

OWNER'S MANUAL

MODEL V77 ADM-1

ANALOG TO DIGITAL MODULE

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Thank you for selecting the BayTech Model V77 ADM-1 Analog-to-Digital Module.

The data provided in this Owner's Manual explains the various ways you can operate the V77 ADM-1 and how to configure your unit. We suggest that you read this manual carefully before attempting to install the Model V77 ADM-1, and that you place special emphasis on correct cabling and configuration. If you have any problems with your installation, please contact a BayTech applications engineer for assistance.

BayTech also manufactures other data communications devices that provide port sharing and expansion, networking, port contention, buffered and non-buffered printer sharing, network print servers, and statistical multiplexing. If you would like information on any of these models, please contact BayTech Customer Service.

We welcome any comments you may have about our products. And we hope that you will continue to look to BayTech for your data collection and communications needs.

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1 GENERAL

BayTech's ADM-1 programmable analog-to-digital input board, is a plug-in module designed for use with the BayTech M Series DAC Data Acquisition Controllers. The primary feature of the ADM-1 is a 12 bit, successive approximation, analog-to-digital converter which provides conversion of data with high accuracy and resolution at moderate throughput rates.

The ADM-1 can be operated as either eight differential or 16 single-ended inputs. Signal input connections to the ADM-1 are made through a standard DB-25 female connector. Data resolution is 12 bits using unipolar (0 to +X volts) operation or 11 bits plus sign in the bipolar (-X to +X volts) mode. A total of eight software selectable and one hardware (jumper) selectable, unipolar/bipolar input voltage ranges are available. Three point (25%, 50% 75%) self-calibration is provided in software to reduce or remove errors introduced by input offsets.

Sample rates up to 4000 S/sec and data averaging from 1 to 4000 samples are selectable through configuration options. Data averaging can be expanded to include larger sample sets through the use of BayTech, or commercially available, application software. Time stamping or "Time Tagging" of data is available through the use of a "time-of-day" clock located in the M16/M8 base unit. A time tag includes month, day, year, hour, minute and second.

Data samples are supplied to the host computer/controller from any of the following modes:

1. Upon user request (COMMAND).
- 2) At a specific date and/or time (SCHEDULE).
- 3) Real time sampling (i.e., as samples are received or IMMEDIATE).

2 SPECIFICATIONS

(typical for 25° C unless otherwise noted)

ANALOG INPUT:

Channels: 8 Differential or 16 Singled-Ended inputs

Input Resolution: 12 bits, 1 to 4,096 (11 bits plus sign in bipolar mode);
Guaranteed monotonic over operating temperature range

Type of Converter: Successive-Approximation

Input impedance: > 1 Meg ohm

Input Ranges: $\leq 0.675\text{V}$, $\leq 1.25\text{V}$, $\leq 2.5\text{V}$, $\leq 5\text{V}$, $\leq 10\text{V}$; 0 to
1.25V, 0 to 2.5V, 0 to 5V, 0 to 10V

Gain ranges: 0.5 (jumper selectable), 1, 2, 4, 8 (software selectable)

System noise: <1.5 LSB rms (all gains)

Overvoltage Protection: $\leq 50\text{ V}$ without damage, power "on" $\leq 35\text{ V}$
without damage, power "off"

Common-Mode Input Voltage: $\leq 13\text{ volts}$ (max)

Common-Mode Rejection Ratio: 95 db @60 Hz, all gains

ACCURACY

Relative accuracy: ≤ 1.5 LSB maximum
(nonlinearity + quantization error) ≤ 1.0 LSB typical

Differential nonlinearity: ≤ 1.0 LSB maximum (no missing codes over temperature range)

Integral nonlinearity: ≤ 1.0 LSB maximum (no missing codes over temperature range)

Full Scale (FS) Error: $\leq 0.2\%$ maximum (gain = 1) $\leq 0.03\%$ typical

Offset error: ≤ 3 LSB maximum, ≤ 1 LSB typical

INTERNAL VOLTAGE REFERENCE: 0.05 % (of 5V) maximum 0.002% (of 5V) typical

SELF CALIBRATION: 3 points (25%, 50%, & 75%) on -5 to +5 V range. Auto offset calibration on all ranges

SAMPLING:

Sample Rates: 1 to 4000 S/s

Sample Averaging: 1 to 4000 samples

FIFO buffer: 12KB (stores up to 6000 averaged samples w/o a Time Tag or 1500 w/Time Tag, without requiring data transfer to an external memory module)

DYNAMIC PERFORMANCE

<u>Gain</u>	<u>Bipolar</u>	<u>Unipolar</u>	<u>Sample rate</u>	<u>Selectable</u>
0.5	\times 10 V NA		4 kS/s	Jumper
1	\times 5 V	0 to 10 V	4 kS/s	Software
2	\times 2.5 V	0 to 5 V	4 kS/s	Software
4	\times 1.25 V	0 to 2.5 V	4 kS/s	Software
8	\times 0.625 V	0 to 1.25 V	4 kS/s	Software

POWER REQUIREMENTS:

+5VDC (from M16/M8 power supply), 175 ma maximum,
150 ma typical

ENVIRONMENTAL:

Operating temperature range: 0° to 70° C

Storage temperature range: -40° to 85° C

Humidity: 5% to 95% non-condensing

3 INSTALLATION

The ADM-1 is installed in the M Series chassis as described in *Section 3.5* of the base unit operator's manual.

NOTE: The ADM-1 cannot be installed as Module 1. If an ADM-1 is removed from a module slot and a different ADM-1 is installed in that location, the newly installed module acquires the previous module's configuration. Moving an ADM-1 to a different module location requires reconfiguration because the configuration parameters are stored as a function of slot location and module type. The configuration information does not stay with a relocated module.

IMPORTANT: You must install jumper *JP1* to use $\pm 10V$ range. First, remove the ADM-1 from the M Series chassis. Next, locate *JP1* in *Appendix B* and install a jumper connector on *JP1*.

Once the ADM-1 has been installed in the M Series chassis, connect a cable with a DB-25 male connector to the input connector, J2. Determine if you will be using single-ended or differential inputs. Singled-ended operation allows up to 16 inputs using grounds of the same potential. Differential operation allows up to 8 inputs using different reference polarities. Configure your input cable as shown in *Figure 1* for single-ended operation or as shown in *Figure 2* for differential operation.

Input	Pin #	Input	DI Channel #	Pin #
Ground	1	14		
Ground	2	15		
Channel 8	3	16		
Channel 7	4	17		
Channel 6	5	18		
Channel 5	6	19		
Channel 4	7	20		
Channel 3	8	21		
Channel 2	9	22		
Channel 1	10	23		
Ground	11	24		
Ground	12	25		
Ground	13			
			1	10 & 22
			2	9 & 21
			3	8 & 20
			4	7 & 19
			5	6 & 18
			6	5 & 17
			7	4 & 16
			8	3 & 15
				+ -
				Polarity

Figure 1: Single-ended Input Connections **Figure 2: Differential Input Connections**

IMPORTANT: If you are connecting multiple single-ended devices, it is imperative all the grounds returns are at the same potential or erroneous operation could result. If a channel is not connected to an external circuit, it should be terminated to ground or programmed as inactive (see *Section 5.1.5.4*). This prevents the presentation or reporting of erroneous data from unused inputs.

4 OPERATION

This section discusses the general ADM-1 operation (*Section 4.1*), user-programmable features (*Section 4.2*), supported data commands (*Section 4.3*), data message generation (*Section 4.4*) and data message presentation (*Section 4.5*).

4.1 GENERAL

The ADM-1 may be operated as 8 differential or 16 single ended input channels. The input source is an analog voltage signal which is sampled and digitized into a *data message*. The data message is sent to a *host communication module* automatically or upon request. The host communication module is the primary user interface to the ADM-1 which allows a host computer or terminal to change configuration or transmit data commands and receive data messages.

Each data message may be presented in a hexadecimal, decimal, or voltage format and will be preceded by the unit/module/channel number from which the data message came. The data message may be optionally appended with a "real time" *Time Tag* showing the date and time the data message was recorded. Data resolution is 12 bits.

Data commands are used to instruct the ADM-1 to perform various tasks that pertain to data acquisition. These include calibration, buffer clearing, report a single data message or all data messages in the receive buffer, and sample/report a single data message on demand. The supported data commands and the data command procedure are described in *Section 4.3*.

