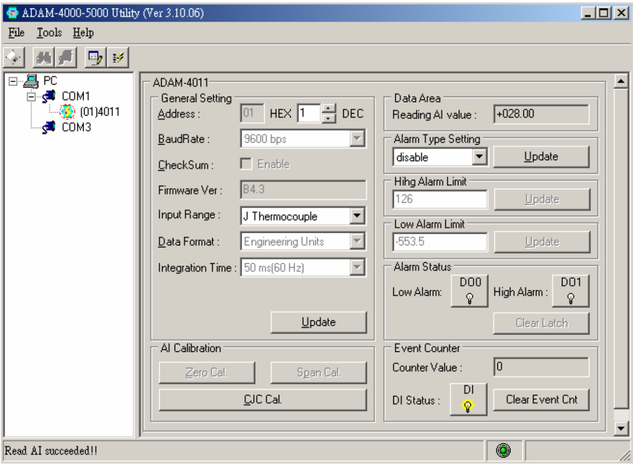


Figure 2-4 ***Multi-module Connection***

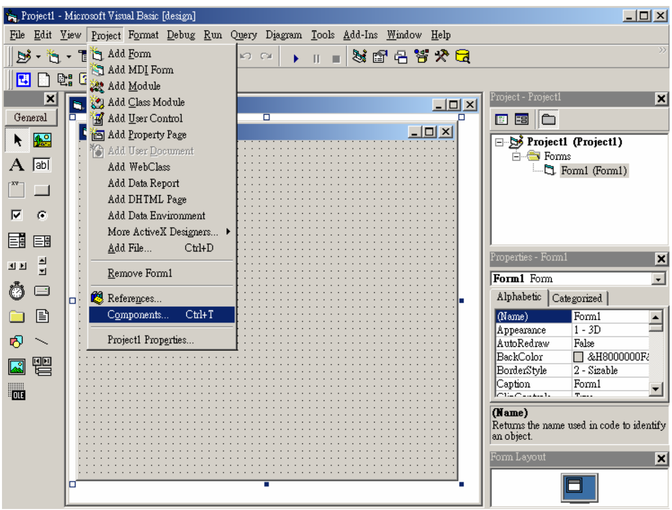
2.5 Programming Example

The following example is a simple program written in Visual Basic 6.0 that demonstrates how to get temperature reading from ADAM-4011 module, which is addressed at 01H.

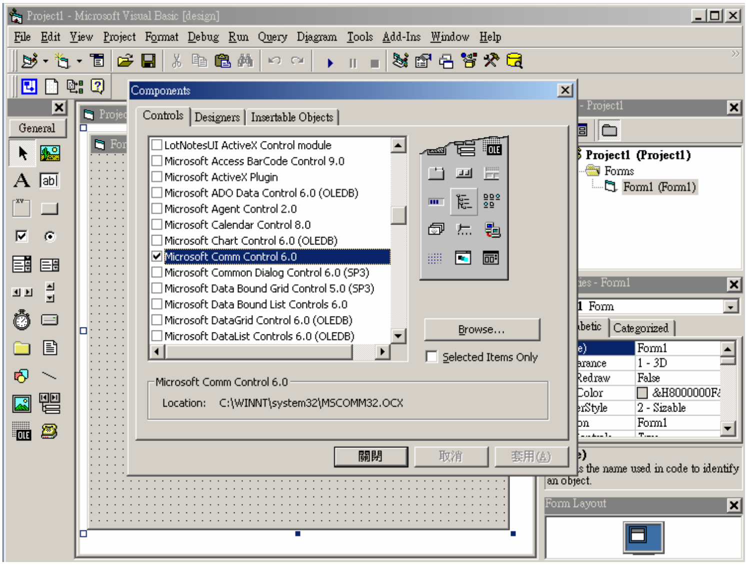
Step 1. Using ADAM Utility to check the settings of “Address = 01H”, “Baud rate = 9600” and “Checksum = Disabled” as following.



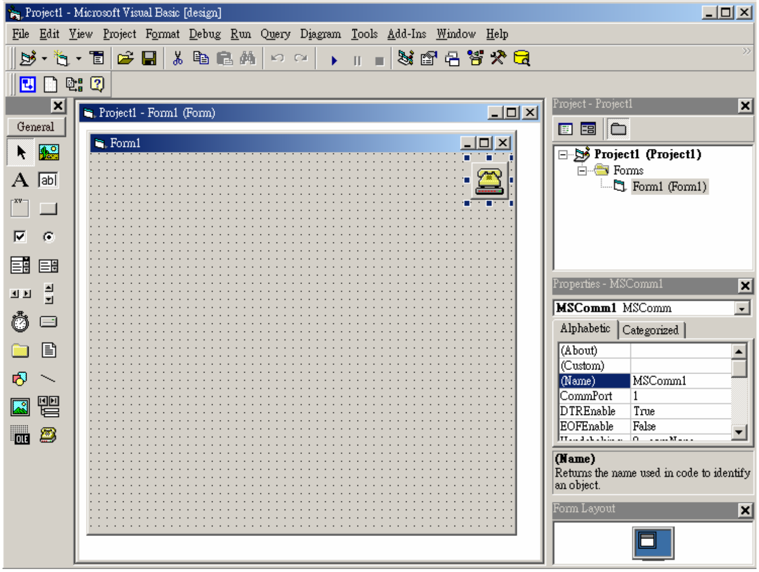
Step 2. Run VB 6.0 and add a control via “Project\Component”.



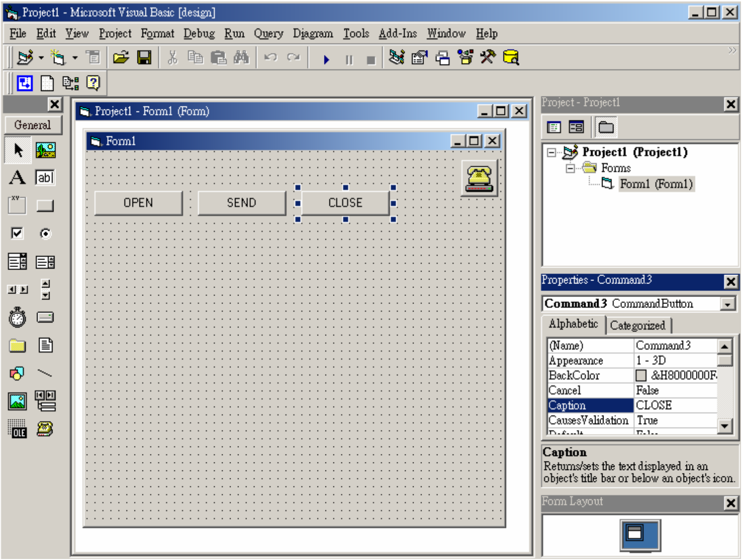
Step 3. Select "Microsoft Comm Control"



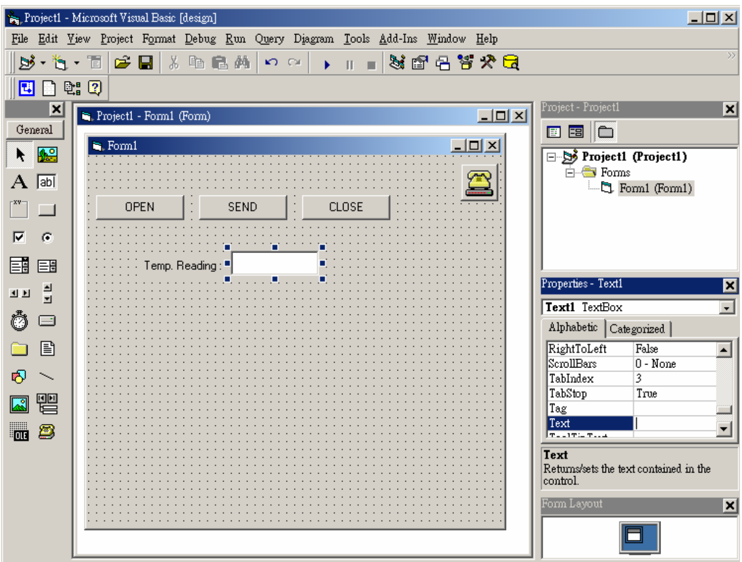
Step 4. Add the Comm Control on the form.



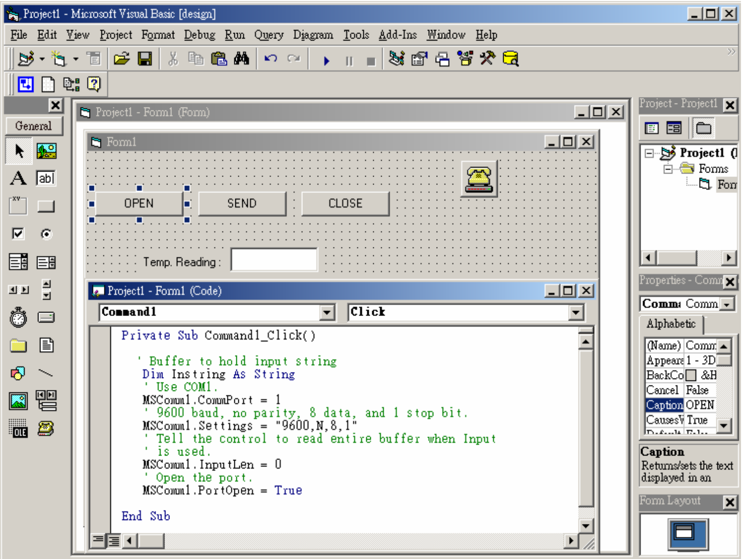
Step 5. Add three Command Buttons on the form as following



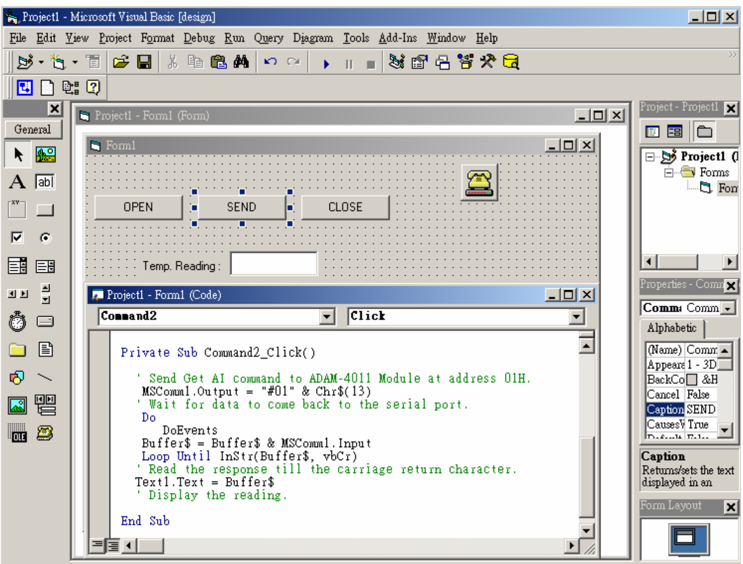
Step 6. Add one Label and one Text on the form as following.



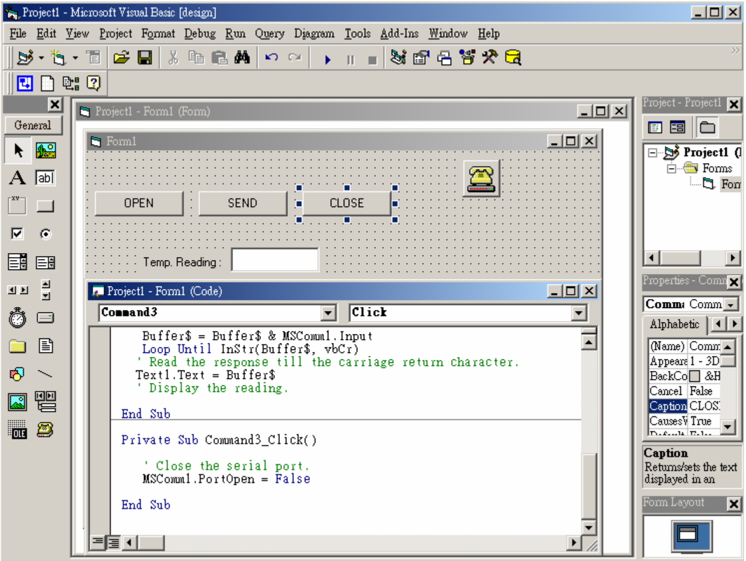
Step 7. Click OPEN Button and type following codes. The source codes are listed at the end of this section.



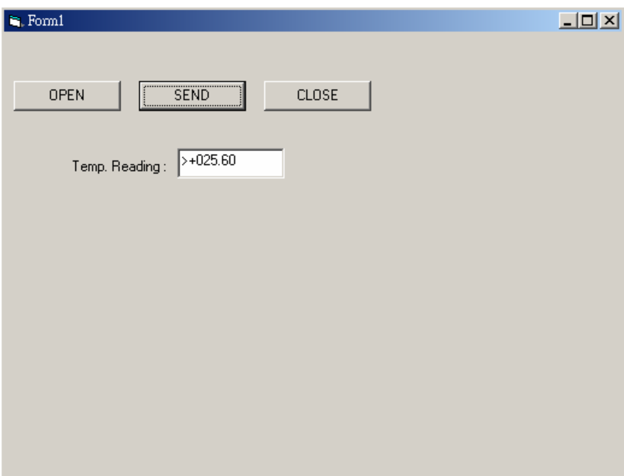
Step 8. Click SEND Button and type following codes. The source codes are listed at the end of this section.



Step 9. Click CLOSE Button and type following codes. The source codes are listed at the end of this section.



