OWNER'S MANUAL

MODEL V84 ADR-1 & V84 ADR-1A

COMBINATION ANALOG-TO-DIGITAL, CONTROL RELAY, AND SWITCH CLOSURE/OPTICALLY ISOLATED INPUT MODULES

BayTech Publication #U140E115-01

Thank you for selecting the BayTech Model V84 ADR-1/ADR-1A combination Analog-to-Digital, Control Relay, and Switch Closure/Optically Isolated Input Module.

The data provided in this Owner's Manual explains the various ways you can operate the V84 ADR-1/ADR-1A and how to configure your unit. We suggest that you read this manual carefully before attempting to install the Model V84 ADR-1/ADR-1A, 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 V84 ADR-1 and V84 ADR-1A are programmable combination analog-to-digital input, control relay, and switch closure/optically isolated input modules. The ADR-1 and ADR-1A are designed for use with the BayTech M Series DAC Data Acquisition Controllers. The main features of the ADR-1(A) are:

1. Six 12-bit, successive approximation analog-to-digital (A-to-D) converter inputs.
2. Four electromechanical, form C, single-pole-double-throw (SPDT) relays.
3. Six switch closure inputs (ADR-1) or six optically isolated voltage inputs (ADR-1A).

The A-to-D section can be operated in any combination of one to six differential or single-ended inputs. Data resolution is 12 bits. A total of eight software selectable input voltage ranges are available. 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 by using BayTech or commercially available application software.

The relays on the ADR-1 are programmable to change state via command or time schedule (when clock option is installed). The relays are capable of controlling loads up to 3 amps at 120 Vrms. Each relay has a set of normally open (NO) and a set of normally closed (NC) contacts. The present status of a relay (energized or de-energized) can be requested by a host computer/controller.

The switch closure inputs of the ADR-1 provide a reliable method to detect and report a state change from high resistance (open) to continuity (closed) or vice versa. The optically-isolated voltage inputs of the ADR-1A can be individually set to detect the presence and change of state of AC or DC inputs. The inputs can observe, record, and report when a transition or event occurs and the total events that occurred during a selected period.

Time stamping or "Time Tagging" of data is available through the use of a "time & date" clock located in M Series units with clock option installed (standard on M8, M9, and M16 units). A time tag includes month, day, year, hour, minute and second.

Data messages are sent to the host computer/controller in one of the following modes:

1. Upon user request (COMMAND).
2) At a specific date and/or time (SCHEDULE).
3) Real time reporting (i.e., as data messages are generated - IMMEDIATE).

The ADR-1 has an HDL-44 female connector for connection to the A-to-D and switch closure/isolated voltage inputs. The ADR-1 also has a DA-15 connector for connection to the relays.

2 SPECIFICATIONS

(typical for 25^{o} C unless otherwise noted)

2.1 ANALOG-TO-DIGITAL INPUT SECTION

Channels: 6 Differential or Single-Ended inputs

Input Resolution: 12 bits, 1 to 4,096 parts. Guaranteed monotonic over operating temperature range
Type of Converter: Successive-Approximation
Input impedance: > 1 Meg ohms
Input Ranges: ±1.25V, ±2.5V, ±5V, ±10V; 0 to 1.25V, 0 to 2.5V, 0 to 5V, 0 to 10V
System noise: <1.5 LSB rms (all gains)
Overvoltage Protection: ±44 V without damage, power "on" ±30 V without damage, power "off"
Common-Mode Input Voltage: ±11 volts (max)
Typical Common-Mode Rejection Ratio: 95 db @60 Hz, all ranges

ACCURACY

Relative accuracy: ±1.0 LSB maximum (nonlinearity + quantization error)
Differential nonlinearity: ±1.0 LSB maximum (no missing codes over temperature range)
Full Scale (FS) Error: ±0.19% maximum (gain = 1)
±0.025% typical
Offset error: 0.15% maximum
±1 LSB typical (adjustable to 0 through software)

INTERNAL VOLTAGE REFERENCE: 0.05 % (of 2.5V) maximum; 0.002% (of 2.5V) typical

SAMPLING:

Sample Rates: 1 to 4000 samples/second
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)