You have the choice of programming the ADM-1 via verbose (menu-driven) or non-verbose (dynamic) configuration mode. When using verbose configuration mode, a series of menus will prompt you to enter the desired configuration parameters. Non-verbose or dynamic configuration mode allows you to program certain parameters of the ADM-1 by downloading configuration commands. Configuration is discussed in *Section 5*.

4.2 USER-PROGRAMMABLE FEATURES

You may program the *Sampling Setup*, *Reporting Setup*, *Channel Input Setup*, and enable/disable *Dynamic Configuration* on the ADM-1. *Section 4.2.1* discusses Sampling Setup, *Section 4.2.2* discusses Reporting Setup, and *Section 4.2.3* discusses Channel Input Setup.

4.2.1 SAMPLING SETUP

Sampling Setup allows you to program how the ADM-1 takes samples of the analog input voltage signals. The items you may program in the Sampling Setup include *Sampling Method*, *Sample Start Time*, *Sample Interval*, *Sample Rate*, and *Number of Samples to Average*. The following subsections describe these features in more detail.

4.2.1.1 SAMPLING METHOD

Sampling Method is the manner in which sampling is initiated. The ADM-1 provides three Sampling Methods. These are Command (upon request via data commands only), Immediate (upon exiting configuration), and Schedule (where sampling begins at a specified time). **The default Sampling Method is Command.**

4.2.1.2 SAMPLE START TIME

Sample Start Time is the time sampling begins when Schedule Sampling Method is selected. The start of sampling may be delayed up to twenty-four hours from the current time recorded by the M Series time-of-day clock. **The default Sample Start Time is 00:00.**

4.2.1.3 SAMPLE INTERVAL

You may program the ADM-1 to sample continuously or in repetitive periods where the ADM-1 will sample for a certain period of time, stop sampling, and then resume sampling after a specified time interval. Sample Interval is the time between the start of sampling periods. The duration of a sampling period is determined by the Sampling Rate and the Number of Samples to average as described in *Section 4.4*. Continuous sampling is selected by choosing no Sample Interval. **The default Sample Interval is 00:00:00 (continuous sampling).**

4.2.1.4 SAMPLE RATE

Sample Rate is the actual number of samples an ADM-1 channel will read in one second. Sample Rate may range from 1 to 4000 samples per second (S/sec). The sample rate for an individual channel is the programmed rate divided by the number of active channels.

The default Sample Rate is 1 S/sec.

4.2.1.5 NUMBER OF SAMPLES TO AVERAGE

The Number of Samples to Average is the number of samples averaged per data message. The ADM-1 will sample at a certain Sampling Rate and average a specified number of samples. This average will then be quantized into a discrete digital value and sent to a host module as a data message upon request or automatically depending on the Reporting Method. The Number of Samples to Average may range from 1 to 4000 samples. **The default Number of Samples to Average is 10 samples.**

4.2.2 REPORTING SETUP

Reporting Setup allows you to program how the ADM-1 reports data messages to the host module. The items you may program in the Reporting Setup include *Reporting Method*, *Report Start Time*, *Report Interval*, *Set Host Address*, *Data Format*, *Time Tag*, and *Terminating Character(s)*. The following subsections describe these features in more detail.

4.2.2.1 REPORTING METHOD

Reporting Method is the manner in which data messages are sent to the designated host module. The ADM-1 provides three Reporting Methods. These are Command (upon request via data commands), Immediate (upon exiting configuration), and Schedule (where reporting begins at a specified time). **The default Reporting Method is Command.**

4.2.2.2 REPORT START TIME

Report Start Time is the time reporting begins when Schedule Reporting Method is selected. The start of reporting may be delayed up to 24 hours from the current time recorded by the M Series time-of-day clock and reporting will occur in cyclic periods as determined by the Report Interval. **The default Report Start Time is 00:00.**

4.2.2.3 REPORT INTERVAL

You may program the ADM-1 to report in repetitive periods using Schedule Reporting Method, where the ADM-1 will report all data messages in the receive buffer after the specified Report Interval has elapsed. The ADM-1 will report until the buffer is empty and then report again after the specified Report Interval has expired. **The default Report Interval is 00:00 (every 24 hours).**

4.2.2.4 HOST ADDRESS

Host Address is the designated host module where data messages are sent when using Immediate or Schedule Reporting Method. The Host Address consists of the Unit Number (1 to 32), Module Number (1 to 16), and Port Number (1 to 4) of the designated host module. **The default Host Address is Unit 1, Module 1, Port 1.**

4.2.2.5 DATA FORMAT

Data Format is the format of the data messages sent to the designated host module which may be in Hexadecimal, Decimal, or Engineering Units. When Hexadecimal Data Format is selected, the data message will appear as a hexadecimal value between 000 Hex (low range) and FFF Hex (high range). When Decimal Data Format is selected, the data message will appear as a decimal value between 0 (low range) and 4095 (high range). When Engineering Units Data Format is selected, the data message will appear as the actual sampled voltage. **The default Data Format is Hexadecimal.**

4.2.2.6 TIME TAG

When Time Tag is enabled, a time tag is appended immediately after the data. The time tag consists of the month, day, year, hour, minute, and second at which the data was calculated. Time Tag may be enabled or disabled. **The default Time Tag is disabled.**

4.2.2.7 TERMINATING CHARACTER(S)

The Terminating Character(s) is added at the end of a complete data message to match the requirements of the host terminal or application software. The Terminating Character(s) consists of one or two hexadecimal characters. **The default Terminating Characters are 0D Hex (*Carriage Return*) followed by 0A Hex (*Line Feed*).**

4.2.3 CHANNEL INPUT SETUP

Channel Input Setup allows you to program the various measurement features of the ADM-1 inputs. The items you may program in the Channel Input Setup include *Range*, *Unipolar/Bipolar*, *Single Ended/Differential*, and *Active Channels*. The following subsections describe these features in more detail.

4.2.3.1 RANGE

Range is the desired working voltage range of the channel inputs. You may choose one of nine different voltage ranges. The voltage range depends on the Unipolar/Bipolar voltage input polarity setting discussed in *Section 4.2.3.2*. The unipolar voltage ranges are: 0 to +10 volts, 0 to +5 volts, 0 to +2.5 volts, and 0 to +1.25 volts. The bipolar voltage ranges are -10 to +10 volts with jumper JP1 installed, -5 to +5 volts, -2.5 to +2.5 volts, -1.25 to +1.25 volts, and -0.625 to +0.625 volts. **The default Range is 0 to +10 volts.**

4.2.3.2 UNIPOLAR/BIPOLAR

The Unipolar/Bipolar setting is used in conjunction with the Range to establish the desired input voltage range. A Unipolar setting allows an input to range from 0 to +X volts and a bipolar setting allows an input to range from -X to +X volts where X is the selected voltage range. **The default Unipolar/Bipolar setting is Unipolar.**

4.2.3.3 SINGLE ENDED/DIFFERENTIAL

The Single Ended/Differential selection provides selection of single-ended or differential operation. Single Ended mode allows 16 active channels and Differential mode allows 8 active channels. **The default Single Ended/Differential setting is Single Ended mode.**

4.2.3.4 ACTIVE CHANNELS

The Active Channels selection is used to enable individual input channels on the ADM-1 for data acquisition. Single Ended mode allows up to 16 active channels and Differential mode allows up to 8 active channels. **The default Active Channels setting has Channel 1 active and all other channels inactive.**

4.2.4 DYNAMIC CONFIGURATION

You may enable or disable Dynamic Configuration for the ADM-1. Dynamic configuration mode allows non-verbose or "on-the-fly" configuration commands to be issued to the ADM-1 which are summarized in *Section 5.2*. **The default Dynamic Configuration setting is disabled.**

4.3 DATA COMMANDS

You may issue ADM-1 data commands through a host module to perform single operations while temporarily overriding the module's current operating configuration. Some data commands apply to all types of DAC modules, while others apply to specific modules. Data commands may be entered repeatedly to get specific data messages or to direct the ADM-1's actions. You may issue a single data command for action on multiple channels. Data commands must be used to obtain data when using Command Reporting Method. ADM-1 data commands are sent through a host module using the following procedure:

1. Select the ADM-1 from the host module by sending a *select sequence* which consists of the port select code (\$BT - default), the appropriate unit number followed by a colon (01: to 30: - for cascaded units only), the desired module number (2 to 16), and a terminating character of *Carriage Return* (0D Hex) or *Line Feed* (0A Hex). For example, to select an ADM-1 Module installed as Module 15 in a non-cascaded unit using the default port select code, send **\$BT15<cr>**.