Step 10. Run the Project → Click OPEN to open COM1 → Click SEND to send the Get Temperature Reading Command. Now you will find the reading is displayed as following format.



Program Source Codes:

- OPEN Command Button:

```
Private Sub Command1_Click()
  ' Buffer to hold input string
   Dim Instring As String
   ' Use COM1.
   MSComm1.CommPort = 1
   ' 9600 baud, no parity, 8 data, and 1 stop bit.
   MSComm1.Settings = "9600,N,8,1"
   ' Tell the control to read entire buffer when Input
   ' is used.
   MSComm1.InputLen = 0
   ' Open the port.
   MSComm1.PortOpen = True
End Sub
```

- SEND Command Button:

```
Private Sub Command2_Click()
  ' Send Get AI command to ADAM-4011 Module at address 01H.
   MSComm1.Output = "#01" & Chr$(13)
  ' Wait for data to come back to the serial port.
   Do
      DoEvents
   Buffer$ = Buffer$ & MSComm1.Input
   Loop Until InStr(Buffer$, vbCr)
  ' Read the response till the carriage return character.
  Text1.Text = Buffer$
  ' Display the reading.
End Sub
```

- CLOSE Command Button

```
Private Sub Command3_Click()
   ' Close the serial port.
   MSComm1.PortOpen = False
End Sub
```

3.0 The common specification of ADAM-4000 I/Oseries

Communication:

- RS-485 (2-wire) to host
- Speeds: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps (ADAM-4080, ADAM-4080D only support up to 38400 bps)
- Max. communication distance: 4000 feet (1.2 km)
- Power and communication LED indicator
- ASCII command/response protocol
- Communication error checking with checksum
- **Asynchronous data format: 1** start bit, **8** data bits, **1** stop bit, **no** parity (**N, 8, 1**)
- Up to 256 multidrop modules per serial port
- Online module insertion and removal
- Transient suppression on RS-485 communication lines

Power Requirements

- Unregulated +10 ~ +30 VDC
- Protected against power reversal

Mechanical

- **Case** ABS with captive mounting hardware
- **Plug-in screw terminal block** Accepts 0.5 mm2 to 2.5 mm2, #14 to #22 AWG

Environment

- **Operating Temperature** -10 ~ 70° C (14 ~ 158° F)
- **EMI** Meets FCC Class A or CE
- **Storage Temperature** -25 ~ 85° C (-13 ~ 185° F)
- **Humidity** 5 ~ 95%, non-condensing

3.4 ADAM-4015 6-channel RTD Input Module

A RTD module is popular for temperature measurement. Unlike the traditional design, the ADAM-4015 provides six RTD input channels for different types of RTD signal as an effective solution in industrial & building automation. Usually, broken external wiring will lead to inaccurate current value. The ADAM-4015 provides a broken wiring detecting function so users can easily troubleshoot broken wiring problems. This module can accept 2 wires or 3 wires RTD sensor.

ADAM-4015

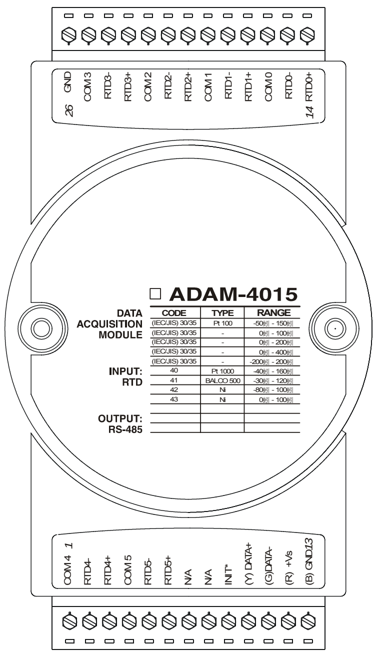
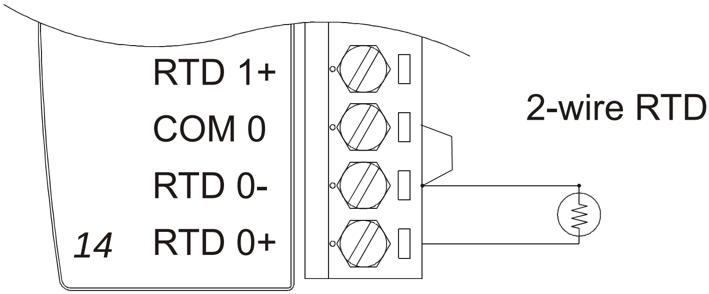


Figure 3-17: ADAM-4015 6-channel RTD Input Module

Application Wiring



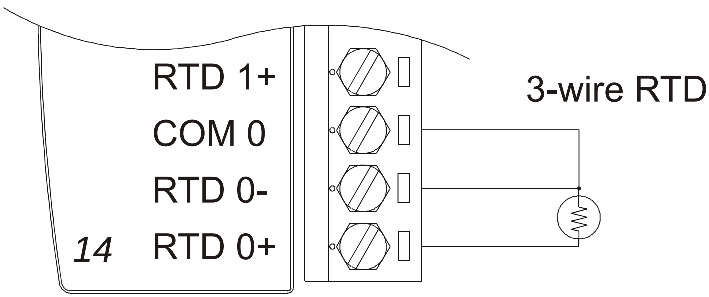


Figure 3-18: ADAM-4015 RTD Input Module Wiring Diagram

Technical specification of ADAM-4015

Channel	6
Input Type	Pt100, Pt1000, BALCO500, Ni
Input type and temperature range	Pt100: -50 to 150° C 0 to 100° C 0 to 200° C 0 to 400° C -200 to 200° C Pt1000: -40 to 160° C BALCO500: -30 to 120° C Ni 50 RTD: -80 to 100° C Ni 508 RTD: 0 to 100° C
Isolation Voltage	3000 VDC
Sampling Rate	12 sample/sec (total)
Input Impedance	10 MΩ
Accuracy	+/- 0.1% or better
Power Consumption	1 W
I/O Connector Type	13- pin plug-terminal

Table 3-1: Technical specification of ADAM-4015

4.1 Introduction

To avoid communication conflicts when several devices try to send data at the same time, all actions are instigated by the host computer. The basic form is a command/response protocol with the host initiating the sequence.

When modules are not transmitting they are in listen mode. The host issues a command to a module with a specified address and waits a certain amount of time for the module to respond. If no response arrives, a timeout aborts the sequence and returns control to the host.

Changing ADAM's configuration might require the module to perform auto calibration before changes can take effect. Especially when changing the range, the module has to perform all stages of auto calibration that it also performs when booted. When this process is under way, the module does not respond to any other commands. The command set includes the exact delays that might occur when modules are reconfigured.

4.2 Syntax

[delimiter character][address][command][data][checksum] [carriage return]

Every command begins with a delimiter character. There are four valid characters: a dollar sign $, a pound sign #, a percentage sign % and an at sign @.

The delimiter character is followed by a two-character address (hexadecimal) that specifies the target module. The actual two character command follows the address. Depending on the command, an optional data segment follows the command string. An optional two character checksum may be appended to the total string. Every commands is terminated by a carriage return (cr).

ALL COMMANDS SHOULD BE ISSUED IN UPPERCASE CHARACTERS!

Before the command set, we provide the I/O module commands search table to help you find the commands you wish to use. The command set is divided into the following three types:

- Analog Input Module commands
- Analog Output Module commands
- Digital I/O, Relay Output and Counter/Frequency Module commands

Every type starts with a command summary of the particular type of module and they are described on Chapter 5, 6 & 7 , followed by datasheets that give detailed information about individual commands.

Although commands in different subsections sometimes share the same format, the effect they have on a certain module can be completely different than they have on another. For example, the configuration command: %AANNTTCCFF affects analog input modules and analog output modules differently. Therefore, the full command set for every module is listed.

ADAM-4015/ADAM-4015T Command Table

Command Syntax	Command Name	Command Description	Page No.
%AANNTTCCFF	Configuration	Sets the address, baud rate, data format, checksum status, and/or integration time for a specified analog input module	5-4
#AAN	Read Analog Input from Channel N	Returns the input value from a specified channel of analog input module in the currently configured data format	5-16
#AA	Analog Data In	Returns the input value from a specified analog input module in the currently configured data format	5-14
$AA0Ci	Single Channel Span Calibration	Calibrates a specified channel to correct for gain errors	5-27
$AA1Ci	Single Channel Offset Calibration	Calibrates a specified channel to correct for offset errors	5-28
$AA2	Configuration Status	Returns the configuration parameters for the specified analog input module	5-10
#**	Synchronized Sampling	Orders all analog input modules to sample their input values and store them in special registers	5-21
$AA4	Read Synchronized Data	Returns the value that was stored in the specified module's register after the #** command	5-22
$AA5VV	Enable/Disable Channels for Multiplexing	Enable or disable the individual channels in an analog module	5-17
$AA6	Read Channel Status	Get the enable/disable status of all channels in an analog module	5-18
$AAB	Channel Diagnose	Diagnose channel status in over range, under range, and wire opening	5-24
$AA7CiRrr	Single Channel Range Configuration	Configure the input type and range of the specified channel in an analog input module	5-29
$AA8Ci	Read Single Channel Range Configuration	Get the input type and range of the specified channel in an analog input module	5-30
$AAXnnnn	Watchdog Timer Setting	Set WDT communication cycle	5-31
$AAY	Read Watchdog Timer Setting	Read the setting of WDT communication cycle	5-32
$AAS0	Internal Calibration	Internal self-calibration for offset and gain errors	5-33
$AAS1	Reload default calibrating parameter	Reload factory default calibrating parameter to overwrite current calibrating parameter	5-34
$AAF	Read Firmware Version	Return the firmware version code from the specified analog input module	5-12
$AAM	Read Module Name	Return the module name from the specified analog input module	5-13

5

Analog Input Module Command Set

5.1 Analog Input Common Command Set

Command Syntax	Description	I/O Module
%AANNTTCCFF	Sets the address, input range, baud rate, data format, checksum status, and/or integration time for a specified analog input module	4011, 4011D, 4012, 4013, 4015, 4015T, 4016, 4017, 4017+, 4018, 4018+, 4018M, 4019+
$AA2	Returns the configuration parameters for the specified analog input module	4011, 4011D, 4012, 4013, 4015, 4015T, 4016, 4017, 4017+, 4018, 4018+, 4018M, 4019+
$AAF	Returns the firmware version code from the specified analog input module	4011, 4011D, 4012, 4013, 4015, 4015T, 4016, 4017, 4017+, 4018, 4018+, 4018M, 4019+
$AAM	Returns the module name from the specified analog input module	4011, 4011D, 4012, 4013, 4015, 4015T, 4016, 4017, 4017+, 4018, 4018+, 4018M, 4019+
#AA	Returns the input value from a specified analog input moudule in the currently configured data format	4011, 4011D, 4012, 4013, 4015, 4015T, 4016, 4017, 4017+, 4018, 4018+, 4019+
#AAN	Returns the input value from channel number n of the specified analog input module	4015, 4015T, 4017, 4017+, 4018, 4018+, 4018M, 4019+
#AA5VV	Enables/disables multiplexing simultaneously for separate channels of the specified input module	4015, 4015T, 4017, 4017+, 4018, 4018+, 4018M, 4019+
$AA6	Ask the specified input module to return the status of all eight channels	4015, 4015T, 4017, 4017+, 4018+, 4018, 4018M, 4019+
$AA0	Calibrate the analog input module to correct for gain errors	4011, 4011D, 4012, 4013, 4016, 4017, 4018, 4018M
$AA1	Calibrate the analog input module to correct for offset errors.	4011, 4011D, 4012, 4013, 4016, 4017, 4018, 4018M
#**	Orders all analog input modules to sample their input values and store them in special registers	4011, 4011D, 4012, 4013, 4015, 4015T, 4016

Command Syntax	Command Description	I/O Module
$AA4	Returns the value that was stored in the specified module's register after the #** command	4011, 4011D, 4012, 4013, 4015, 4015T, 4016
$AAB	Ask the module to respond whether the wiring is open or closed	4011D, 4015, 4015T, 4018+, 4019+
$AA3	Returns the value of the CJC sensor for a specified analog input module	4011, 4011D, 4018, 4018+, 4018M, 4019+
$AA9	Calibrates the CJC sensor for offset errors	4011, 4011D, 4018, 4018+, 4018M 4019+
$AA0Ci	Calibrates a specified channel to correct for gain errors	4015, 4015T, 4017+, 4018+, 4019+
$AA1Ci	Calibrates a specified channel to correct for offset errors	4015, 4015T, 4017+, 4018+, 4019+
$AA7CiRrr	Configure the input type and range of the specified channel in an analog input module	4015, 4015T, 4017+, 4018+, 4019+
$AA8Ci	Get the input type and range of the specified channel in an analog input module	4015, 4015T, 4017+, 4018+, 4019+
$AAXnnnn	Set WDT communication cycle	4015, 4015T, 4018+,4019+
$AAY	Read the setting of WDT communication cycle	4015, 4015T, 4018+, 4019+
$AAS0	Internal self-calibration for offset and gain errors	4015, 4015T
$AAS1	Reload factory default calibrating parameter to overwrite current calibrating parameter	4015, 4015T

%AANNTTCCFF

Name Configuration

Description Sets address, input range, baud rate, data format, checksum status, and/or integration time for an analog input module.

Syntax %AANNTTCCFF(cr)

% is a delimiter character.

AA(range 00-FF) represents the 2-character hexadecimal address of the analog input module you want to configure.

NN represents the new hexadecimal address of the analog input module. Range is from 00h to FFh.