2.2 RELAY SECTION

Type and Quantity: Four; SPDT (single pole, double throw), Form-C, electromechanical
Contact Material: Silver, gold plated
Operate Time: 5 ms at nominal coil voltage
Release Time: 2 ms at nominal coil voltage
Contact Rating: 3 Amps @ 120 Vrms
Life Expectancy: 20 million operations (mechanical)
Voltage Isolation: 500 Vrms channel-channel & channel-ground

2.3 SWITCH CLOSURE/ISOLATED VOLTAGE INPUT SECTION

SWITCH CLOSURE INPUTS (V84 ADR-1)

Number of Inputs: 6 with common ground
Drive Distance: Up to 1000 ohms cable resistance,
e.g., AWG 36 - 2400 ft., AWG 24 - 15000 ft.,
AWG 22 - 62000
Debounce: 0 to 60,000 ms in 10 ms steps (software selectable)

OPTICALLY ISOLATED INPUTS (V84 ADR-1A)

Number of Inputs: 6 (with returns)
Input Voltage Range: 2-24 VAC/VDC
Max Input Current: 10 ma
Min Turn-On Current: 1 ma
Max Turn-On Time: <10 ms
Max Turn-Off Time: <10 ms
Max Counter Rate: 100 Hz
Voltage Isolation: 100 Vrms (input-input & input-ground)
Debounce: 0 to 60,000 ms in 10 ms steps (software selectable)

2.4 GENERAL

POWER REQUIREMENTS: +5VDC (from M Series power supply), 200 ma maximum, 150 ma typical

CONNECTORS:
Relays: DA-15M (15-pin male)
A-to-D & Switch Closure /Isolated Voltage Inputs:
HDL-44F (44-pin female)

ENVIRONMENTAL:
Operating temperature range: 0^{o} to 70^{o} C
Storage temperature range: -40^{o} to 85^{o} C
Humidity: 5% to 95% non-condensing

3 INSTALLATION AND CABLING

The ADR-1 and ADR-1A are installed in the M Series chassis as described in *Section 4.5* of the base unit operator's manual.

NOTE: The ADR-1 and ADR-1A cannot be installed as Module 1. Also, if an ADR-1(A) is removed from a module slot and a different ADR-1(A) is installed in that location, the newly installed module acquires the previous module's configuration. Moving an ADR-1(A) 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.

Once the ADR-1 or ADR-1A has been installed in the M Series chassis, connect your analog and isolated voltage input signals to the input connector J1 with a HDL-44 male connector. Connect single-ended A-to-D ground returns to the minus (-) HDL-44 pin connector for the channel(s) to be used. For example, if Channel 1 is used in single-ended mode, connect your signal under measurement to Pin 1 and the ground to Pin 2. Make all relay connections to the input connector J2 with a DA-15F connector. Configure your input cable as shown in *Figure 1* on the following page for the ADR-1 analog and switch closure inputs, *Figure 2* on Page 6 for the ADR-1A analog and isolated voltage inputs, or as shown in *Figure 3* on Page 7 for relay connections.