2. Once the ADM-1 is selected, it will go into *Command Mode* and allow you to send data commands. The ADM-1 data commands begin with two capital letters designating the specific command and are terminated with a *Carriage Return*. Most data commands also require a number between the command letters and *Carriage Return*. This number is typically the desired input channel(s) for the data command. If you have a requirement to send the data command to multiple channels simultaneously, you may use one of the following formats as shown for the SA (sample) command:

SA1,2,3,4,5,6,7,8<cr>	Take a single sample for Ports 1-8
SA1-8<cr>	Take a single sample for Ports 1-8
SA0<cr>	Take a single sample for Ports 1-8
SA1,2,4-8<cr>	Take a single sample for Ports 1, 3, 4, 5, 6, 7, and 8

3. After you have sent the desired data commands to the ADM-1 module, you may disconnect from the ADM-1, by sending **\$BT<cr>**. You may disconnect from the ADM-1 and select a different module or the base unit by sending **\$BTX<cr>**, where X is the desired module number or 0 for the base unit.

IMPORTANT: If the ADM-1 is operating in *self reporting mode* (i.e., Immediate or Schedule Reporting Method) and a host device issues a data command, the host system must disconnect by sending the Port Select Code and *Carriage Return* or *Line Feed* before the ADM-1 will resume sending data messages to the designated host module.

Section 4.3.1 through *Section 4.3.5* provide detailed information on the functionality of each data command supported by the ADM-1. *Appendix A* provides these same commands in a condensed version for quick reference.

4.3.1 CALIBRATE COMMAND

The Calibrate (CA) command initiates auto-calibration. When this command is sent, the ADM-1 tests for offsets and automatically generates a correction value to remove any that are observed. These offset corrections are applied to all A/D values from 0 to 100 % of Full Scale (FS). Corrections are continually applied to all reported data messages until another Calibrate command is issued. At that time, a new calibration is performed and any resulting corrections applied to future readings. The Calibrate command has the following format:

CA*n***<cr>**

where $n=0$ to 3 (0 = all, 1 = 25%, 2 = 50%, and 3 = 75% of FS).

4.3.2 CLEAR BUFFER COMMAND

The Clear Buffer (CB) command is useful to clear all old data from the FIFO buffer when a new data set is started. If the buffer is not cleared, previous data samples remain in the buffer until overwritten. The Clear Buffer command has the following format:

CB*n***<cr>**

where n = Channel# (1 to 16 or 0 for all).

4.3.3 REPORT ALL BUFFERED SAMPLES COMMAND

The Report All Buffered Samples (RA) command instructs the ADM-1 to report all samples currently stored in the buffer of the selected channel(s). The Report All Buffered Samples command has the following format:

RA*n***<cr>**

where n = Channel# (1 to 16 or 0 for all).

4.3.4 REPORT A SINGLE BUFFERED SAMPLE COMMAND

The Report A Single Buffered Sample (RS) command instructs the ADM-1 to report the first sample stored in the buffer of the selected channel(s). The Report A Single Buffer Sample command has the following format:

RS n <cr>

where n = Channel# (1 to 16 or 0 for all).

4.3.5 SAMPLE COMMAND

The Sample (SA) command instructs the ADM-1 to read and report a single data message for each channel specified. When using Command Reporting Method, the data message is made from the programmed No. of Samples to Average taken at the programmed Sample Rate. When using Immediate or Schedule Reporting Method, the data message is made from the programmed No. of Samples to Average taken at a *burst* sampling rate. For example, if the Sample command is sent and the present No. of Samples to Average is 400, the data message reported is 400 samples taken at the burst sample rate, averaged, then reported. The Sample command has the following format:

SA n <cr>

where n = Channel# (1 to 16 or 0 for all).

4.4 DATA MESSAGE GENERATION

The ADM-1 generates digital data messages by taking samples of the analog input voltage(s) at a specified sampling rate. The ADM-1 computes an average value of these samples and presents this average to the host device in the form of a data message. The number of samples taken per data message is determined by the Number of Samples to Average. The ADM-1 will sample analog inputs in one of three ways: Command (via command only), Immediate, and Schedule. A host module may request a data message on command using any of these Sampling Methods. Immediate Sampling Method provides continuous or repetitive interval sampling. Schedule Sampling Method is basically the same as Immediate except sampling begins at a specified Sample Start Time.

If a Sample Interval is used, the ADM-1 will sample the input(s) in repetitive intervals. The Sample Interval is the time between the start of sample periods. A sample period is the time the ADM-1 actually samples between each Sample Interval (see *Figure 3* below). The sample period is computed by dividing the Sampling Rate by the Number of Samples to Average. For example, suppose every 10 minutes you desire to sample at a 60 S/sec rate and average 720 samples. The ADM-1 acquires 720 samples in 12 seconds ($720/60$), buffers the data, then waits 9 minutes and 48 seconds before taking another 720 samples. If the Reporting Period is set to 10 minutes, the data collected during the most recent Sample Interval is reported.

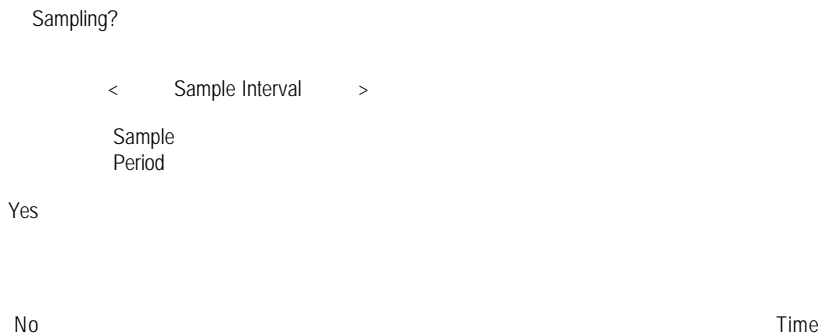


Figure 3: Sample Interval

4.5 DATA MESSAGE PRESENTATION

Data message presentation varies slightly in format depending on module configuration. Entries such as, time tag, data format, number of active channels, etc. all change how data messages appear to a host-controller. However, all data messages are presented in the same basic order of fields as follows:

UU:MM,CC HHH or DDDD or VV MM/DD/YY HH:MM:SS

where, **UU** is the M Series Unit Number

MM is the ADM-1 Module Number

CC is the ADM-1 Channel Number

HHH is a Hex value ranging from 000 to FFF

DDDD is a Decimal value ranging from 0 to 4095

VV is an Engineering unit ranging from -10 to +10 volts

MM is the month (if Time Tag enabled)

DD is the day (if Time Tag enabled)

YY is the year (if Time Tag enabled)

HH is the hour (if Time Tag enabled)

MM is the minute (if Time Tag enabled)

SS is the second (if Time Tag enabled)

EXAMPLE: A complete data message from an ADM-1 installed as Unit 1, Module 15 with Channels 1-8 active using Hex Data Format and having Time Tag enabled, would appear as follows:

```
1:15:1 7FE 11/18/93 09:12:22
1:15:2 7FA 11/18/93 09:12:22
1:15:3 8C3 11/18/93 09:12:22
1:15:4 CD4 11/18/93 09:12:22
1:15:5 568 11/18/93 09:12:22
1:15:6 04E 11/18/93 09:12:22
1:15:7 CBA 11/18/93 09:12:22
1:15:8 7D2 11/18/93 09:12:22
```

```
UNIT#
MODULE#
CHANNEL#
DATA
DATE
TIME
```

Data messages requested through the use of Data Commands might include the messages from one or more channels.

5 CONFIGURATION

You may program the ADM-1 using a menu-driven configuration procedure from a host module or the M Series service port as described in *Section 5.1* or by sending dynamic configuration commands from a host module as described in *Section 5.2*. You may view the current configuration from the front panel (see *Section 5.3*).