TT represents the type (input range) code.(4015 and 4019 must be 00)

CC represents the baud rate code.

FF is a hexadecimal number that equals the 8-bit parameter representing the data format, checksum status and integration time. The layout of the 8-bit parameter is shown in figure 4-1. Bits 2 through 5 are not used and are set to 0.

(cr) is the terminating character, carriage return (0Dh)

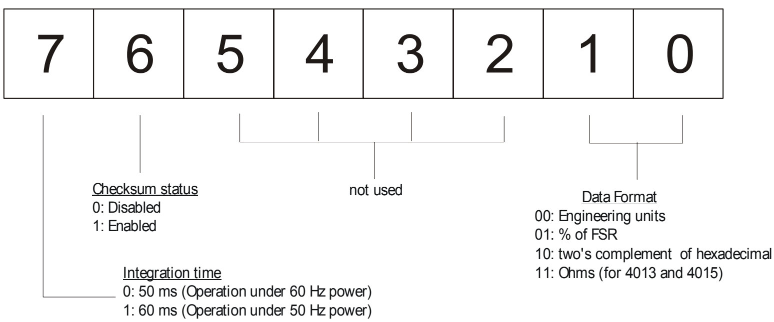


Figure 5-1 ***Data format for 8-bit parameter***

%AANNTTCCFF

Response !AA(cr) if the command is valid.

?AA(cr) if an invalid parameter was entered or if the INIT* terminal was not grounded when attempting to change baud rate or checksum settings.

There is no response if the module detects a syntax error or communication error or if the specified address does not exist.

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid

AA (range 00-FF) represents the 2-character hexadecimal address of an analog input module.

(cr) is the terminating character, carriage return (0Dh)

Example command: %2324050600(cr)
response: !24(cr)

The ADAM-4011 module with address 23h is configured to a new address of 24h, an input range ±2.5 V, baud rate 9600, integration time 50 ms (60 Hz), engineering units data format and no checksum checking or generation.

The response indicates that the command was received.

Wait 7 seconds to let the new configuration settings take effect before issuing a new command to the module.

NOTICE: *Only ADAM-4011, ADAM-4011D, ADAM-4012, ADAM-4013,ADAM-4016 and ADAM-4018+ support "% of FSR" and "two's complement of hexadecimal" Data Format.*

NOTICE: *An analog input module requires a maximum of 7 seconds to perform auto calibration and ranging after it is reconfigured. During this time span, the module cannot be addressed to perform any other actions.*

NOTICE: *All configuration parameters can be changed dynamically, except checksum and baud rate parameters. They can only be altered when the INIT* terminal is grounded. (Refer to Baud rate and Checksum configuration in Chapter 2, for the correct procedure)*

Table 5-1 Input Range Codes (Type Code)

Input Range Code (Hex)	Input Range for **4011,4011D,4018,4018+(**Thermocouple and ± 20 mA only**), 4018M**
00	± 15 mV
01	± 50 mV
02	± 100 mV
03	± 500 mV
04	± 1 V
05	± 2.5 V
06	± 20 mA
0E	Type J Thermocouple 0^0 to 760^0 C
0F	Type K Thermocouple 0^0 to 1370^0 C
10	Type T Thermocouple -100^0 to 400^0 C
11	Type E Thermocouple 0^0 to 1000^0 C
12	Type R Thermocouple 500^0 to 1750^0 C
13	Type S Thermocouple 500^0 to 1750^0 C
14	Type B Thermocouple 500^0 to 1800^0 C

Input Range Code(Hex)	Input Range for **4012,4017,4017+**
08	± 10 V
09	± 5 V
0A	± 1 V
0B	± 500 mV
0C	± 150 mV
0D	± 20 mA1
Notice: The input range requires the usage of a 125 Ω current conversion resistor	

Input Rage Code (Hex)	Input Range for **4016**
00	±15 mV
01	±50 mV
02	±100 mV
03	±500 mV
06	±20 mA

Input Range Code (Hex)	Input Range for **4013**
20	Platinum, -100o to 100oC, a=0.00385
21	Platinum, 0o to 100oC, a=0.00385
22	Platinum, 0o to 200oC, a=0.00385
23	Platinum, 0o to 600oC, a=0.00385
24	Platinum, -100o to 100oC, a=0.003916
25	Platinum, 0o to 100oC, a=0.003916
26	Platinum, 0o to 200oC, a=0.003916
27	Platinum, 0o to 600oC, a=0.003916
28	Nickel, -80o to 100oC
29	Nickel, 0o to 100oC

ADAM-4015/4015T command codes against Input ranges table

Command Code (Hex)	Input Type	Input Range
20	Platinum 100 (IEC)	-50° C to 150° C
21	Platinum 100 (IEC)	0° C to 100° C
22	Platinum 100 (IEC)	0° C to 200° C
23	Platinum 100 (IEC)	0° C to 400° C
24	Platinum 100 (IEC)	-200° C to 200° C
25	Platinum 100 (JIS)	-50° C to 150° C
26	Platinum 100 (JIS)	0° C to 100° C
27	Platinum 100 (JIS)	0° C to 200° C
28	Platinum 100 (JIS)	0° C to 400° C
29	Platinum 100 (JIS)	-200° C to 200° C
2A	Platinum 1000	-40° C to 160° C
2B	BALCO 500	-30° C to 120° C
2C	Ni 604	-80° C to 100° C
2D	Ni 604	0° C to 100° C

IEC RTD 100O, α = 0.00385

JIS RTD 100O, α = 0.00391

Input Range Code (Hex)	Input Range for **4019+**
02	± 100 mV
03	± 500 mV
04	± 1 V
05	± 2.5 V
07	+4~20mA
08	± 10 V
09	± 5 V
0D	± 20 mA1
0E	Type J Thermocouple 0^0 to 760^0 C
0F	Type K Thermocouple 0^0 to 1370^0 C
10	Type T Thermocouple -100^0 to 400^0 C
11	Type E Thermocouple 0^0 to 1000^0 C
12	Type R Thermocouple 500^0 to 1750^0 C
13	Type S Thermocouple 500^0 to 1750^0 C
14	Type B Thermocouple 500^0 to 1800^0 C

Table 5-2 *Baud Rate Codes*

Baud Rate Code (hex)	Baud Rate
03	1200 bps
04	2400 bps
05	4800 bps
06	9600 bps
07	19.2 kbps
08	38.4 kbps

$AA2

Name Configuration Status

Description The command requests the return of the configuration data from the analog input module at address AA.

Syntax $AA2(cr)

$ is a delimiter character.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module that you want to interrogate.

2 is the Configuration Status command.

(cr) is the terminating character, carriage return (0Dh).

Response !AATTCCFF(cr) if the command is valid.

?AA(cr)if an invalid operation was entered.

There is no response if the module detects a syntax error or communication error or if the specified address does not exist.

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid.

AA (range 00-FF) represents the 2-character hexadecimal address of an analog input module.

TT represents the type code. Type code determines the input range.

CC represents the baud rate code.

FF is a hexadecimal number that equals the 8-bit parameter that represents the data format, checksum status and integration time . The layout of the 8-bit parameter is shown in figure 4-1. Bits 2 to 5 are not used, and are set to 0.

(cr) is the terminating character, carriage return (0Dh).

(Also see the %AANNTTCCFF configuration command)

$AA2

Example command: $452(cr)
response: !45050600(cr)

The command asks the analog input module at address 45h to send its configuration data.

The analog input module at address 45h responds with an input range of 2.5 volts, a baud rate of 9600 bps, an integration time of 50 ms (60 Hz), engineering units are the currently configured data format, and no checksum function or checksum generation.

$AAF

Name	Read Firmware Version
Description	The command requests the analog input module at address AA to return the version code of its firmware
Syntax	$AAF (cr) $ is a delimiter character. AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module that you want to interrogate. F identifies the version command. (cr) is the terminating character, carriage return (ODh)
Response	!AA(Version)(cr) if the command is valid. There is no response if the module detects a syntax error or communication error, or if the specified address does not exist. ! is a delimiter character indicating a valid command was received. AA (range 00-FF) represents the 2-character hexadecimal address of an analog input module. (Version) is the version code of the module’s firmware at address AA. (cr) is the terminating character, carriage return (ODh).

$AAM

Name	Read Module Name
Description	The command requests the analog input module at address AA to return its name
Syntax	$AAM (cr) $ is a delimiter character. AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module that you want to interrogate. M is the Read Module Name command. (cr) is the terminating character, carriage return (ODh)
Response	!AA(Module Name)(cr) if the command is valid. There is no response if the module detects a syntax error or communication error, or if the specified address does not exist. ! is a delimiter character indicating a valid command was received. AA (range 00-FF) represents the 2-character hexadecimal address of an analog input module. (Module Name) is the name of the module at address AA. (cr) is the terminating character, carriage return (ODh).

#AA

Name Analog Data In

Description The command will return the input value from a specified (AA) module in the currently configured data format.

Syntax #AA(cr)

is a delimiter character.

AA (range 00-FF) represents the 2-character hexadecimal address of an analog input module.

(cr) is the terminating character, carriage return (0Dh).

Response >(data)(cr)

There is no response if the module detects a syntax error or communication error or if the specified address does not exist.

> is a delimiter character.

(data) is the input value in the configured data format of the interrogated module. (For data formats, see Appendix B).

(cr) is the terminating character, carriage return (0Dh).

Example command: #33(cr)

response: >+5.8222(cr)

The command interrogates the analog input module at address 33h for its input value.

The analog input module responds with +5.8222 volts. (The configured data format of the analog input module in this case is engineering units.)

Example command: #21(cr)

response: +7.2111+7.2567+7.3125+7.1000
+7.4712+7.2555+7.1234+7.5678 (cr)

The command interrogates the analog input module at address 21h for its input values of all channels.

The analog input module responds with channels from 0 to 7 with +7.2111 volts, +7.2567 volts, +7.3125 volts, +7.1000 volts, +7.4712 volts, +7.2555 volts, +7.1234 volts and +7.5678 volts.

#AA

Example command: #DE(cr)

response: >FF5D(cr)

The analog input module at address DEh has an input value of FF5D. (The configured data format of the analog input module is two's complement)

	Two's complement	% of Span	Engineering units
under	0000	-0000	-0000
over	FFFF	+9999	+9999

NOTICE: *When modules measure **Thermocouple** or **RTD** input values that are outside their configured range they will send data that implies input out of bounds. The next table shows the values that the modules will return, depending on the configured data format and if the input value falls under or exceeds the configured range.*

Only when modules are configured for Thermocouple or RTD will this "input out of bounds" warning occur. When analog input modules measure voltage or current that falls outside the configured range, they will return the actual measured input!

In the next example the target module is configured for an input range of T/C type J (Input range: 0 - 760° C) and for a data format in engineering units. The module measures an input value of 820° C.

Example command: #D1(cr)

response: >+9999(cr)

By returning a high value, +9999, the module at address D1h indicates that the measured input value exceeds the configured range.

#AAN

Name Read Analog Input from Channel N

Description The command will return the input value from one of the eight channels of a specified (AA) module in the currently configured data format.

Syntax #AAN(cr)

is a delimiter character.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module.

N identifies the channel you want to read. The value can range from 0 to 7 for 4017, 4018, 4018M, 4019. (the range of 4015 is from 0 to 5)

(cr) is the terminating character, carriage return (0Dh).

Response >(data)(cr)

There is no response if the module detects a syntax error or communication error or if the specified address does not exist.

> is a delimiter character.

(data) is the input value of the channel number N. Data consists of a + or - sign followed by five decimal digits with a fixed decimal point.

(cr) is the terminating character, carriage return (0Dh).

Example command: #120(cr)
response: >+1.4567(cr)

The command requests the analog input module at address 12h to return the input value of channel 0.

The analog input module responds that the input value of channel 0 is equal to +1.4567 volts.

$AA5VV

Name Enable/disable channels for multiplexing

Description Enables/disables multiplexing simultaneously for seperate channels of a specified input module

Syntax $AA5VV(cr)

$ is a delimiter character.

AA (range 00-FF) represents the 2-character hexadecimal address of analog input module.

5 is the enable/disable channels command.

VV are two hexidecimal values. The values are interpreted by the module as two binary words (4-bit). The first word represents the status of channel 4-7, the second word represents the status of channel 0-3. Value 0 means the channel is disabled, value 1 means the channel is enabled.

(cr) is the terminating character, carriage return (0Dh).

Response !AA(cr) if the command is valid.

?AA(cr)if an invalid operation was entered.

There is no response if the module detects a syntax error or communication error or if the specified address does not exist.

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid.

AA (range 00-FF) represents the 2-character hexadecimal address of an analog input module.

(cr) is the terminating character, carriage return (0Dh).

Example command: $00581(cr)
response: !00(cr)

Hexadecimal 8 equals binary 1000, which enables channel 7 and disables channels 4, 5, and 6.

Hexadecimal 1 equals binary 0001, which enables channel 0 and disables channel 1,2, and 3.

$AA6

Name Read Channel Status

Description Asks a specified input module to return the status of all channels

Syntax $AA6(cr)

AA (range 00-FF) represents the 2-character hexadecimal address of analog input module of which the channel status you want to send. The channel status defines whether a channel is enabled or disabled

(cr) is the terminating character, carriage return (0Dh).

Response !AAVV(cr) if the command is valid.

?AA(cr)if an invalid operation was entered.

There is no response if the module detects a syntax error or communication error or if the specified address does not exist.

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid.

AA (range 00-FF) represents the 2-character hexadecimal address of an analog input module.

VV are two hexadecimal values. The values are interpreted by the module as two binary words (4-bit). The first word represents the status of channel 4-7, the second word represents the status of channel 0-3. Value 0 means the channel is disabled, value 1 means the channel is enabled.