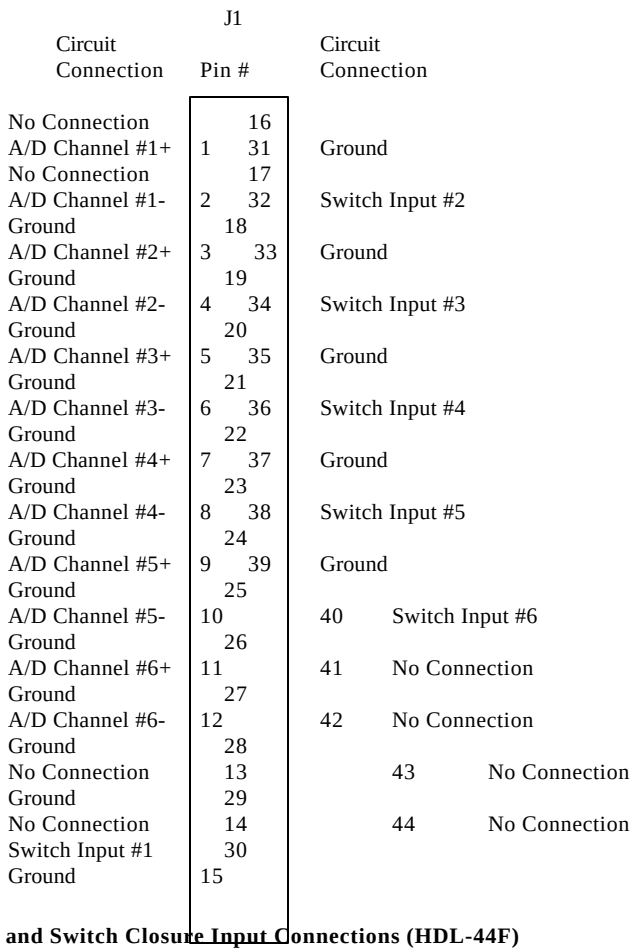


Figure 1: **ADR-1 Analog and Switch Closure Input Connections (HDL-44F)**

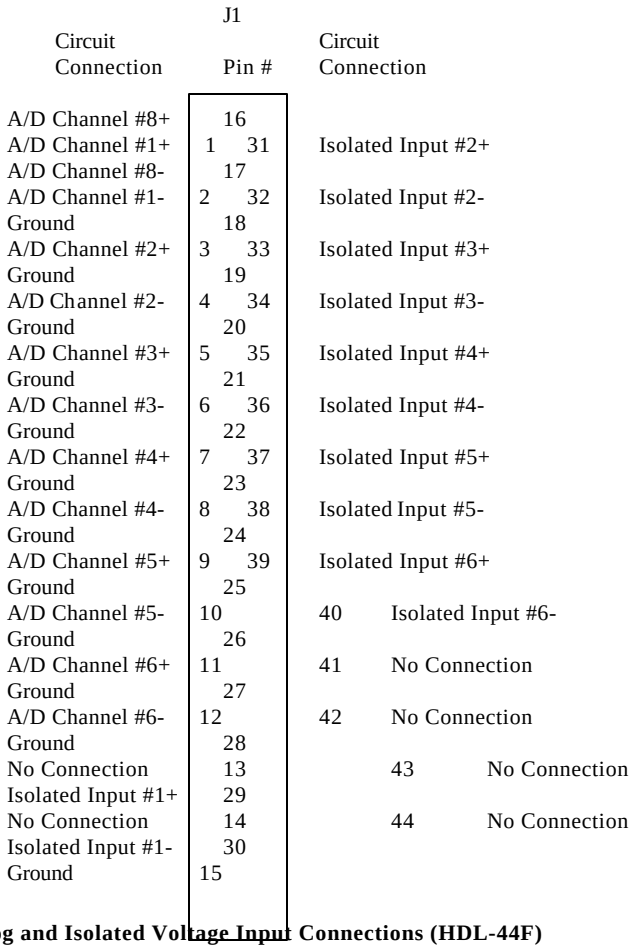


Figure 2: ADR-1A Analog and Isolated Voltage Input Connections (HDL-44F)

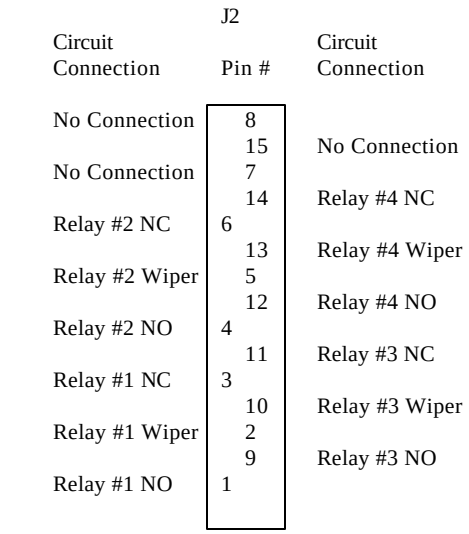


Figure 3: Relay Connections (DA-15M)

4 OPERATION

This section discusses the general ADR-1(A) 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 ADR-1(A) consists of six differential or single ended analog inputs for A-to-D conversion, four electromechanical relays, and six switch closure inputs (ADR-1) or six optically isolated voltage inputs (ADR-1A). The ADR-1(A) communicates to a host computer system via a host communication module installed in the M Series chassis. The host communication module is the primary user interface to the ADR-1(A) which allows the host computer/controller to change configuration, send commands, and receive data.