5.1 MENU-DRIVEN CONFIGURATION

To access the menu-driven configuration mode of the ADM-1 from any host module, use the following procedure:

1. Configure the host terminal's serial parameters to match those of the host module. From the factory, the host module is set at 9600 baud, 8 bit word size, 1 stop bit, no parity, and XON/XOFF disabled. If you do not have a dumb terminal or a terminal emulation program, BayTech supplies a utility diskette which includes software to put an IBM PC or compatible into a terminal mode (TERM.EXE).
2. Connect to the ADM-1 module by sending the port select code (\$BT - default), the appropriate unit number followed by a colon (01: to 30: - for cascaded units only), the desired module number (2 to 16), and *Carriage Return* or *Line Feed*.
3. Access configuration mode by sending **\$CONFIG<cr>**.

For example, if the ADM-1 is installed as Module 2 in a non-cascaded unit and the default port select code (\$BT) is used, send **\$BT2<cr>\$CONFIG<cr>** to enter into configuration mode. No characters should be typed between **\$BT2<cr>** and **\$CONFIG<cr>**. If this happens, the entire configuration sequence will be discarded and you will have to send the configuration sequence again.

NOTE: All commands must be in uppercase.

To access the menu-driven configuration mode of the ADM-1 from the service port, use the following procedure:

1. Connect a terminal to the *EIA-232* service port and configure the terminal's serial parameters to 9600 baud rate, 8 word size, 1 stop bit, and no parity.
2. Connect to the ADM-1 by sending **\$BAYTECH**, the desired module number (2 to 16), and *Carriage Return* or *Line Feed*.
3. Access configuration mode by sending **\$CONFIG<cr>**. Following the example on the previous page, you would send **\$BAYTECH2<cr>\$CONFIG<cr>** to configure Module 2.

NOTE: All commands must be in uppercase.

5.1.1 CONFIGURATION MAIN MENU

The ADM-1 installed as Module X will respond to the receiving of **\$CONFIG<cr>** with an identification block and a menu of the available configuration options similar to the following:

```
Copyright (c) Bay Technical Associates,1993
DAC V77 ADM-1 Rev. 1.##
This Module is X

CONFIGURATION MAIN MENU

Module Status.....1
Sampling Setup.....2
Reporting Setup.....3
Channel Input Setup.....4
Dynamic Configuration.....5
Exit.....X

Enter Selection:
```

NOTE: The configuration menus shown in the following sections are depicted with factory default settings and may vary slightly in presentation.

Enter the number corresponding to your desired choice. Each choice will invoke a sub-menu. Each sub-menu is described in the following sections. When you exit a sub-menu, you will be returned to the configuration main menu. When "Exit" is selected from the main menu, the ADM-1 will exit from configuration mode and go into an active data collection mode.

5.1.2 MODULE STATUS

By responding to the *Enter Selection:* message at the end of the Configuration Main Menu (see *Section 5.1.1*) with "1" (Module Status), you may review the current configuration status. The ADM-1 will respond with a menu similar to the following:

```
MODULE STATUS

Sampling Method.....COMMAND
Sample Start Time.....HH:MM
Sample Period.....HH:MM:SS
Sample Rate.....1S/sec
No. of Samples to Average.....10
Reporting Method.....COMMAND
Reporting Start Time.....24:00
Reporting Period.....24:00
Host Address.....1:1,1
Data Format.....HEX
Time Tagging.....DISABLED
Terminating Characters.....OD0A

Press a key to continue or X to Exit..

Range.....+/-5 or 0-10 Volts
Unipolar / Bipolar.....BI
Single Ended / Differential.....SE
Active Channels.....1000000000000000
Dynamic Configuration.....DISABLED

Press any key to Exit.
```

5.1.3 SAMPLING SETUP

By responding to the *Enter Selection:* message at the end of the Configuration Main Menu (see *Section 5.1.1*) with "2" (Sampling Setup), you may program how the ADM-1 samples the analog input voltage signals. The items you may program are *Sampling Method*, *Sample Start Time*, *Sample Interval*, *Sample Rate*, and *Number of Samples to Average*. The operational functionality of these items is discussed in *Section 4.2.1*. The ADM-1 will respond with the Sampling Setup menu as follows:

```
SAMPLING SETUP
Sampling Method.....1
Sample Start Time.....2
Sample Interval.....3
Sample Rate.....4
No. of Samples to Average.....5
Exit.....X
```

Enter Selection:

If you respond to one of the above selections with 1 to 5, a sub-menu will be presented for that item. After making any necessary changes under sub-menus 1 to 5, you be returned to the Sampling Setup menu. The "Exit" selection will return you to the Configuration Main Menu.

5.1.3.1 SAMPLING METHOD

By responding to the *Enter Selection:* message at the end of the Sampling Setup Menu with "1" (Sampling Method), you may program the method in which sampling is initiated. The ADM-1 will respond with the Select Sampling Method sub-menu as follows:

```
SELECT SAMPLING METHOD
Sampling Method.....COMMAND
Command.....1
Immediate.....2
Schedule.....3
Exit.....X
```

Enter Selection:

The ADM-1 provides three Sampling Methods. These are Command (upon request via data commands only), Immediate (upon exiting configuration), and Schedule (where sampling begins at a specified time). When Command Sampling Method is selected, the ADM-1 will only sample when the **SA**n command is issued (see *Section 4.3.5*). One data message will be read at the programmed Sampling Rate and No. of Samples to Average and reported to the host device for each channel specified. The **SA**n command may be issued to the ADM-1 in any of the three Sampling Methods.

When Immediate Sampling Method is selected, the ADM-1 will sample at the selected Sample Rate, Sample Interval, and Number of Samples to Average immediately after exiting the Configuration Main Menu. When Schedule Sampling Method is selected, the ADM-1 will begin sampling at the programmed Sample Start Time (see *Section 5.1.3.2*). Sampling will occur at the programmed Sample Rate, Sample Interval, and Number of Samples to Average. The Sample Start Time is programmable up to 24 hours in advance of the current (time-of-day) clock time.

IMPORTANT: If you program the ADM-1 to commence sampling after the Report Start Time (see *Section 5.1.4.2*), data messages are not furnished until the Sampling Start Time is reached. Conversely, if you start sampling before the Report Start Time, the first report will contain all data sampled and buffered until reporting is initiated.

NOTE: When a "Command" sample is requested by entering the **SA**n data command, the Reporting Method and Sampling Method currently programmed are overridden and a single data message is read and reported. Multiple **SA**n commands may be entered before returning to self-reporting operation. To resume the programmed Sampling Method and Reporting Method, send the port select code followed by *Carriage Return*.

5.1.3.2 SAMPLE START TIME

By responding to the *Enter Selection:* message at the end of the Sampling Setup Menu on page 21 with "2" (Sample Start Time), you may program when the ADM-1 will begin sampling when using Schedule Sampling Method. The ADM-1 will respond with the Sample Start Time sub-menu as follows:

```
SAMPLING START TIME

Sampling Start Time.....HH:MM
Current Date and Time.....MM/DD/YY HH:MM:SS

Enter Hours (0-24) <cr>, or X to Exit:
Enter Minutes (0-59) <cr>, or X to Exit:
```

This menu shows the current Sample Start Time, the base unit's current date and time, and prompts you to enter the desired Sampling Start Time. Sampling can be delayed up to 24 hours from the current time. The Current Date and Time are the values reported by the base unit's time-of day clock when the reporting start time entry was selected.

IMPORTANT: The Current Date and Time is not updated during data entry. Therefore, you must consider any delays from the time you enter the Sample Start Time until you exit the Configuration Main Menu. Be sure to set the Sample Start Time late enough to complete all configurations and exit the Configuration Main Menu before the designated Sample Start Time. If you set a Sample Start Time and exit the main configuration menu after the designated Sample Start Time elapses, sampling will be delayed until the following day.

Enter the desired Sample Start Time. For example, suppose the current time is 9:20:30 and the Sample Start Time is set to 10:45. After you exit the Configuration Main Menu, the ADM-1 will start sampling data at 10:45 the programmed Sampling Setup. If the M Series loses power, sampling resumes the next time the designated Sample Start Time is observed by the time-of day clock. If, for example, power is removed at 11:30 and restored at 12:00 and the Sample Start Time is set to 10:45, sampling will resume at 10:45 the following day.

5.1.3.3 SAMPLE INTERVAL

By responding to the *Enter Selection:* message at the end of the Sampling Setup Menu on page 21 with "3" (Sample Interval), you may program the ADM-1 to sample continuously or to sample in repetitive periods when using Immediate or Schedule Sampling Methods. The ADM-1 will respond with the Sample Interval menu as follows:

SAMPLE INTERVAL

Sample Period.....HH:MM:SS or "CONTINUOUS"

NOTE Enter 00:00:00 for continuous sampling.