(cr) is the terminating character, carriage return (0Dh).

Example command: $026(cr)
response: !02FF(cr)

The command asks the analog input module at address 02 to send the status of it input channels. The analog input module at address 02 responds that all its multiplex channels are enabled (FF equals 1111 and 1111).

#**

Name Synchronized Sampling

Description Orders all analog input modules to sample their input values and store the values in special registers.

Syntax #**

is a delimiter character.

** is the actual synchronized sampling command.

The terminating character, in the form of a carriage return (0Dh), is not required.

Response The analog input modules will send no response after executing the synchronized sampling command. In order to retrieve the data, a separate Read Synchronized Data command has to be issued for every analog input module.

The pound sign (#) followed by two asterisks (**) does not represent an optional value, but is the actual command string.

$AA4

Name Read Synchronized Data

Description Returns the input value that was stored in the addressed module's register, after a Synchronized Sampling command #** was issued.

Syntax $AA4(cr)

$ is a delimiter character.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module from which data is to be sent.

4 is the Read Synchronized Data command.

(cr) is the terminating character, carriage return (0Dh).

Response !AA(status)(data)(cr) if the command was valid.

?AA(cr) if an invalid operation was entered.

There is no response if the module detects a syntax error or communication error or if the specified address does not exist.

! delimiter character indicates a valid command was received.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module that is responding.

(status) will tell you if the data (data) from the last Synchronized Sampling command (#**) has already been sent. If status=1, then the data has been sent for the first time since a Synchronized Sampling command was issued. If status=0, then the data has been sent at least once before.

(data) a value stored in a special register of the interrogated module in the configured data format. It has been sampled by the module after a Synchronized Sampling command. (For possible data formats, see Appendix B, Data Formats and I/O Ranges)

(cr) represents terminating character, carriage return (0Dh).

Example

command: $074(cr)
response: >071+5.8222(cr)

The command asks the analog input module at address 07h to send its analog input data.

The analog input module responds with status = 1, which means that this is the first time that the data has been sent and that the data = +5.8222 Volts.

(Configured data format of the analog input module in this case is engineering units.)

command: $074(cr)
response: >070+5.8222(cr)

The command asks the analog input module at address 07h to send its analog input data.

The analog input module responds with status = 0, which means that it has sent the same data at least once before, and data = +5.8222 Volts. This could indicate that a previous Synchronized Sampling command was not received!

(Configured data format of the analog input module in this case is engineering units.)

$AAB

Name Channel Diagnose

Description Diagnose channel status in over range, under range, and wire opening

Syntax $AAB(cr)

$ is a delimiter character

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module to be detected.

B is the channel diagnose command.

(cr) is the terminating character, carriage return (0Dh)

Response !AA0(cr) if the module detects a close thermocouple. (4011D only)

!AA1(cr) if the module detects an open thermocouple. (4011D only)

!AANN(cr) if the command is valid when it applied with ADAM-4015.

?AA(cr) if an invalid command was issued.

There is no response if the module detects a syntax error or communication error of if the specified address does not exist.

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module.

NN (range 00-FF) is a hexadecimal number that equals the 8-bit parameter, representing the status of analog input channels. Bit value 0 means normal status; and bit value 1 means channel over range, under range, or open wiring.

(cr) is the terminating character, carriage return (0Dh)

$AA0Ci

Name Single Channel Span Calibration

Description The command calibrates a specified channel to correct for gain errors.

Syntax $AA0Ci(cr)

$ is a delimiter character.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module which is to be calibrated.

0 represents the span calibration command.

Ci represent the specified input channel you want to calibrate.

(cr) is the terminating character, carriage return (0Dh).

Response !AA(cr) if the command was valid.

?AA(cr) if an invalid operation was entered.

There is no response if the module detects a syntax error or communication error or if the specified address does not exist.

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module.

(cr) represents terminating character, carriage return (0Dh).

In order to successfully calibrate an analog input module’s input range, a proper calibration input signal should be connected to the analog input module before and during the calibration. (See also Chapter 5, Calibration)

NOTICE: *An analog input module requires a maximum of 7 seconds to perform auto calibration and ranging after it received a Span Calibration command. During this interval, the module can not be addressed to perform any other actions.*

$AA1Ci

Name Single Channel Offset Calibration

Description The command calibrates a specified channel to correct for offset errors.

Syntax $AA1Ci(cr)

$ is a delimiter character.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module which is to be calibrated.

1 represents the offset calibration command.

Ci represent the specified input channel you want to calibrate.

(cr) is the terminating character, carriage return (0Dh).

Response !AA(cr) if the command was valid.

?AA(cr) if an invalid operation was entered.

There is no response if the module detects a syntax error or communication error or if the specified address does not exist.

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module.

(cr) represents terminating character, carriage return (0Dh).

Example command: $021C5(cr)

response: !02(cr)

The command calibrates channel 5 of the analog input module at address 02 for correcting offset errors.

$AA7CiRrr

Name Single Channel Range Configuration

Description This command configure the input type and range of the specified channel in an analog input module.

Syntax $AA7CiRrr(cr)

$ is a delimiter character.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module which is to be configured.

7 represents the range configuration command.

Ci represent the specified input channel you want to configure.

Rrr represent the type and range you want to set. (refer to Table 4-3 to check range code)

(cr) is the terminating character, carriage return (0Dh).

Response !AA(cr) if the command was valid.

?AA(cr) if an invalid operation was entered.

There is no response if the module detects a syntax error or communication error or if the specified address does not exist.

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module.

(cr) represents terminating character, carriage return (0Dh).

Example command: $027C5R21(cr)

response: !02(cr)

The command configures the range of channel 5 in the analog input module at address 02 as Pt100 (IEC) 0~100oC.

$AA8Ci

Name Read Single Channel Range Configuration

Description This command read the input type and range configuration of the specified channel in an analog input module.

Syntax $AA8Ci(cr)

$ is a delimiter character.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module which is to be read.

8 represents the read range configuration command.

Ci represent the specified input channel you want to read.

(cr) is the terminating character, carriage return (0Dh).

Response !AACiRrr(cr) if the command was valid.

?AA(cr) if an invalid operation was entered.

There is no response if the module detects a syntax error or communication error or if the specified address does not exist.

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module.

Ci represent the specified input channel you read.

Rrr represent the type and range setting in the specified channel. (refer to Table 4-3 to check range code)

(cr) represents terminating character, carriage return (0Dh).

Example command: $028C5(cr)

response: !02C5R21(cr)

The command read the range of channel 5 in the analog input module at address 02. The response “R21” means Pt100 (IEC) 0~100° C.

$AAXnnnn

Name Watchdog Timer Setting

Description This command set the Watchdog Timer communication cycle.

Syntax $AAXnnnn(cr)

$ is a delimiter character.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module which is to be read.

X represents the setting WDT command.

nnnn (range 0000~9999) represent the specified value of communication cycle you want to set.

(cr) is the terminating character, carriage return (0Dh).

Response !AA(cr) if the command was valid.

?AA(cr) if an invalid operation was entered.

There is no response if the module detects a syntax error or communication error or if the specified address does not exist.

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module.

(cr) represents terminating character, carriage return (0Dh).

Example command: $02X1234(cr)

response: !02(cr)

The command set the WDT cycle as 1234 in the input module at address 02.

NOTICE: *If the value of "nnnn" is 0000, the communication WDT function will be disable.*

$AAY

Name Read Watchdog Timer Setting

Description This command read the setting of Watchdog Timer communication cycle.

Syntax $AAY(cr)

$ is a delimiter character.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module which is to be read.

Y represents the reading WDT cycle command.

(cr) is the terminating character, carriage return (0Dh).

Response !AAnnnn(cr) if the command was valid.

?AA(cr) if an invalid operation was entered.

There is no response if the module detects a syntax error or communication error or if the specified address does not exist.

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module.

nnnn (range 0000~9999) represent the specified value of communication cycle you read.

(cr) represents terminating character, carriage return (0Dh).

Example command: $02Y(cr)

response: !020030(cr)

The command read the WDT cycle as 0030 in the input module at address 02.

$AAS0

Name Internal Calibration

Description This command execute Internal self-calibration for offset and gain errors.

Syntax $AAS0(cr)

$ is a delimiter character.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module which is to be calibrated.

S0 represents the internal calibration system command.

(cr) is the terminating character, carriage return (0Dh).

Response !AA(cr) if the command was valid.

?AA(cr) if an invalid operation was entered.

There is no response if the module detects a syntax error or communication error or if the specified address does not exist.

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module.

(cr) represents terminating character, carriage return (0Dh).

$AAS1

Name Reload Default Calibrating Parameter

Description Reload factory default calibrating parameter to overwrite current calibrating parameter

Syntax $AAS1(cr)

$ is a delimiter character.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module which is to be reloaded.

S1 represents the reload calibrating parameter system command.

(cr) is the terminating character, carriage return (0Dh).

Response !AA(cr) if the command was valid.

?AA(cr) if an invalid operation was entered.

There is no response if the module detects a syntax error or communication error or if the specified address does not exist.

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module.

(cr) represents terminating character, carriage return (0Dh).

Analog input/output modules are calibrated when you receive them. However, calibration is sometimes required. No screwdriver is necessary because calibration is done in software, with calibration parameters stored in the ADAM module's onboard EEPROM.

The ADAM modules come with utility software that supports the calibration of analog input and analog output. Besides the calibration that is carried out through software, the modules incorporate automatic Zero Calibration and automatic Span Calibration at boot-up or reset.

8.1 Analog Input Module Calibration

Models: ADAM- 4011, 4011D, 4012, 4014D, 4016, 4017, 4017+, 4018, 4018+, 4018M, 4019+

1. Apply power to the module and let it warm up for about 30 minutes
2. Assure that the module is correctly installed and is properly configured for the input range you want to calibrate. You can do this by using the ADAM utility software. (Refer to Appendix D, Utility Software.)
3. Use a precession voltage source to apply a calibration voltage to the module's +IN and -IN terminals of the ADAM-4011, 4011D and 4012. Use a precession voltage source to apply a calibration voltage to the module's Vin+ and Vin- terminals (or Iin+ and Iin-) for the ADAM-4014D and 4016. Use a precession voltage source to apply a calibration voltage to the module's Vin0+ and Vin0- terminals for ADAM-4017, 4017+, 4018, 4018+, 4018M, 4019 and 4019+.

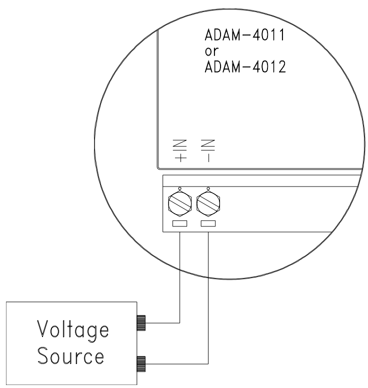


Figure 8-1 ***Applying Calibration Voltage***

Table 8-2 *Calibration Resistance*

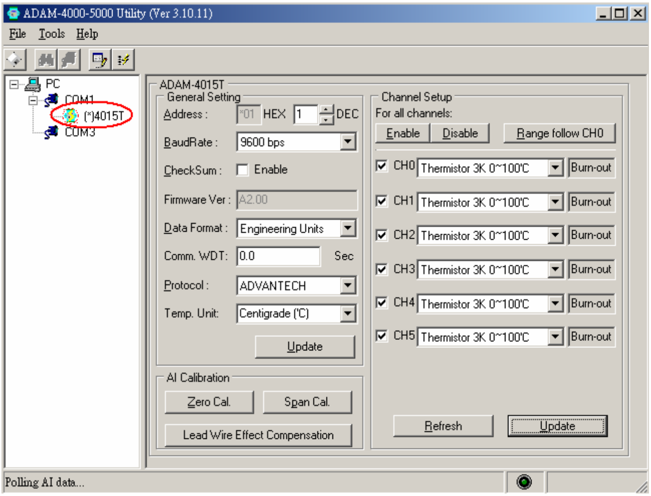
Module	Input Range Code (Hex)	Input Range	Span Calibration Resistance	Offset Calibration Resistance
4013	20	Pt, -100° C to 100° C a = 0.00385	140 Ω	60 Ω
	21	Pt, 0° C to 100° C a = 0.00385	140 Ω	60 Ω
	22	Pt, 0° C to 200° C a = 0.00385	200 Ω	60 Ω
	23	Pt, 0° C to 600° C a = 0.00385	440 Ω	60 Ω
	24	Pt, -100° C to 100° C a = 0.003916	140 Ω	60 Ω
	25	Pt, 0° C to 100° C a = 0.003916	140 Ω	60 Ω
	26	Pt, 0° C to 200° C a = 0.003916	200 Ω	60 Ω
	27	Pt, 0° C to 600° C a = 0.003916	440 Ω	60 Ω
	28	Ni, -80 °C to 100 °C	200 Ω	60 Ω
	29	Ni, 0 °C to 100 °C	200 Ω	60 Ω

8.3 Analog Input Thermistor module Calibration

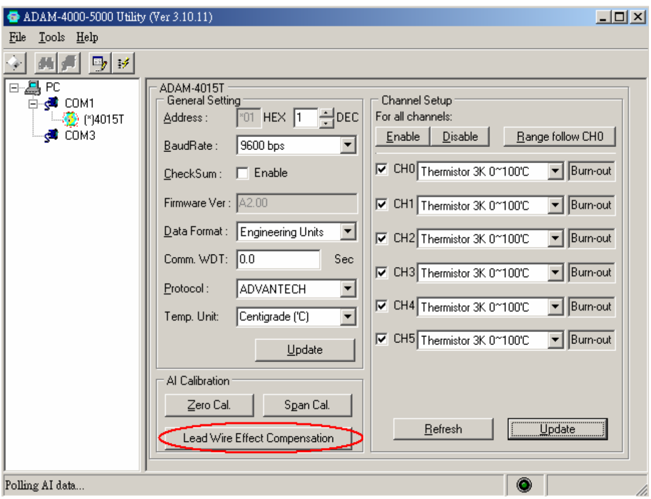
Model: ADAM-4015T

If you select the range "Thermistor 3K 0~100C", please follow the calibration steps as below.