The analog inputs of the ADR-1(A) are operated as six differential or single ended input channels. The input source is an analog voltage signal which is sampled and digitized into an *A-to-D data message*. The data message indicates the actual voltage present on the input channel. Each data message generated by the A-to-D inputs can be presented in a hexadecimal, decimal, or voltage format. Data resolution is 12 bits.

Each ADR-1(A) relay has a set of normally open (NO) and normally closed (NC) contacts and is capable of switching AC and DC loads up to 3 amps. The relays have zero current leakage and can be used to switch very low-current loads. All relays can change state via data commands or time schedule. Individual relay status (energized or de-energized) can be presented to a host system automatically or upon request. The relay status can be the current state or change-in-state history of a specific relay. Data associated with the relay status which is generated by the ADR-1(A) and sent to the host system is referred to as a *relay data message*.

The switch closure inputs of the ADR-1 provide a reliable method to detect and report a state change from high resistance (open) to continuity (closed) or vice versa. The optically-isolated voltage inputs of the ADR-1A can be individually set to detect the presence and change of state of AC or DC inputs.

An *event* is defined as two transitions of an input. These transitions can be HI to LO and back to HI or LO to HI and back to LO. The *Event Polarity* defines which type of transition defines the start of an event. False reporting of events is prevented by a programmable *Debounce Delay*. Each input channel has an *Event Counter* which counts the number of events that have occurred. Each input channel features a *Data Latch* where the time and state of the initial event for one or more channels is latched and held until user reset. Multiple events are stored for later retrieval and analysis. The actual data associated with an event which is calculated by the ADR-1(A) module is referred to as an *event data message*.

Data messages are sent to a host communication module automatically or upon request and are preceded by the unit/module/channel number from which the data message came. The data message can be optionally appended with a "real time" *Time Tag* showing the date and time the data message was recorded.

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

You have the choice of programming the ADR-1 via verbose (menu-driven) or non-verbose (dynamic) configuration mode. When using verbose configuration mode, a series of menus prompt you to enter the desired configuration parameters. Non-verbose or dynamic configuration mode allows you to program many of the operating parameters of the ADR-1 by sending configuration commands from the host computer/controller. Configuration is discussed in *Section 5*.

4.2 USER-PROGRAMMABLE FEATURES

You can program the *Sampling Setup* (see *Section 4.2.1*), *Reporting Setup* (see *Section 4.2.2*), *Channel Input Setup* (see *Section 4.2.3*), *Dynamic Configuration* (see *Section 4.2.4*), and Relay Operation Schedule (see *Section 4.2.5*) on the ADR-1(A).

4.2.1 SAMPLING SETUP

Sampling Setup allows you to program how the ADR-1(A) takes samples of the A-to-D and isolated voltage input signals. The items you can program in the Sampling Setup include *Sampling Method, Sample Start Time, Sample Interval, Sample Rate, Number of Samples to Average, Debounce Delay, and Event Polarity.* The following subsections describe these features in more detail.

4.2.1.1 SAMPLING METHOD

Sampling Method is the manner in which A-to-D sampling is initiated. The ADR-1(A) 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 A-to-D sampling begins when Schedule Sampling Method is selected. The start of sampling can 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 24:00.**

4.2.1.3 SAMPLE INTERVAL

The ADR-1(A) can sample A-to-D inputs continuously or in repetitive periods. If a repetitive period is selected, the ADR-1(A) samples 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 4.4.1*. Choose no Sample Interval for Continuous sampling. **The default Sample Interval is continuous.**

4.2.1.4 SAMPLE RATE

Sample Rate is the actual number of samples an ADR-1(A) A-to-D channel reads in one second. The Sample Rate for individual channels can range from 1 to 4000 samples per second (S/sec). The maximum Sample Rate for an

individual channel is 4000 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 A-to-D data message. The ADR-1(A) samples at a certain Sampling Rate and averages a specified number of samples. This average is then 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 can range from 1 to 4000. **The default Number of Samples to Average is 10.**