Enter Hours (0-24) <cr>, or X to Exit:

Enter Minutes (0-59) <cr>, or X to Exit:

Enter Seconds (0-59) <cr>, or X to Exit:

Enter the desired Sample Interval. Enter 00:00:00 for continuous sampling. Continuous sampling is conducted at the programmed Sample Rate and Number of Samples to Average.

If a Sample Interval is entered, repetitive sampling will occur where the ADM-1 will sample for a specified period of time and then stop sampling for a specified time interval. Sample Interval is the time interval between the start of sampling periods. The length of time of sampling periods is determined by the Sampling Rate and the Number of Samples to Average as described in *Section 4.4*.

5.1.3.4 SAMPLE RATE

By responding to the *Enter Selection:* message at the end of the Sampling Setup Menu on page 21 with "4" (Sample Rate), you may program the rate of sampling as a function of samples/sec. The ADM-1 will respond with the Sample Interval menu as follows:

```
SAMPLE RATE
Sample Rate.....1S/sec
Enter Rate (1-4000S/sec) <cr>, or X to Exit:
```

Samples rates between 1 and 4000 samples/sec can be selected. The programmed Sample Rate is the sample rate for individual channels. The maximum sample rate for an individual channel is 4000 divided the number of active channels. For example, if there are eight active channels, the maximum individual channel sample rate is 500S/sec.

The maximum sample rate, based on the number of active channels selected, is calculated automatically. If you try to exceed the maximum individual channel sample rate, your entry is ignored and the correct maximum rate displayed.

NOTE: The number "4000" in the above menu is automatically reduced to the maximum individual channel sample rate based upon the number of active channels.

5.1.3.5 NUMBER OF SAMPLES TO AVERAGE

By responding to the *Enter Selection:* message at the end of the Sampling Setup Menu on page 21 with "4" (Sample Rate), you may program the how many samples the ADM-1 averages for each data message. The ADM-1 will respond with the Sample Interval menu as follows:

```
NUMBER OF SAMPLES TO AVERAGE
No. of Samples to Average.....10
Enter Samples (1-4000) <cr>, or X to Exit:
```

Enter the desired Number of Samples to Average.

5.1.4 REPORTING SETUP

By responding to the *Enter Selection:* message at the end of the Configuration Main Menu (see *Section 5.1.1*) with "3" (Reporting Setup), you may program how the ADM-1 reports data messages to the host device and the format in which the data messages will appear. The items you may program are *Reporting Method*, *Report Start Time*, *Report Interval*, *Host Address*, *Data Format*, *Time Tag*, and *Terminating Character(s)*. The operational functionality of these items is discussed in *Section 4.2.2*. The ADM-1 will respond with the Reporting Setup menu as follows:

```
REPORTING SETUP
Reporting Method.....1
Report Start Time.....2
Report Interval.....3
Host Address.....4
Data Format.....5
Time Tag.....6
Terminating Character(s).....7
Exit.....X
```

Enter Selection:

If you respond to one of the above selections with 1 to 7, a sub-menu will be presented for that item. After making any necessary changes under sub-menus 1 to 7, you be returned to the Reporting Setup menu. The "Exit" selection will return you to the Configuration Main Menu.

5.1.4.1 REPORTING METHOD

By responding to the *Enter Selection:* message at the end of the Reporting Setup Menu with "1" (Reporting Method), you may program how the ADM-1 reports data messages to the host device. The ADM-1 will respond with the Select Reporting Method sub-menu as follows:

```
SELECT REPORTING METHOD
Reporting Method.....COMMAND

Command.....1
Immediate(when Sample Available)...2
Schedule.....3
Exit.....X
```

Enter Selection:

NOTE: The information provided in this section is identical to *Section 5.1.3.1* except "Sampling" is replaced with "Reporting".

The ADM-1 provides three Reporting Methods. These are Command (via data commands only), Immediate (upon exiting configuration), and Schedule (where reporting begins at a specified time).

When Command Reporting Method is selected, the ADM-1 will report data messages to the host module only when the **RA_n** and **RS_n** commands are issued (see *Section 4.3.3* and *Section 4.3.4* respectively). If ADM-1 receives a **RA_n** (Read All Buffered Samples) command, all data messages currently stored in the buffer of the selected channel(s) are transmitted to the host-controller. Each time the ADM-1 receives a **RS_n** (Report a Single Sample if available) command, the oldest data message available is transmitted to the host-controller. The **RA_n** and **RS_n** commands may be issued to the ADM-1 in any of the three Reporting Methods.

When Immediate Reporting Method is selected, the ADM-1 will report data messages when they are available. If no data message is available, no report is made. Reporting begins immediately after exiting the Configuration Main Menu

When Schedule Reporting Method is selected, the ADM-1 will begin reporting data messages at the programmed Report Start Time (see *Section 5.1.4.2*). The Report Start Time is programmable up to 24 hours in advance of the current (time-of-day) clock time. Data messages are stored in the buffer until the Report Start Time is reached at which time all buffered data messages are reported to the host module. Further reporting is based upon the selected Report Interval as explained in *Section 5.1.4.3*.

NOTE: When a data message is requested by entering the **RA_n** or **RS_n** data commands, the Reporting and Sampling Methods currently programmed are overridden and the data message(s) is reported. To resume the programmed Sampling Method and Reporting Method, sent the port select code followed by *Carriage Return*.

5.1.4.2 REPORT START TIME

By responding to the *Enter Selection:* message at the end of the Reporting Setup Menu on page 26 with "2" (Report Start Time), you may program the time the ADM-1 will start reporting when using Schedule Reporting Method. The ADM-1 will respond with the Report Start Time menu as follows:

```
REPORT START TIME

Reporting Start Time.....HH:MM
Current Date and Time.....MM/DD/YY HH:MM:SS

Enter Hours (0-24) <cr>, or X to Exit:
Enter Minutes (0-59) <cr>, or X to Exit:
```

This menu shows the current Reporting Start Time, Current Date and Time as reported by the base unit's time-of day clock when the reporting start time entry was selected, and prompts you to enter the desired Report Start Time. Reporting can be delayed up to 24 hours from the current time.

Enter the desired Report Start Time. For example, suppose the Current Time is 9:20:30 and the Reporting Start Time is set to 10:45. After you exit the Configuration Main Menu, the ADM-1 will start reporting data messages at 10:45 at the programmed Sampling Setup. If the M Series loses power, reporting resumes the next time the designated Report Start Time is observed by the time-of day clock.

IMPORTANT: The Current Date and Time is not updated during data entry. You must consider any delays from the time you enter the Report Start Time until you exit the Configuration Main Menu. Be sure to set the Report Start Time far enough ahead of the current time to complete all configurations and exit configuration mode.

NOTE: When using Schedule Reporting Method and the ADM-1 is initially reporting, if you enter into the menu-driven mode of configuration and exit, the ADM-1 will not resume reporting data messages until the programmed Report Start Time elapses. You may program the ADM-1 without disrupting data message reporting by using dynamic configuration (see *Section 5.2*).

5.1.4.3 REPORT INTERVAL

By responding to the *Enter Selection:* message at the end of the Reporting Setup Menu on page 26 with "3" (Report Interval), you may program the time interval between reporting periods when using Schedule Reporting Method. The ADM-1 will respond with the Report Interval menu as follows:

```
REPORT INTERVAL

Report Interval.....HH:MM

Enter Hours (0-24) <cr>, or X to Exit:
Enter Minutes (0-59) <cr>, or X to Exit:
```

Enter the desired Report Interval. The Report Interval can range from 1 minute to 24 hours. Once the Report Start Time elapses, the ADM-1 will report all buffered data messages to the designated host module until the buffer is empty. The ADM-1 will continue to transmit all buffered data messages every time the Report Interval expires. For example, if the Report Start Time is 12:00 and the Report Interval is 1:00 (1 hour), the ADM-1 will report all messages in its buffer every hour on the hour starting at 12:00.