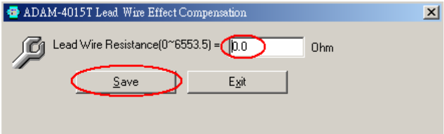
1. Short INIT* pin to GND and then power up ADAM-4015T. Run ADAM-4000-5000 Utility and search the module.



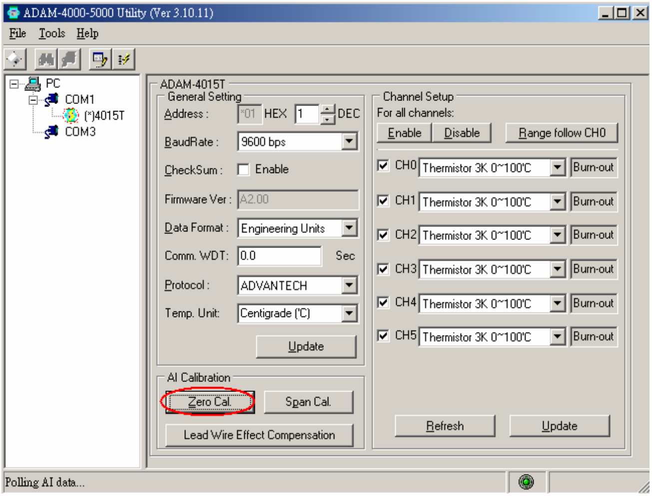
2. Click "Lead Wire Effect Compensation"



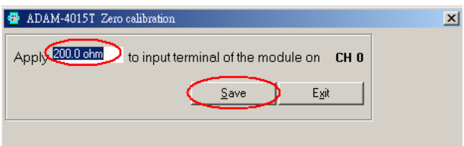
3. Set the resistance to "0" and click "Save"



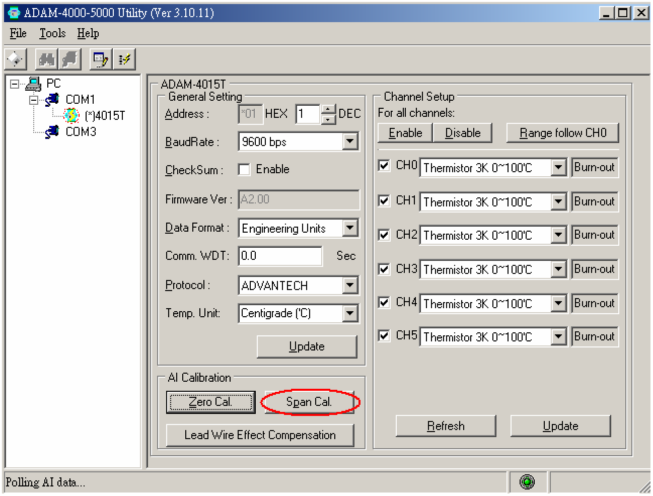
4. Click "Zero Cal."



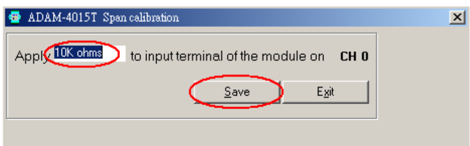
5. Apply 200.0 ohms 0.01% accuracy resistor to CH0 and then Click "Save"



6. Click “Span Cal.”



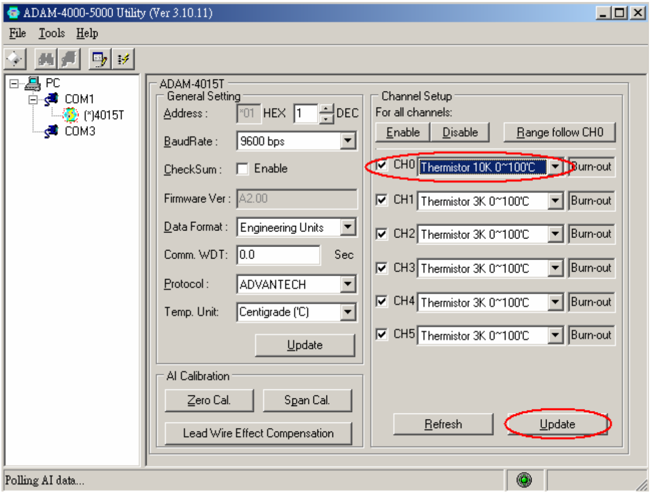
7. Apply 10K ohms 0.01% accuracy resistor to CH0 and then Click “Save”



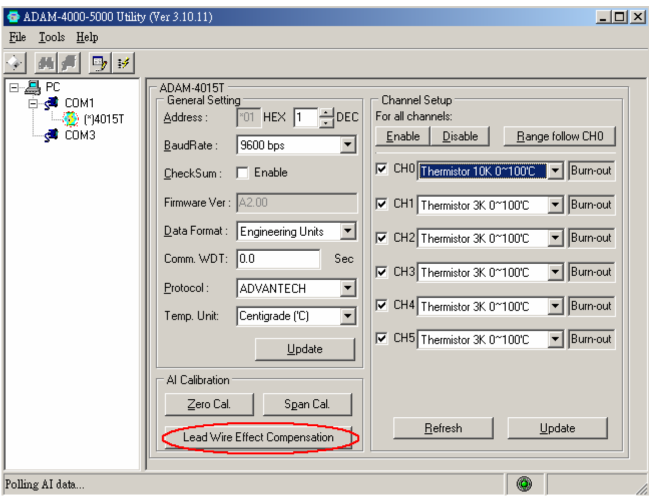
8. Finished!

If you select the range “Thermistor 10K 0~100C”, please follow the calibration steps as below.

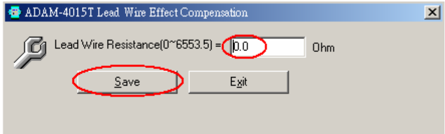
1. Change the input range to “Thermistor 10K 0~100C” and click “Update”



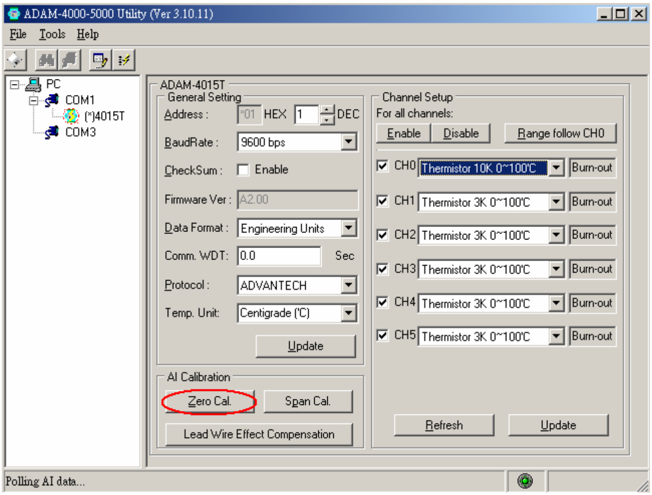
2. Click “Lead Wire Effect Compensation”



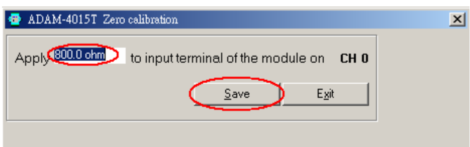
3. Set the resistance to “0” and click “Save”



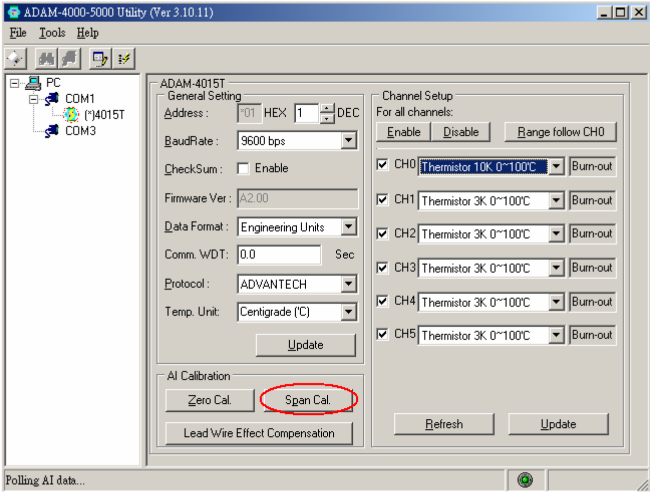
4. Click “Zero Cal.”



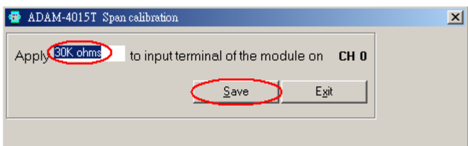
5. Apply 800.0 ohms 0.01% accuracy resistor to CH0 and then Click “Save”



6. Click “Span Cal.”



7. Apply 30K ohms 0.01% accuracy resistor to CH0 and then Click “Save”



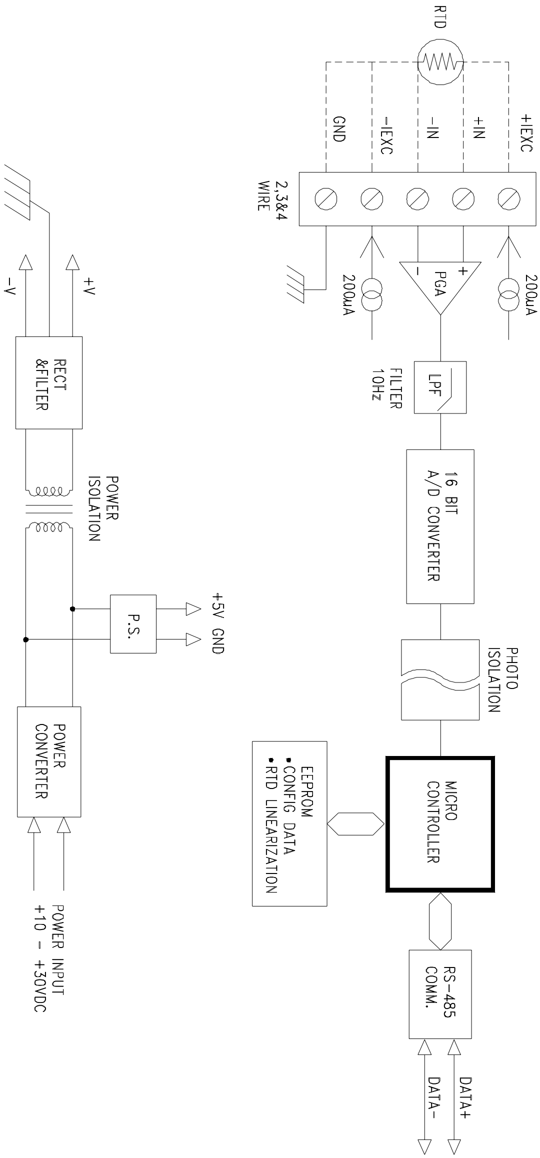
8. Finished!

A.4 ADAM-4013 RTD Input Module

Table A-6 *ADAM-4013 Specifications*

Input range	Pt and Ni RTD
Output speed (in bps) maximum distance	RS-485 (2-Wire) 1200, 2400, 4800, 9600, 19.2K, 38.4K, 57.6K, 115.2K 4000 ft. (1200 m.)
Accuracy	±0.05% or better
Zero drift	±0.01 °C/ °C
Span drift	±0.01 °C/ °C
Input connections	2, 3, or 4 wires
Isolation-rated voltage	3000 VDC
CMR @ 50/60 Hz	150 dB
NMR @ 50/60 Hz	100 dB
Bandwidth	4 Hz
Conversion rate	10 samples/sec.
Input impedance	2 MΩ
Watchdog timer	Yes
Power supply	+10 to +30 VDC (non-regulated)
Power consumption	0.7 W

Figure A-4 ***ADAM-4013 Function Diagram***



B.1 Analog Input Formats

The ADAM analog input modules can be configured to transmit data to the host in one of the following data formats:

-Engineering Units

-Percent of FSR

-Twos complement hexadecimal

-Ohms

B.1.1 Engineering Units

Data can be represented in engineering units by assigning bits 0 and 1 of the data format/checksum/integration time parameter the value 00.

This format presents data in natural units such as degrees, volts, millivolts and milliamps. The engineering format is readily parsed by the majority of computer languages, because the total data string length, including sign, digits and decimal point, does not exceed seven characters.