4.2.1.6 DEBOUNCE DELAY

The Debounce Delay is used to guard against erroneous switch closure/isolated voltage input transitions. A transition is not valid unless the input remains at a changed state for the debounce duration. The debounce delay can be programmed from 0 (disabled) to 60000 ms in 10 ms steps. **The default Debounce Delay time is 0 ms.**

4.2.1.7 EVENT POLARITY

NOTE: This section applies to the ADR-1A only.

The Event Polarity is used to instruct individual switch closure/optically isolated inputs to detect events based on positive going (LO to HI) transitions, negative going (HI to LO) transitions, or both (all transitions). **The default Event Polarity is a HI to LO transition.**

4.2.2 REPORTING SETUP

Reporting Setup allows you to program how the ADR-1(A) reports data messages to the host module. The items you can program in the Reporting Setup include *Reporting Method*, *Report Start Time*, *Report Interval*, *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 ADR-1(A) 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 can be delayed up to 24 hours from the current time recorded by the M Series time-of-day clock and reporting occurs in cyclic periods as determined by the Report Interval. **The default Report Start Time is 24:00.**

4.2.2.3 REPORT INTERVAL

You can program the ADR-1(A) to report in repetitive periods using Schedule Reporting Method, where the ADR-1(A) reports all data messages in the receive buffer after the specified Report Interval has elapsed. The ADR-1(A) reports until the buffer is empty and then report again after the specified Report Interval has expired. **The default Report Interval is 24:00 (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 A-to-D data messages sent to the designated host module which can be in Hexadecimal, Decimal, or Engineering Units (volts). When Hexadecimal Data Format is selected, the data message appears as a hexadecimal value between 000 Hex (low range) and FFF Hex (high range). When Decimal Data Format is selected, the data message appears as a decimal value between 0 (low range) and 4095 (high range). When Engineering Units Data Format is selected, the data message appears 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 sampled. Time Tag can be enabled or disabled. **The default Time Tag is disabled.**

4.2.2.7 TERMINATING CHARACTER(S)

Terminating Character(s) are 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 ADR-1(A) A-to-D voltage inputs. The items you can program in the Channel Input Setup include *Range*, *Unipolar/Bipolar*, and *Enable/Disable*. The following subsections describe these features in more detail.

4.2.3.1 RANGE

Range is the desired working voltage range of the A-to-D channel inputs. You can choose one of eight 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, -5 to +5 volts, -2.5 to +2.5 volts, and -1.25 to +1.25 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 A-to-D 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 ENABLE/DISABLE

The Enable/Disable selection is used to enable or disable individual A-to-D input channels on the ADR-1(A) for data acquisition. Up to six active channels can be programmed. **The default Active Channels setting has Channel 1 active and all other channels inactive.**

4.2.4 DYNAMIC CONFIGURATION

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

4.2.5 RELAY OPERATING SETUP

The Relay Operating Setup allows you to program the relay time schedule. You can view the current relay schedule, create and/or modify the current schedule, enable or disable individual events, and delete individual events.

The default relay schedule is null (no schedule).

4.3 DATA COMMANDS

You can issue ADR-1(A) 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 can be entered repeatedly to get specific data messages or to direct the ADR-1(A)'s actions. You may issue a single data command for action on multiple channels. Data commands must be used to obtain data messages when using Command Reporting Method. ADR-1(A) data commands are sent through a host module using the following procedure:

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

2. Once the ADR-1(A) is selected, it goes into *Command Mode* allowing you to send data commands. The ADR-1(A) 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 can use one of the following formats as shown for the SA (sample) command:

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

3. After you have sent the desired data commands to the ADR-1(A) module, you can disconnect from the ADR-1(A), by sending **$BT<cr>**. You can disconnect from the ADR-1(A) and select a different module or the base unit by sending **$BTX<cr>**, where X is the desired module number or 0 for the base unit.
   IMPORTANT: If the ADR-1(A) 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 ADR-1(A) resumes sending data messages to the

designated host module.