5.1.4.4 HOST ADDRESS

By responding to the *Enter Selection:* message at the end of the Reporting Setup Menu on page 26 with "4" (Host Address), you may program the address of the designated host module. The designated host module is where data messages are sent when using Immediate or Schedule Reporting Method. The ADM-1 will respond with the Host Address menu as follows:

```
HOST ADDRESS

Host Address.....1:1,1

Enter Unit Number (1-32) <cr>, or X to EXIT:
Enter Module Number (1-16) <cr>, or X to EXIT:
Enter Port Number (1-4) <cr>, or X to EXIT:
```

Enter the appropriate Host Address. This consists of the Unit Number (1 to 32), Module Number (1 to 16), and Port Number (1 to 4) where the designated host module is located. Each entry should be followed by <ENTER>. If there is a single M Series unit in service, the Host Address would typically be Unit 1, Module 1, Port 1.

NOTE: The Host Address must be supplied to direct self-reporting data messages to the desired destination. If the Host Address is incorrect, self-reporting data messages will be misdirected or lost.

5.1.4.5 DATA FORMAT

By responding to the *Enter Selection:* message at the end of the Reporting Setup Menu on page 26 with "5" (Data Format), you may program the how the ADM-1 will present sampled data to the designated host module. The ADM-1 will respond with the Select Data Format menu as follows:

```
SELECT DATA FORMAT

Data Format.....HEX

Hexadecimal.....1
Decimal.....2
Engineering Units.....3
Exit.....X

Enter Selection:
```

Type the number corresponding to the desired choice. The "Data Format" sub-menu provides a choice in the format of the sampled data contained in each data message. Data can be reported in Hexadecimal, Decimal, or in Engineering Units (volts).

5.1.4.6 TIME TAG

By responding to the *Enter Selection:* message at the end of the Reporting Setup Menu on page 26 with "6" (Time Tag), you may program the ADM-1 to append a time tag to the end of data samples automatically. The ADM-1 will respond with the Enable/Disable Time Tagging menu as follows:

```
ENABLE / DISABLE TIME TAGGING

Time Tagging.....DISABLED

Enable.....1
Disable.....2
Exit.....X

Enter Selection:
```

With time tag enabled, a MM/DD/YY HH/MM/SS entry is appended to all samples, where MM is the month, DD is the day, YY is the year, HH is the hour, MM is the minute, and SS is the second according to the base unit's time-of-day clock.

5.1.4.7 TERMINATING CHARACTER(S)

By responding to the *Enter Selection:* message at the end of the Reporting Setup Menu on page 26 with "7" (Terminating Character(s)), you may program one or two characters to be appended at the end of each data message. This option allows a user to match the host terminal and/or requirements of their application software. The ADM-1 will respond with the Enter Terminating Character menu as follows:

```
ENTER TERMINATING CHARACTER

Terminating Character(s).....0D0A

Enter 1 or 2 Terminating Characters in Hex Format
(i.e. 0D0A for CR+LF) <cr>, or X to Exit:
```

Type the hexadecimal representation of the desired terminating character(s). For example, *Carriage Return* would be represented by 0D Hex and *Line Feed* would be represented by 0A Hex.

NOTE: Only ASCII characters A-F and 0-9 are acceptable.

5.1.5 CHANNEL INPUT SETUP

By responding to the *Enter Selection:* message at the end of the Configuration Main Menu (see *Section 5.1.1*) with "4" (Channel Input Setup), you may program the various measurement features of the ADM-1 inputs. The items you may program in the Channel Input Setup include *Range*, *Unipolar/Bipolar*, *Single Ended/Differential*, and *Active Channels*. The operational functionality of these items is discussed in *Section 4.2.3*. The ADM-1 will respond with the Channel Input Setup menu as follows:

```
CHANNEL INPUT SETUP

Range.....1
Unipolar / Bipolar.....2
Single Ended / Differential.....3
Active Channels.....4
Exit.....X

Enter Selection:
```

If you respond to one of the above selections with 1 to 4, a sub-menu will be presented for that item. After making any necessary changes under sub-menus 1 to 4, you be returned to the Channel Input Setup menu. The "Exit" selection will return you to the Configuration Main Menu.

5.1.5.1 RANGE

By responding to the *Enter Selection:* message at the end of the Channel Input Setup Menu with "1" (Range), you may program the operating voltage range for the ADM-1 channel inputs. The ADM-1 will respond with the Select Input Voltage Range menu as follows:

```
SELECT INPUT VOLTAGE RANGE

Range..... +/-5 or 0-10 Volts

+/-10 Volts with JP1 installed.....1
+/-5 or 0-10 Volts.....2
+/-2.5 or 0-5 Volts.....3
+/-1.25 or 0-2.5 Volts.....4
+/-0.625 or 0-1.25 Volts.....5
Exit.....X

Enter Selection:
```

Enter the number (1 to 5) corresponding to the desired Range.

IMPORTANT: If you intend to operate at +/- 10 volts, insure jumper JP1 is installed before connecting inputs to the ADM-1 (see *Appendix B.*).

NOTE: A correct Unipolar/Bipolar selection must be made in conjunction with Range selection to insure proper operation (see *Section 5.1.5.2*) below.

5.1.5.2 UNIPOLAR/BIPOLAR

By responding to the *Enter Selection:* message at the end of the Channel Input Setup Menu on page 32 with "2" (Unipolar / Bipolar), you may program the operating voltage polarity of the channel inputs. The ADM-1 will respond with the Select Input Polarity menu as follows:

```
SELECT INPUT POLARITY

Unipolar / Bipolar.....UN

Unipolar.....1
Bipolar.....2
Exit.....X

Enter Selection:
```

Select the desired Input Polarity (unipolar or bipolar). Unipolar allows the channel inputs to operate between 0 and +X volts and bipolar allows the channel inputs to operate between -X and +X volts, where X is the selected Range. The Input Polarity must be programmed in conjunction with the Range sub-menu to set up a correct signal input voltage mode of operation (see *Section 5.1.5.1*).

5.1.5.3 SINGLE ENDED/DIFFERENTIAL

By responding to the *Enter Selection:* message at the end of the Channel Input Setup Menu on page 32 with "3" (Single Ended / Differential), you may program the ADM-1 to use up to 16 single ended inputs or 8 differential inputs. The ADM-1 will respond with the Select Input Configuration menu as follows:

```
SELECT INPUT CONFIGURATION

Single Ended / Differential.....SE

Single Ended.....1
Differential.....2
Exit.....X

Enter Selection:
```

Select the desired Input Configuration. Singled-ended operation allows up to 16 inputs using grounds of the same potential. Differential operation allows up to 8 inputs using different reference polarities. See *Figure 1* or *Figure 2* on page 5 to determine the correct connections on connector J2.

5.1.5.4 ACTIVE CHANNELS

By responding to the *Enter Selection:* message at the end of the Channel Input Setup Menu on page 32 with "4" (Active Channels), you may program which input channels on the ADM-1 will be active for data acquisition. The ADM-1 will respond with the Select Active Channels menu as follows:

```
SELECT ACTIVE CHANNELS

Enter 1 to ENABLE or 0 to DISABLE each channel <cr>, or X to Exit.

NOTE: Only channels 1-8 can be active if DIFFERENTIAL inputs selected!

CHANNEL NUMBERS
1111111
1234567890123456
CURRENT STATUS 1000000000000000

ENTER SELECTION:
```

Type a number between 0000000000000000 and 1111111111111111 followed by <ENTER>. A "1" indicates that a channel is active and a "0" indicates the channel is inactive. You may enable or disable any individual input channel. It is not necessary to enter all 16 channels. You have only to enter up to the highest channel you wish to activate or deactivate. For example, if all channels are initially inactive (0000000000000000), and you only want to activate channels one and four, enter 1001<cr>.

NOTE: Only channels 1 through 8 may be enabled if Differential inputs are selected (i.e., channels 9-16 cannot be active). If you enter a "1" for channels 9-16 while in differential mode, those entries will automatically revert to "0".

If you increase the number of active channels and exceed the maximum sample rate, a menu appears showing the maximum permissible sample rate based on the number of active channels. For example, if you had eight active channels allowing a maximum sample rate of 500S/sec and increased to 16 active channels, the following message appears if you select Set Sample Rate under the Sampling Setup menu (see *Section 5.1.3.4*):

SET SAMPLE RATE.....250S/sec

Enter Rate (1-250S/sec) followed by ENTER or X to Exit:

An entry within the displayed range must be entered, or you can exit this menu and reduce the number of active channels.