Input Range	Resolution
±15 mV, ±50 mV	1 μV (three decimal places)
±100 mV, ±150 mV, ±500 mV	10 μV (two decimal places)
±1 V, ±2.5 V, ±5 V	100 μV (four decimal places)
±10 V	1 mV (three decimal places)
±20 mA	1 μA (three decimal places)
Type J and T thermocouple	0.01° C (two decimal places)
Type K, E, R, S and B thermocouple	0.1° C (one decimal place)

Data is grouped into a plus (+) or minus (-) sign, followed by five decimal digits and a decimal point. The input range which is employed determines the resolution or the number of decimal places used as illustrated in the following table:

Example 1

The input value is -2.65 and the corresponding analog input module is configured for a range of ±5 V. The response to the Analog Data In command is:

-2.6500 (cr)

Example 2

The input value is 305.5° C. The analog input module is configured for a type J thermocouple whose range is (0° C to 760° C). The response to the Analog Data In command is:

+305.50 (cr)

Example 3

The input value is +5.653 V. The analog input module is configured for a ±5 V range. When the engineering units format is used, the ADAM Series analog input modules are configured so that they automatically provide an overrange capability. The response to the Analog Data In command in this case is:

+5.6530 (cr)

B.1.2 Percent of FSR

This mode is used by setting bits 0 and 1 of the data format/checksum /integration time parameter to 01. The format used in Percent of FSR consists of a Plus (+) or minus (-) sign followed by five decimal digits including a decimal point. The maximum resolution possible is 0.01%. The decimal point is fixed.

Data is given as the ratio of the input signal to the value of the full-scale range.

Example 1

The input value is +2.0 V. The input module is configured for a range of ±5 V. The response to the Analog Data In command is as follows:

+040.00 (cr)

The full calibrated voltage range ranges from -100% to 100% as voltage input ranges are always bipolar. A ±5 V input would range from -5 V
(-100%) to 5 V (100%).

In this example the input is represented by +40% of the full-scale range which equals (+(40/100) x 5 V = +2.0 V) the actual input value.

Example 2

The input value is 652.5° C. A type E thermocouple (0° C to 1000° C) is configured in the analog input module. The response to the Analog Data In command is:

+065.25 (cr)

The result shows that the value of the input (652.5° C) is 65.25% of the value of the calibrated full-scale range (1000° C).

Thermocouple input ranges are always assumed to be bipolar with zero being the point of symmetry. This holds true regardless of the specified range of operation. For example, when using a type J thermocouple (0° C to 760° C) 760° C corresponds to +100% and 0° C corresponds to 0%. Even if 0° C lies outside the specified range of operation for the thermocouple, zero will remain the point of symmetry. For instance, a type B thermocouple is specified for operation from +500° C to +1800° C. In this case +1800° C corresponds to + 100% and 500° C corresponds to +27.77%.

The percentage is related to the full span of the configured range. If for instance a nickel RTD is specified for -80° C to +100° C then the lower value of -80° C equals 0% of span and the upper value of +100° C equals 100% of span.

When in the FSR mode, if a value exceeds the uppermost value of the input range, an overrange feature is automatically invoked by the ADAM analog input modules. Take, for instance, an analog module which is configured for a ±5 V range but one of the values read is + 5.5V. The resulting value would then be 110%.

The readings must fall within the input range to be guaranteed of accuracy. Although they are typically linear readings which fall between the ±100% and ±115% limits are not accurate, but still generally linear. Readings beyond these limits are neither accurate nor linear.

B.1.3 Twos complement hexadecimal

Easily transferred to integer format the Twos Complement Hexadecimal format represents the data in ASCII hexadecimal form providing rapid communication, high resolution and easy conversion to computer-compatible integer format.

To indicate twos complement hexadecimal bits 0 and 1 of the data format/checksum/integration time parameter must be set to 10. This format displays data in the form of a 4-character hexadecimal string.

This string represents a 16-bit twos complement binary value. Positive full scale is denoted as 7FFF (+32,767) while negative full scale is represented by the value 8000 (-32,768). The resolution is one least significant bit (LSB) of 16 bits.

Example

The input value is -1.234 V. An analog input module is configured for a ±5 V range. The value returned is:

E069 (cr)

This value is equivalent to the signed integer -8087.

Input ranges with voltage and milliamp values are used with the full calibrated voltage range from 8000 to 7FFF. For instance, an ADAM-4011 module is given a ±5 V input range. In this case -5 V is represented as 8000h and +5 V is denoted as 7FFFh.

When thermocouple input ranges are used, an input range which is bipolar and symmetric about zero is assumed. The following table provides several examples.

Thermocouple Type	Temperature Range (Degrees)	Temperature Range (Hex)
J	0° C to 760° C	0000h - 7FFFh
T	-100° C to 400° C	E000h - 7FFFh
R	500° C to 1750° C	2492h - 7FFFh

The given span of the specified range is used to determine the RTD input ranges for twos complement hexadecimal values. As an example, if the nickel RTD is specified for the range -80° C to +100° C, the respective values in hexadecimal notation would be 8000h to 7FFFh.

B.1.4 Ohms

To indicate ohms, set bits 0 and 1 of the data format/checksum/integration time parameter to 11; this data format is only valid for ADAM-4013 analog input modules.

The ohms format allows you to read the value of the RTD resistance in ohms. It consists of a “+” or “-” sign followed by five decimal digits and a decimal point. The resolution (position of the decimal point) of Platinum-Nickel RTDs is 10 m Ω. (two decimal places).

For example, for a 100 Ω. platinum RTD specified for -100° C to +100° C, +100° C corresponds to +138.50 Ω. and -100° C corresponds to +060.60 Ω.

B.2 Analog Input Ranges

Range Code (hex)	Input Range Description	Data Formats	+F.S.	Zero	-F.S.	Displayed Resolution
00	± 15 mV	Engineering Units	+15.000	±00.000	-15.000	1 µv
		% of FSR	+100.00	±000.00	-100.00	0.01%
		Twos Complement	7FFF	0000	8000	1 LSB*
01	± 50 mV	Engineering Units	+50.000	±00.000	-50.000	1 µv
		% of FSR	+100.00	±000.00	-100.00	0.01%
		Twos Complement	7FFF	0000	8000	1 LSB*
02	± 100 mV	Engineering Units	+100.00	±000.00	-100.00	10 µv
		% of FSR	+100.00	±000.00	-100.00	0.01%
		Twos Complement	7FFF	0000	8000	1 LSB*
03	± 500 mV	Engineering Units	+500.00	±000.00	-500.00	10 µv
		% of FSR	+100.00	±000.00	-100.00	0.01%
		Twos Complement	7FFF	0000	8000	1 LSB*
04	± 1 V	Engineering Units	+100.00	±0.0000	-1.0000	100.00 µv
		% of FSR	+100.00	±000.00	-100.00	0.01%
		Twos Complement	7FFF	0000	8000	1 LSB*
05	± 2.5 V	Engineering Units	+2.5000	±0.0000	-2.5000	100.00 µv
		% of FSR	+100.00	±000.00	-100.00	0.01%
		Twos Complement	7FFF	0000	8000	1 LSB*
06	± 20 mV	Engineering Units	+20.000	±00.000	-20.000	1 µv
		% of FSR	+100.00	±000.00	-100.00	0.01%
		Twos Complement	7FFF	0000	8000	1 LSB*
07	not used					

Range Code (hex)	Input Range Description	Data Formats	+F.S.	Zero	-F.S.	Displayed
08	± 10 mV	Engineering Units	+10.000	±00.000	-10.000	Resolution
		% of FSR	+100.00	±000.00	-100.00	1 µv
		Twos Complement	7FFF	0000	8000	0.01%
09	± 5 V	Engineering Units	+5.0000	±0.0000	-5.0000	1 LSB*
		% of FSR	+100.00	±000.00	-100.00	100.00 µv
		Twos Complement	7FFF	0000	8000	0.01%
0A	± 1 V	Engineering Units	+1.0000	±0.0000	-1.000	1 LSB*
		% of FSR	+100.00	±000.00	-100.00	100.00 µv
		Twos Complement	7FFF	0000	8000	0.01%
0B	± 500 mV	Engineering Units	+500.00	±000.00	-500.00	1 LSB*
		% of FSR	+100.00	±000.00	-100.00	10 µv
		Twos Complement	7FFF	0000	8000	0.01%
0C	± 150 mV	Engineering Units	+150.00	±000.00	-150.00	1 LSB*
		% of FSR	+100.00	±000.00	-100.00	10 µv
		Twos Complement	7FFF	0000	8000	0.01%
0D	± 20 mV	Engineering Units	+20.000	±00.000	-20.000	1 LSB*
		% of FSR	+100.00	±000.00	-100.00	1 µv
		Twos Complement	7FFF	0000	8000	0.01%

Range Code (hex)	Input Range Description	Data Formats	Maximum Specitied Signal	Minimum Specitied Signal	Displayed Resolution
0E	Type J Thermocouple 0°C to 760°C	Engineering Units	+760.000	+000.00	0.01°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	0000	1 LSB*

Range Code (hex)	Input Range Description	Data Formats	Maximum Specified Signal	Minimum Specified Signal	Displayed Resolution
0F	Type K Thermocouple 0°C to 1370°C	Engineering Units	+1370.0	+0000.0	0.1°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	0000	1 LSB*
10	Type T Thermocouple -100°C to 400°C	Engineering Units	+400.00	-100.00	0.01°C
		% of FSR	+100.00	-0.25.00	0.01%
		Twos Complement	7FFF	E000	1 LSB*
11	Type E Thermocouple 0°C to 1000°C	Engineering Units	+1000.0	+0000.0	0.1°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	0000	1 LSB*
12	Type R Thermocouple 500°C to 1750°C	Engineering Units	+1750.0	+0500.0	0.1°C
		% of FSR	+100.00	+028.57	0.01%
		Twos Complement	7FFF	2492	1 LSB*
13	Type S Thermocouple 500°C to 1750°C	Engineering Units	+1750.0	+0500.0	0.1°C
		% of FSR	+100.00	+028.57	0.01%
		Twos Complement	7FFF	2492	1 LSB*
14	Type B Thermocouple 500°C to 1800°C	Engineering Units	+1800.0	+0500.0	0.1°C
		% of FSR	+100.00	+027.77	0.01%
		Twos Complement	7FFF	2381	1 LSB*
20	100.00 Ω Platinum RTD α = .00385 -100°C to 100°C	Engineering Units	+100.00	-100.000	0.1°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	8000	1 LSB*
		Ohms	+138.50	+060.60	10 mΩ
21	100.00 Ω Platinum RTD α = .00385 0°C to 100°C	Engineering Units	+100.000	+000.00	0.1°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	0000	1 LSB*
		Ohms	+138.50	+100.00	10 mΩ

Range Code (hex)	Input Range Description	Data Formats	Maximum Specitied Signal	Minimum Specitied Signal	Displayed Resolution
22	100.00 Ω Platinum RTD α = .00385 0°C to 200°C	Engineering Units	+200.00	+000.00	0.01°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	0000	1 LSB*
		Ohms	+175.84	+100.00	10 mΩ
23	100.00 Ω Platinum RTD α = .00385 0°C to 600°C	Engineering Units	+600.00	+000.00	0.01°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	0000	1 LSB*
		Ohms	+313.59	+100.00	10 mΩ
24	100.00 Ω Platinum RTD α = .00392 -100°C to 100°C	Engineering Units	+00.00	-100.00	0.01°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	8000	1 LSB*
		Ohms	+139.16	+060.60	10 mΩ
25	100.00 Ω Platinum RTD α = .00392 0°C to 100°C	Engineering Units	+100.00	+000.00	0.01°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	0000	1 LSB*
		Ohms	+139.16	+100.00	10 mΩ
26	100.00 Ω Platinum RTD α = .00392 0°C to 200°C	Engineering Units	+200.00	+000.00	0.01°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	0000	1 LSB*
		Ohms	+177.13	+100.00	10 mΩ
27	100.00 Ω Platinum RTD α = .00392 0°C to 600°C	Engineering Units	+600.00	+000.00	0.01°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	0000	1 LSB*
		Ohms	+317.28	+100.00	10 mΩ
28	120 Ω Nickel RTD -80°C to 100°C	Engineering Unit	+100.000	-80.00	0.01°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	8000	1 LSB*
		Ohms	+200.64	+066.60	10 mΩ

Range Code (hex)	Input Range Description	Data Formats	Maximum Specitied Signal	Minimum Specitied Signal	Displayed Resolution
29	100.00 Ω Nickel RTD α = .00392 0°C to 100°C	Engineering Units	+100.00	+000.00	0.01°C
		% of FSR	+100.00	+000.00	0.01%
		Twos Complement	7FFF	0000	1 LSB*
		Ohms	+200.64	+120.00	10 mΩ

