Installation Guideline 2

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, 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 configuration is 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.

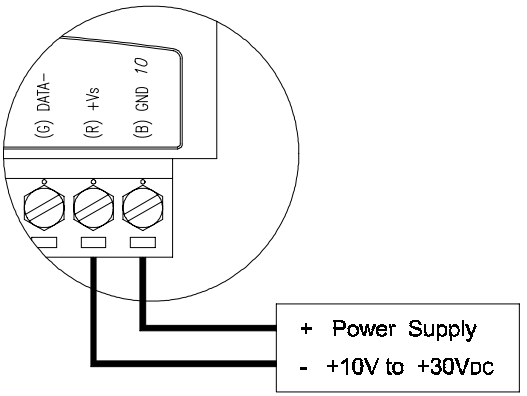

Figure 2-1 *Power Supply Connections*

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 256 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.

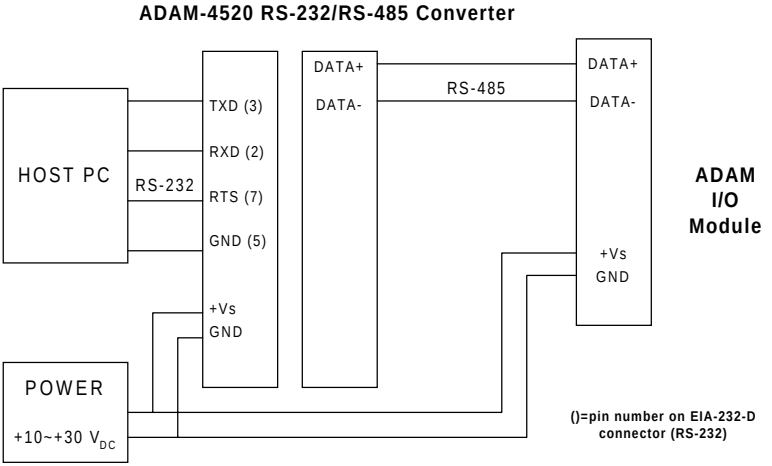

Figure 2-2 *Basic Hook-up of ADAM Module to Host Switches*

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)

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 figure 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).

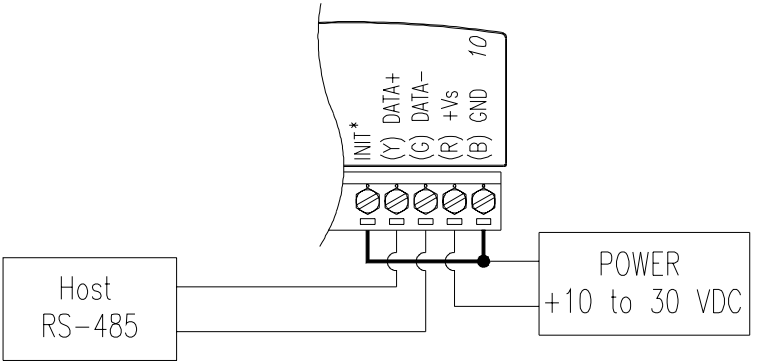

Figure 2-3 *Grounding the INIT* Terminal*

- 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:

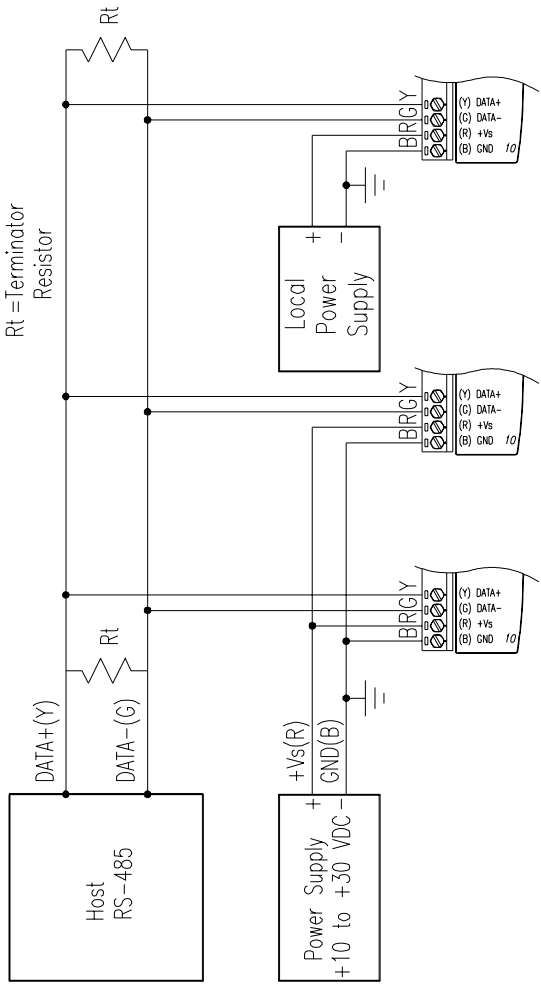

Figure 2-4 *Multi-module Connection*

2.5 Application Example

ADAM-4011 alarm functions may be used to build a simple ON-OFF controller application that will operate without host intervention.

When the proper alarm settings have been stored in ADAM's EEPROM it would be able to function as a stand alone device where no communication lines are required.

A simple controller application would use the momentary alarm output to control the process. Lets assume we are controlling a heating process. The input of the Analog Input will be the process' temperature and its output determine whether the heater is turned on or turned off. (See Figure 2-5)

In order to maintain a steady temperature set the LO limit of the alarm function to desired setpoint and configure the alarm mode as Momentary. Utilize the LO alarm output (DO0/LO) to control the SSR relay that controls the heater.

If the module measures a temperature that undergoes the LO alarm setting it will turn the LO alarm high which causes the heater to be switched on. When a temperature is measured that exceeds the LO alarm setting the LO alarm is set to low and the heater is turned off. In this application the HI alarm output is still available to activate an alarm or generate an emergency shut-down if the temperature gets out of control.

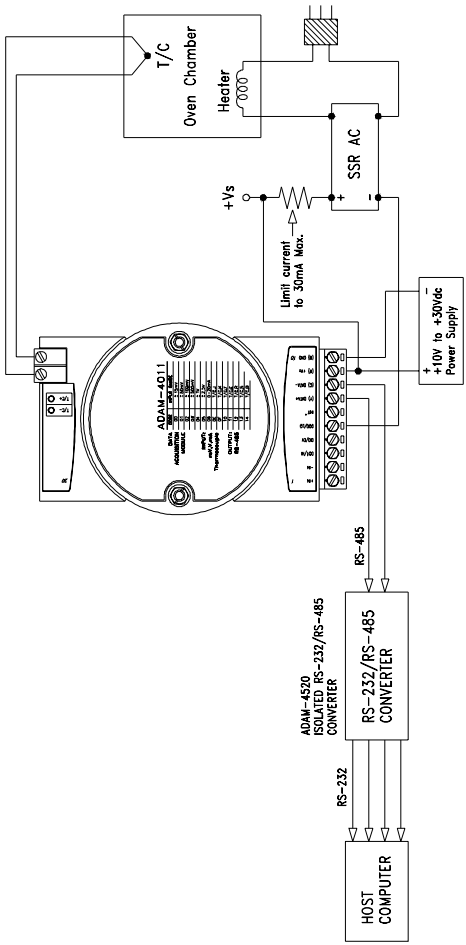

Figure 2-5 *Simple ON/OFF Controller Function*

Programming Example

The following program is a simple program written in BASIC that resembles our application example. The program first configures the ADAM-4011 module to act as an ON/OFF controller and then monitors and displays the process temperature.