5.1.6 DYNAMIC CONFIGURATION

By responding to the *Enter Selection:* message at the end of the Configuration Main Menu (see *Section 5.1.1*) with "5" (Dynamic Configuration), you may program the ADM-1 to respond to dynamic configuration (non-verbose) commands. The ADM-1 will respond with the Dynamic Configuration Commands menu as follows:

```
DYNAMIC CONFIGURATION COMMANDS

Dynamic Configuration Commands.....DISABLED

Enable.....1
Disable.....2
Exit.....X

Enter Selection:
```

Dynamic configuration mode allows the ADM-1 to be programmed by downloading dynamic (on-the-fly) commands. See *Section 5.2* for the procedure to program the ADM-1 via dynamic configuration and a description of the available configuration commands.

5.1.7 EXIT

By responding to the *Enter Selection:* message at the end of the Configuration Main Menu (see *Section 5.1.1*) with "X" (Exit), the ADM-1 will exit the menu-driven configuration mode. If changes are made to any configuration parameter, the ADM-1 will respond with:

```
Save Changes as Defaults? (Y/N)
```

If you reply in the affirmative (Y), the settings are saved as the permanent power-up defaults. That is, if the M16/M8 loses power for any reason, the settings saved as defaults become the power-up settings. If you reply in the negative (N), your selections are saved as current (temporary) operating settings, but are lost upon power-down. The most recent menu selections saved as Defaults are restored as the current operating parameters when power is re-applied. If you respond with "Y", the ADM-1 will respond with:

```
Saving Configuration as Defaults...
Configuration complete
```

5.2 DYNAMIC CONFIGURATION PROCEDURE AND COMMANDS

ADM-1 dynamic configuration commands are issued through a host module. Some configuration commands apply to all types of DAC modules, while others apply to specific modules. The ADM-1 will recognize dynamic configuration commands only when Dynamic Configuration is enabled (see *Section 5.1.6*). Use the following procedure to send dynamic configuration commands to the ADM-1:

1. Select the ADM-1 from the host module by sending a *select sequence* which consists of the port select code (\$BT - default), the appropriate unit number followed by a colon (01: to 30: - for cascaded units only), the desired module number (2 to 16), and a terminating character of *Carriage Return* (0D Hex) or *Line Feed* (0A Hex). For example, to select an ADM-1 Module installed as Module 15 of a non-cascaded unit using the default port select code, send **\$BT15<cr>**.
2. Once the ADM-1 is selected, it will go into *Command Mode* and allow you to send dynamic configuration commands. The ADM-1 configuration commands begin with two capital letters designating the specific command and are terminated with a *Carriage Return*. Most configuration commands require a number between the command letters and *Carriage Return*. This number represents the desired configuration parameter.
3. After you have sent the desired configuration command(s) to the ADM-1 module, you may disconnect from the ADM-1, by sending **\$BT<cr>**. You may disconnect from the ADM-1 and select a different module or the base unit by sending **\$BTX<cr>**, where X is the desired module number or 0 for the base unit.

Section 5.2.1 through *Section 5.2.9* provides detailed information on the functionality of each configuration command supported by the ADM-1. *Appendix A* provides these commands as a quick reference.

NOTE: Multiple configuration commands may be sent while the ADM-1 is in command mode. Each command should be terminated with a *Carriage Return*. For example:

AV300<cr>VR1<cr>SD1<cr>

Please see the following subsections for a description of the AV, VR, and SD commands.

5.2.1 AVERAGE COMMAND

The Average (AV) command programs the Number of Samples to Average between 1 and 4000 (see *Section 4.2.1.5* and *Section 5.1.3.5*). You must ensure the combination of Sample Rate and Sample Interval is sufficient to contain the desired number of samples to be averaged. For example, if you want to average 100 samples at a Sample Rate of 1S/sec, the Sample Interval must be greater than 100 secs. If you enter an interval less than the time required to average the selected number of samples, the ADM-1 continues taking samples until the selected number of samples to be averaged is met. In the example above, if you select an interval of 50 seconds, the sample will not be reported until all 100 samples are taken (100 seconds). The Average command has the following format:

AV n <cr>

where $n = 1$ to 4000.

5.2.2 REPORTING METHOD COMMAND

The Reporting Method (RM) command programs the ADM-1 Reporting Method (see *Section 4.2.2.1* and *Section 5.1.4.1*). The Reporting Method command has the following format:

RM n <cr>

where $n = 1$ to 3. 1 = Command, 2 = Immediate and 3 = Schedule.

5.2.3 SINGLE ENDED OR DIFFERENTIAL COMMAND

The Single Ended or Differential (SD) command programs the ADM-1 to use single ended or differential inputs as described in *Section 4.2.3.3* and *Section 5.1.5.3*. The Single Ended or Differential command has the following format:

SDn<cr>

where n = 1 or 2. 1 = single ended and 2 = differential.

5.2.4 SAMPLING INTERVAL COMMAND

The Sampling Interval (SI) command programs the ADM-1 Sampling Interval as described in *Section 4.2.1.3* and *Section 5.1.3.3*. The Sampling Interval command has the following format:

SI n <cr>

where n = 1 or 2. 1 = continuous and 2 = time.

NOTE: When the command **SI2<cr>** is issued for Time Sampling Interval, the actual Sampling Interval will be that programmed in the menu-driven configuration.

5.2.5 SAMPLING METHOD COMMAND

The Sampling Method (SM) command programs the ADM-1 Sampling Method as described in *Section 4.2.1.1* and *Section 5.1.3.1*. The Sampling Method command has the following format:

SMn<cr>

where n = 1 to 3. 1 = Command, 2 = Immediate and 3 = Schedule.

5.2.6 SAMPLE RATE COMMAND

The Sample Rate (SR) command is used to program the Sampling Rate of the ADM-1 as described in *Section 4.2.1.4* and *Section 5.1.3.4*. The Sampling Rate may be programmed between 1 and 4000 samples per second. The Sample Rate command has the following format:

SRn<cr>

where n = 1 to 4000.

5.2.7 TIME TAG COMMAND

The Time Tag (TT) command is used to enable or disable time tagging as described in *Section 4.2.2.6* and *Section 5.1.4.6*. The Time Tag command has the following format:

TTn

where n = 1 or 2. 1 = enable and 2 = disable.

5.2.8 UNIPOLAR/BIPOLAR COMMAND

The Unipolar/Bipolar command programs the ADM-1 channel inputs for unipolar or bipolar operation as described in *Section 4.2.3.2* and *Section 5.1.5.2*. The Unipolar/Bipolar command has the following format:

UBn<cr>

where n = 1 or 2. 1 = unipolar and 2 = bipolar.

5.2.9 VOLTAGE RANGE COMMAND

The Voltage Range command is used to program the desired operating voltage range of the ADM-1 channel inputs as described in *Section 4.2.3.1* and *Section 5.1.5.1*. The Voltage Range command has the following format:

VRn<cr>

where n = 1 to 5. 1 = -10 to +10V (with JP1 installed), 2 = -5 to +5V (or 0 to +10V), 3 = -2.5 to +2.5V (or 0 to +5V), 4 = -1.25 to +1.25V (or 0 to +2.5V), and 5 = -0.625 to +0.625V (or 0 to +1.25V).

5.3 FRONT PANEL CONFIGURATION

The LCD display and associated front panel controls can provide the configuration status of the ADM-1. All the parameters shown in the LCD status message are fully described in *Section 5.1*.

When the M8/M16 DAC has completed its power-up self-test, the following menu will be displayed on the LCD:

```
Bay Technical Assoc
Select Module
00
```

NOTE: The following LCD screens are examples and will vary depending upon current configuration status.

To review the configuration status of the ADM-1 installed as Module XX (XX = 02 to 16), use the \odot or \otimes keys to highlight "Module XX" from the M Series main menu screen and press the *SELECT* key. The LCD will respond with:

```
V77 ADM-1 MODULE XX
Display Status
Exit Module Menus
```

Highlight "Display Status" with the arrow keys and press *SELECT*. The LCD will respond with:

Sample Method IMMED.
Sample Start IMMED.
Sample Per. CONTIN.
PAGE SELECT-EXIT

Pressing the  or  keys scrolls through the following entries:

Sample Method SCHED.
Sample Start HH:MM
Sample Per. HH:MM:SS
Sample Rate 50 S/s
to Average XXX
Report Method COMMAND
Report Start HH:MM
Report Period HH:MM
Host Address 1:1,1
Data Format HEX
Time Tagging ENABLE
Term Characters ODOA
Range +/-5.0V
Unipolar/Bipolar BI
SE / Differential SE
Chn 1111111111111111
Dyna Cfg Cmd ENABLE

To exit the configuration status mode, press the *SELECT* key at any time. You are returned to the ADM-1's LCD main menu. Next, press either arrow key until the cursor is located on the "Exit Module Menus." Pressing the *SELECT* button returns you to the main M Series LCD menu.