NOTE: * Resolution is one LSB of 16 bits

C.1 ADAM Dimensions

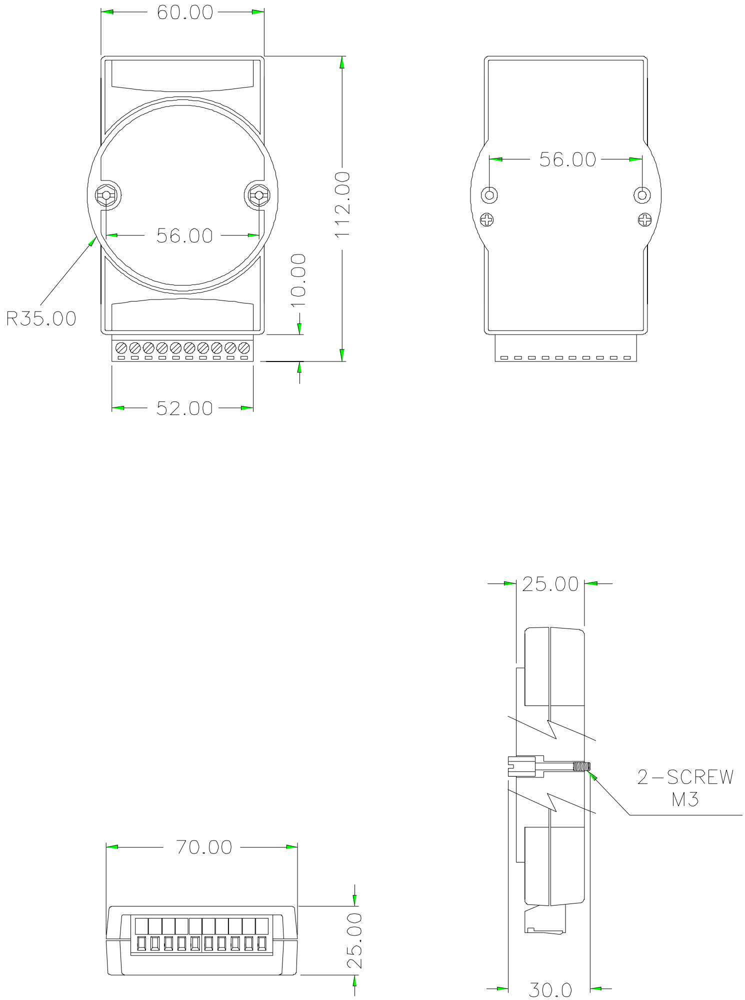


Figure C-1 *ADAM Modules Dimensions*

C.2 Installation

C.2.1 DIN-Rail Mounting

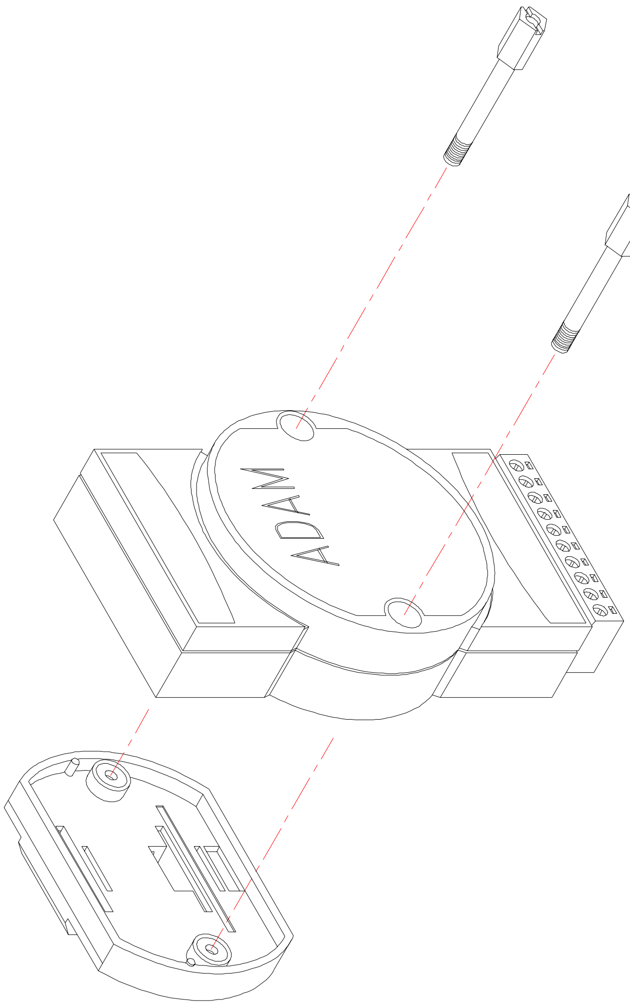


Figure C-2 *DIN-Rail Adapter*

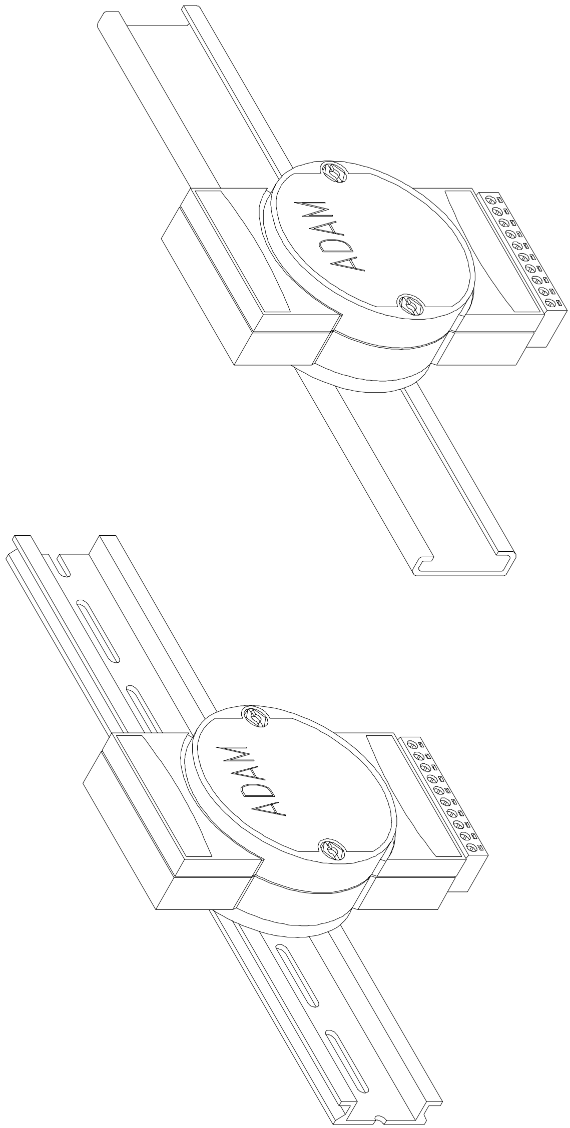


Figure C-3 *DIN-Rail Mounting*

C.2.2 Panel Mounting

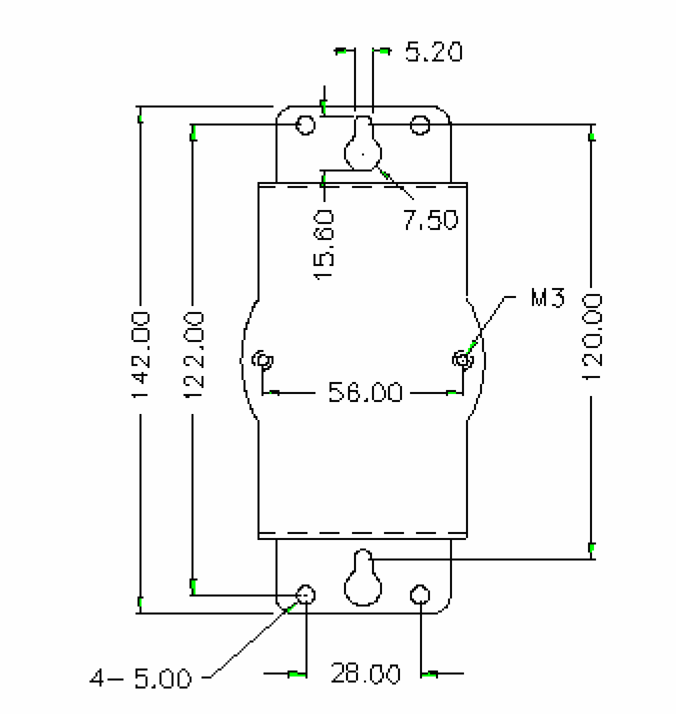


Figure C-4 *Panel Mounting Bracket Dimensions*

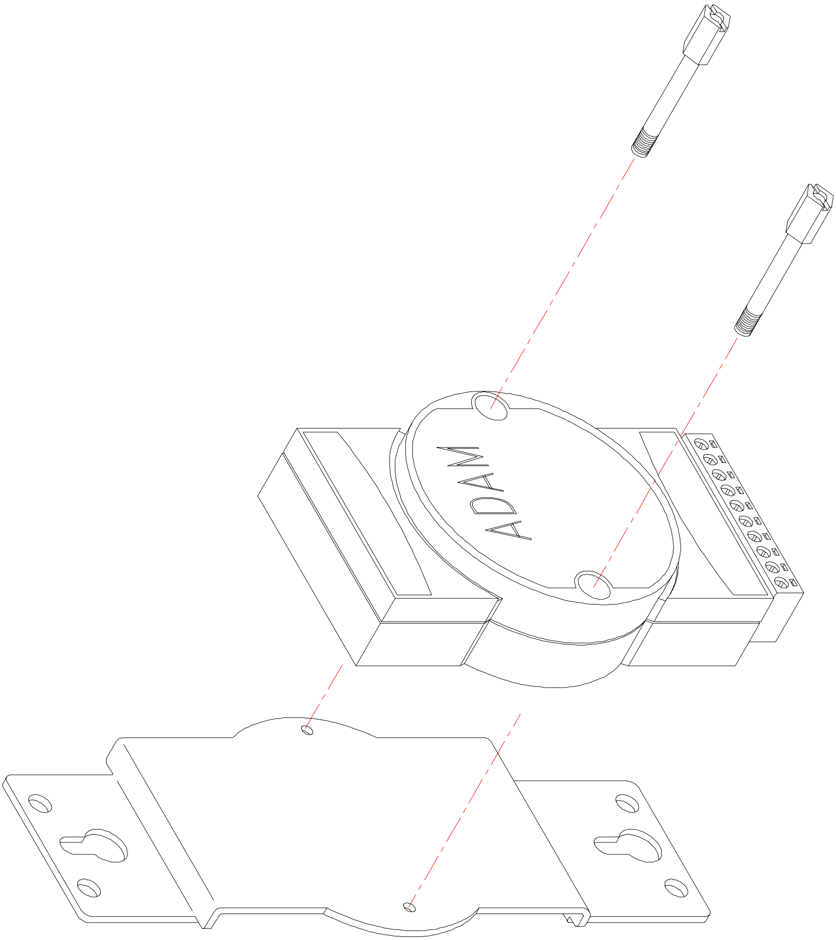


Figure C-5 *Panel Mounting*

C.2.3 Piggyback Stack

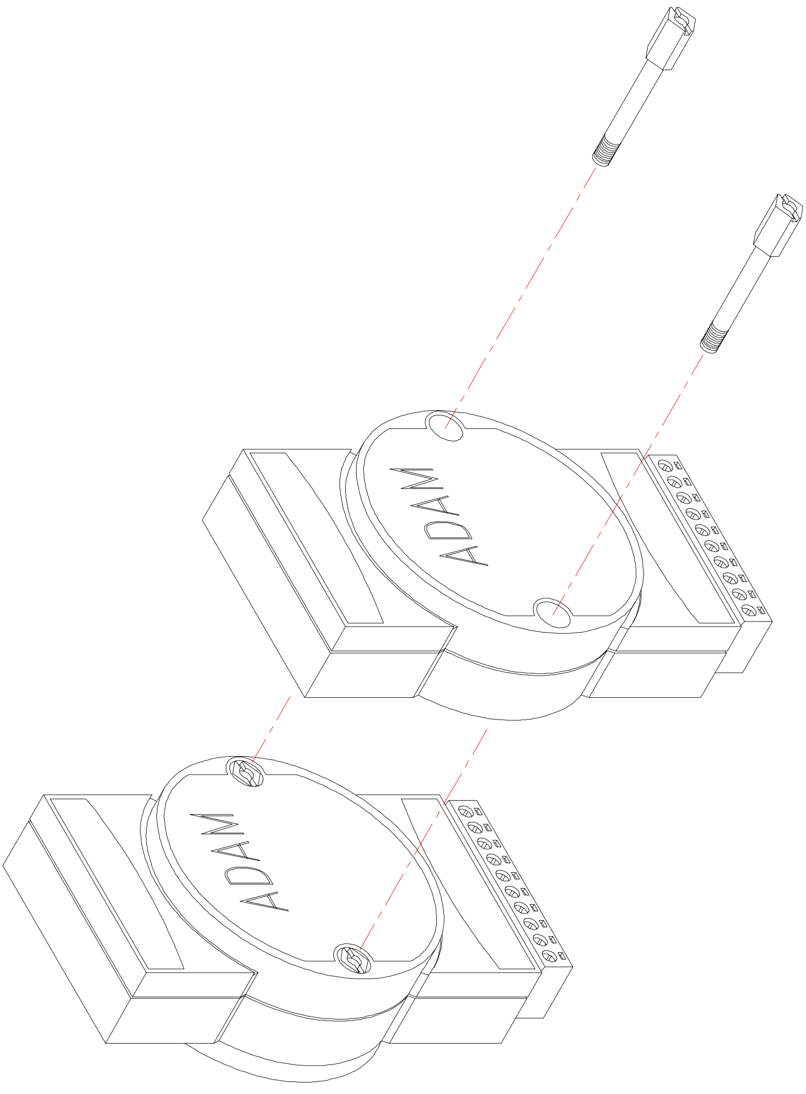


Figure C-6 *Piggyback Stack*

D.1 ADAM-4000 Utility Software

Together with the ADAM modules you will find a utility disk containing utility software with the following capabilities:

- Module configuration
- Module calibration
- Data Input and Output
- Alarm settings
- Autoscan of connected modules
- Terminal emulation

The following text will give you a brief instruction how to use the program.

Search the installed modules

The main screen consists of a menu bar at the top side of the screen and a status field which displays information about the connected modules. When the modules are connected well, you have to start the program and search the modules by clicking the search icon as below. Please do check the COM port and related settings are correct.