APPENDIX A

DATA/CONFIGURATION COMMAND SUMMARY

The tables below summarize the data and configuration commands supported by the V77 ADM-1 I/O module:

V77 ADM-1 DATA COMMAND SUMMARY	
Command	Description
CA <i>n</i> <cr> (<i>n</i> =0 or 1 to 3)	Calibrate. 0=all, 1=25%, 2=50%, and 3=75% of Full Scale (FS). Initiates auto-calibration. ADM-1 tests for offsets and makes necessary corrections. Corrections are continually applied to all reported data messages until another Calibrate command is issued.
CB <i>c</i> <cr> (<i>c</i> =Ch# 1 to 16, 0=all*)	Clear Buffer. Clears all old data from the buffer when a new data set is started.
RA <i>c</i> <cr> (<i>c</i> =Ch# 1 to 16, 0=all*)	Report All Buffered Samples.
RS <i>c</i> <cr> (<i>c</i> =Ch# 1 to 16, 0=all*)	Report Single Sample if Available
SA <i>c</i> <cr> (<i>c</i> =Ch# 1 to 16, 0=all)*	Sample. Read and report sample at programmed setup.

V77 ADM-1 DYNAMIC CONFIGURATION COMMAND SUMMARY	
Command	Description
AV <i>n</i> <cr> (<i>n</i> =1 to 4,000)	Number of Samples to Average
DF <i>n</i> <cr> (<i>n</i> =1 or 2)	Data Format. 1=Hexadecimal and 2=Decimal.
RM <i>n</i> <cr> (<i>n</i> =1 to 3)	Reporting Method. 1=Command, 2=Immediate, and 3=Schedule.
SD <i>n</i> <cr> (<i>n</i> =1 or 2)	Single Ended/Differential. 1=single ended and 2=differential.
SM <i>n</i> <cr> (<i>n</i> =1 or 2)	Sampling Method. 1=Command, 2=Immediate, and 3=Schedule.
SP <i>n</i> <cr> (<i>n</i> =1 or 2)	Sample Period. 1=Continuous and 2=Time.
SR <i>n</i> <cr> (<i>n</i> =1 to 4000)	Sample Rate (Samples/Sec)
TT <i>n</i> <cr> (<i>n</i> =1 or 2)	Time Tag. 1=Enable and 2=Disable.
UB <i>n</i> <cr> (<i>n</i> =1 or 2)	Unipolar/Bipolar. 1=unipolar and 2=bipolar.
VR <i>n</i> <cr> (<i>n</i> =1 to 5)	Set Voltage Range. 1 = $\pm 10V$ (with JP1 installed), 2 = $\pm 5V$ (or 0 to +10V), 3 = $\pm 2.5V$ (or 0 to +5V), 4 = $\pm 1.25V$ (or 0 to +2.5V) and 5 = $\pm 0.625V$ (or 0 to +1.25V)

APPENDIX B

EPROM UPGRADE

You will receive one EPROM (chip with label) for each ADM-1 module to be upgraded. The materials you will need to supply are:

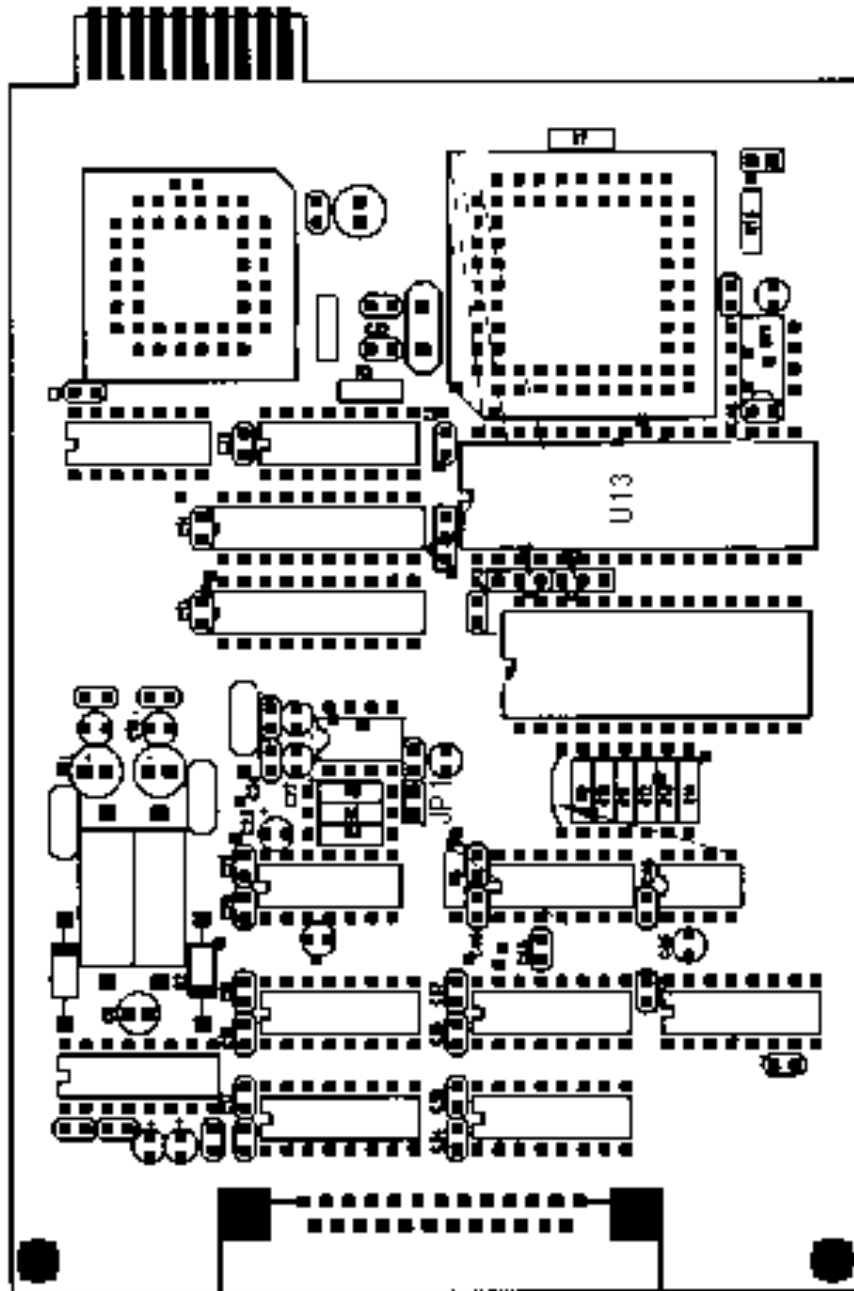
Straight-slot screwdriver

IC DIP extractor or a pair of curved needle-nose pliers

1. **IMPORTANT:** Remove power from the unit by depressing the power switch on the front of the unit to OFF. Also remove power cord from the AC outlet.
2. Remove the appropriate module by loosening the 2 straight slot screws that attach the connector board I/O module to the chassis and then pulling the module out.
3. Refer to the ADM-1 mechanical layout (see *Appendix C*) and locate socket *U13*. Remove existing EPROM from the appropriate socket with IC extractor or needle-nose pliers. Gradually loosen each side of the chip, alternating pliers from side to side, so as not to bend chip pins. Pull loosened EPROM all the way out.
4. Install new EPROM into the appropriate socket. (Make certain you are installing the correct EPROM into the correct module by referring to the label on the EPROM). The EPROM is notched; the notch on the EPROM should line up with the notch on the socket. When installing the new chips, be careful not to bend any of the pins.
5. Re-install the module(s) and apply power to the unit. The upgrade is now complete.

Before you begin operations, check the configuration status to make certain it matches your application. If configuration changes (baud rates, handshaking, etc.) are required, you must make these changes in the configuration mode. See *Section 5* for complete instructions.

APPENDIX C
JP1 LOCATION FOR $\pm 10\text{V}$ RANGE



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APPENDIX D **INDEX**

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