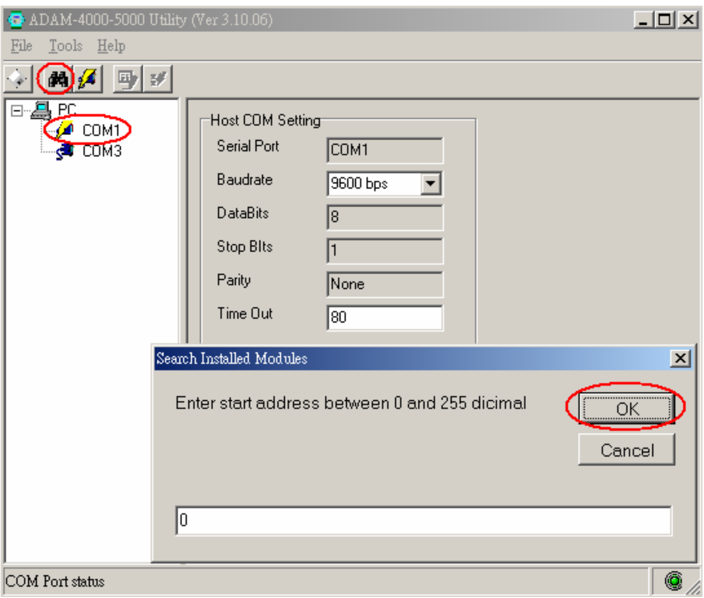


Figure D-1 Search screen

NOTICE: When changing configuration, calibration or alarm parameters, you should always make sure that a window appears notifying you that the target module has confirmed the changes.

An asterix sign "" before the modules address indicates that the module is in the INIT* state*

Configuration

Click the searched module, which you would like to configure. You will find Setup page and related settings. An example is shown in Figure D-2 for an ADAM-4011 module.

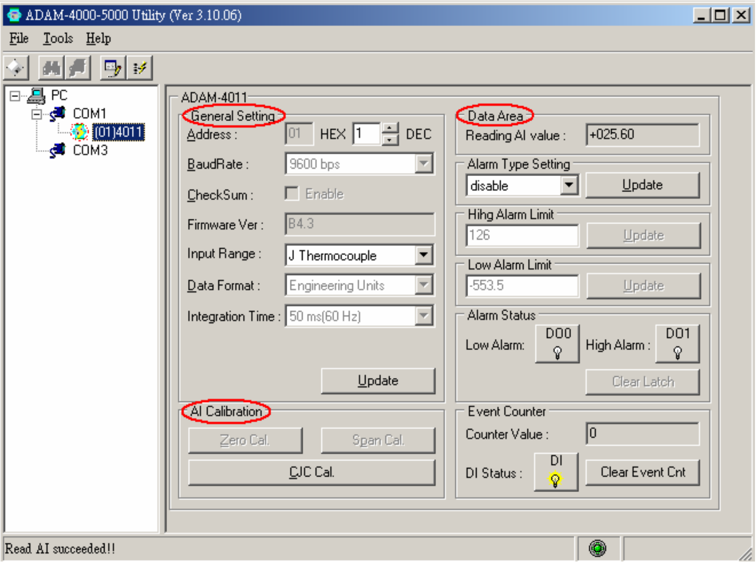


Figure D-2 Configuration Screen

Here there are three major areas, General Setting, Data Area and AI Calibration. You may change the settings by selecting the preferred items and then clicking Update button.

The Checksum and Baud rate options need special attention since they can only be changed when an ADAM module is in the INIT* state. To place a module in INIT state, its INIT terminal should be connected to its GND terminal (see Baud rate and Checksum in Chapter 2). When the ADAM module is not in INIT mode, an error message will appear.

After you have made all necessary changes to the module configuration, the utility will display the process data automatically.

Calibration

Please note only analog input and output modules can be calibrated. For example, ADAM-4011 module has Zero, Span and CJC Calibration items. To learn what steps should be taken to calibrate both input and output modules, please refer to Chapter 5 Calibration.

Terminal Function

When you would like to send and receive commands on the RS-485 line directly, you can use this Terminal function in this utility.

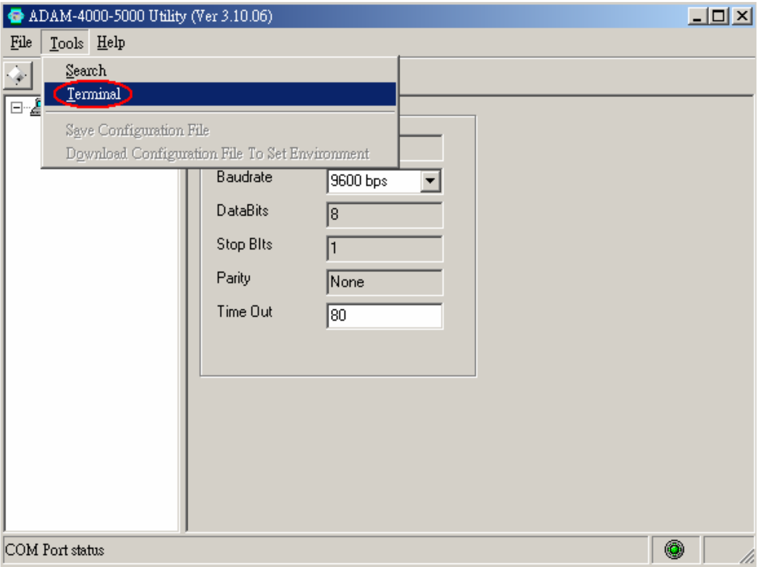


Figure D-3 *Terminal Function*

You can type the ADAM ASCII command in the text box and click Send button for testing the commands which are listed in Chapter 4 Command Set.

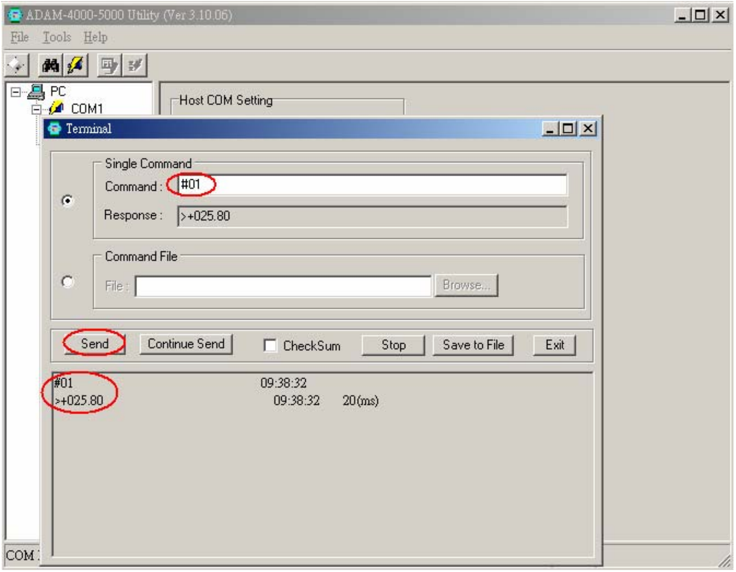


Figure D-4 *Terminal Function*

F

How to use the Checksum feature

A checksum helps you to detect errors in commands from the host to the modules, and in responses from the modules to the host. The feature adds two extra checksum characters to the command or response string, which does reduce the throughput.

F.1 Checksum Enable/Disable

To enable configuration of a module’s checksum feature, its INIT* terminal should be shorted to its GND terminal, after which the module should be rebooted. The checksum feature is enabled by setting bit 6 of the data format/checksum parameter to 1. To disable the checksum, set the parameter to 0. Remember that when using the checksum feature, it should always be enabled for all connected devices including the host computer.

The checksum is represented by a 2-character ASCII hexadecimal format and is transmitted just prior to the carriage return. The checksum equals the modulo-256 (100h) sum of all the ASCII values in the command preceding the checksum. If the checksum in a command is missing or incorrect the module will not respond.

Example 1

The following is an example of an Analog Data In command and response when the checksum is enabled:

Command: #0588(CR)

Response: +3.56719D(CR)

The input value at the module at address 05h is +3.5671 V. (The date format is engineering units.) The command checksum (88h) is the sum of the ASCII values of the following characters: #, 0, and 5. The response checksum (9Dh) is the sum of the ASCII values of the following characters: “>” “+” “3” “.” “5” “6” “7” and “1” .

Example 2

This example explains how to calculate the checksum value of a Read High alarm limit command string:

Case 1. (If the Checksum feature is **disabled**)

Command: $07RH(cr)
Response: !07+2.0500(cr) when the command is valid.

Case 2. (If the Checksum feature is **enabled**)

Command: $07RH25(cr)
Response: !07+2.0500D8(cr)

where:

25 represents the checksum of this command, and
D8 represents the checksum of the response.

The checksum of the command string is derived as shown below:

25h = (24h+ 30h + 37h + 52h + 48h) MOD 100h

The hexadecimal ASCII codes for $, 0, 7, R, H are 24h, 30h, 37h, 52h and 48h respectively. The sum of these ASCII codes is 125h. The module-256(100h) sum of 125h is 25h.

Table F-1 *Printable ASCII Characters*

HEX	ASCII	HEX	ASCII	HEX	ASCII	HEX	ASCII
21	!	40	@	5F	_	7E	~
22	""	41	A	60	'		
23	#	42	B	61	a		
24	$	43	C	62	b		
25	%	44	D	63	c		
26	&	45	E	64	d		
27	'	46	F	65	e		
28	(	47	G	66	f		
29	)	48	H	67	g		
2A	*	49	I	68	h		
2B	+	4A	J	69	i		
2C	,	4B	K	6A	j		
2D	-	4C	L	6B	k		
2E	.	4D	M	6C	l		
2F	/	4E	N	6D	m		
30	0	4F	O	6E	n		
31	1	50	P	6F	o		
32	2	51	Q	70	p		
33	3	52	R	71	q		
34	4	53	S	72	r		
35	5	54	T	73	s		
36	6	55	U	74	t		
37	7	56	V	75	u		
38	8	57	W	76	v		
39	9	58	X	77	w		
3A	:	59	Y	78	x		
3B	;	5A	Z	79	y		
3C	<	5B	[	7A	z		
3D	=	5C	\	7B	{		
3E	>	5D	]	7C	|		
3F	?	5E	^	7D	}		

G

ADAM-4000 I/O Modbus Mapping Table

The model list of ADAM-4000 I/O series support Modbus protocol

	Model	Description
1	ADAM-4015	6-channel RTD Input Module
	ADAM-4015T	6-channel Thermistor Input Module
2	ADAM-4017+	8-channel Analog Input Module
3	ADAM-4018+	8-channel Thermocouple Input Module
4	ADAM-4019+	8-Channels Universal Analog Input Module
5	ADAM-4024	4-channel Analog Output Module
6	ADAM-4051	16-channel Isolated Digital Input with LED Module
7	ADAM-4055	16-channel Isolated Digital I/O with LED Module
8	ADAM-4056S	12 channel Sink-type Isolated Digital Output Module
9	ADAM-4056SO	12 channel Source-type Isolated Digital Output Module
10	ADAM-4068	8 Relay Output Module
11	ADAM-4069	8 Power Relay Output Module

1. ADAM-4015 6-channel RTD Input Module and ADAM-4015T 6-channel Thermistor Input Module

ADDR 0X	Channel	Item	Attribute	Memo
00201	0	Burn-out Signal	R	1:Burn-out
00202	1	Burn-out Signal	R	
00203	2	Burn-out Signal	R	
00204	3	Burn-out Signal	R	
00205	4	Burn-out Signal	R	
00206	5	Burn-out Signal	R	
00207	6	Burn-out Signal	R	
00208	7	Burn-out Signal	R	

ADDR 4X	Channel	Item	Attribute	Memo
40001	0	Current Value	R	
40002	1	Current Value	R	
40003	2	Current Value	R	
40004	3	Current Value	R	
40005	4	Current Value	R	
40006	5	Current Value	R	
40007	6	Current Value	R	
40008	7	Current Value	R	
40201	0	Type Code	R/W	0x00 0x0e
40202	1	Type Code	R/W	
40203	2	Type Code	R/W	
40204	3	Type Code	R/W	
40205	4	Type Code	R/W	
40206	5	Type Code	R/W	
40207	6	Type Code	R/W	
40208	7	Type Code	R/W	
40211		Module Name 1	R	0x40 0x18
40212		Module Name 2	R	0x50 0x00
40213		Version 1	R	0xa2 0x00
40214		Version 2	R	0x00 0x00
40221		Channel Enable	R/W	0x00 0xff

Changing Configuration to Modbus Protocol

The ADAM-4000 Modbus version modules may come from the factory set for ADAM ASCII protocol as the default protocol.

If the module is connected to a Modbus network, the Modbus network may not recognize the module. This may be because the ADAM-4000 module is set for ADAM ASCII protocol and needs to be set-up for Modbus protocol.

Please follow the steps as below for configuring an ADAM-4000 module to Modbus protocol.

1. Configure the ADAM-4000 Module with the ADAM-4000 utility (latest ADAM-4000 utility can be found at www.advantech.com service & support.)
2. Initialize the ADAM-4000 on a RS-485 network (the preferred method is one module at a time on the RS-485 network).
3. With the module powered off, place a jumper on the INIT* terminal to the GND terminal (if the module has an INIT* switch, put the INIT* switch in the "Init" position).
4. Power the module up
5. Wait 10 seconds for the module to initialize.
6. Using the ADAM-4000 utility, search (scan) for the module to change the protocol. (Initial COM settings: 9600 baud, N-8-1)
7. The utility will identify the module from the search function.
8. The ADAM-4000 utility will now permit the serial data protocol to be changed to the Modbus protocol.
9. The address and COM port settings can also be changed at this time.
10. To access the module click on the module icon in the utility.
11. Using the utility, under general settings for the module, update the protocol by pressing the "Update" button.
12. Power down the module.
13. Remove the INIT* terminal wire from the GND terminal and INIT* terminal (Or put the INIT* switch back in "Normal" position)
14. The module is now ready to be placed in the Modbus network.