The supported data commands are divided up into three sections. *Section 4.3.1* describes the data commands supported by the analog-to-digital inputs, *Section 4.3.2* describes the data commands supported by the relays, and *Section 4.3.3* describes the data commands supported by the isolated voltage inputs. *Appendix A* provides these same commands in a condensed version for quick reference.

4.3.1 DATA COMMANDS FOR ANALOG-TO-DIGITAL INPUTS

4.3.1.1 CLEAR BUFFER COMMAND

The Clear Buffer (CB) command is useful to clear all old A-to-D data messages from the FIFO buffer when a new data message is started. If the buffer is not cleared, previous data messages remain in the buffer until overwritten. The Clear Buffer command has the following format: **CB*n*<*cr*>** where *n* = Channel# (1 to 6 or 0 for all).

4.3.1.2 REPORT ALL BUFFERED A-TO-D DATA MESSAGES COMMAND

The Report All Buffered A-to-D Data Messages (RA) command instructs the ADR-1(A) to report all A-to-D data messages currently stored in the buffer of the selected channel(s). The Report All Buffered A-to-D Data Messages command has the following format: **RA*n*<*cr*>** where n = Channel# (1 to 6 or 0 for all).

4.3.1.3 REPORT A SINGLE BUFFERED A-TO-D DATA MESSAGE COMMAND

The Report a Single Buffered A-to-D Data Message (RS) command instructs the ADR-1(A) to report the first sample stored in the buffer of the selected channel(s). The Report a Single Buffered A-to-D data message command has the following format: **RS*n*<cr>** where n = Channel# (1 to 6 or 0 for all).

4.3.1.4 SAMPLE COMMAND

The Sample (SA) command instructs the ADR-1(A) to read and report a single data message for each A-to-D channel specified. The A-to-D data message is made from the programmed No. of Samples to Average taken at the programmed Sample Rate. The Sample command has the following format: **SA*n*<cr>** where *n* = Channel# (1 to 6 or 0 for all).

4.3.2 DATA COMMANDS FOR RELAYS

4.3.2.1 DE-ENERGIZE RELAY COMMAND

The De-energize Relay (DR) command instructs the ADR-1(A) to de-energize the specified relay(s). The De-energize Relay command has the following format: **DR*n*<cr>** where *n* = Relay# (1 to 4 or 0 for all).

4.3.2.2 ENERGIZE RELAY COMMAND

The Energize Relay (ER) command instructs the ADR-1(A) to energize the specified relay(s). The Energize Relay command has the following format: **ERn<cr>** where n = Relay# (1 to 4 or 0 for all).

4.3.2.3 SEND RELAY DATA COMMAND

The Send Relay Data (RD) command instructs the ADR-1(A) to report all data messages currently stored in the buffer of the selected relay(s). The Send Relay Data command has the following format: **RA*n*<*cr*>** where n = Relay# (1 to 4 or 0 for all).

4.3.3 DATA COMMANDS FOR SWITCH/ISOLATED VOLTAGE INPUTS

4.3.3.1 CLEAR EVENT COUNTER COMMAND

The Clear Event Counter (CC) command is used to reset the event counter for one or more switch closure/isolated voltage input channels to zero without reading the value of the event counter. The function of the event counters is discussed in *Section 4.4.3*. The Clear Event Counter command has the following format: **CC*n*<cr>** where *n* = Channel# (1 to 6 or 0 for all).

4.3.3.2 CLEAR SWITCH/ISOLATED VOLTAGE INPUT BUFFER

The Clear Switch/Isolated Voltage Input Buffer (CI) command is used to clear all old data messages related to the switch closure/isolated voltage inputs when a new data message is started. If the buffer is not cleared, previous data messages remain in the buffer until overwritten. The Clear Isolated Input Buffer command has the following format: **CI*n*<cr>** where *n* = Channel# (1 to 6 or 0 for all).

4.3.3.3 CLEAR EVENT LATCH DATA

The Clear Event Counter (CR) command is used to clear the event latch buffer. Latched data is discussed more in *Section 4.4.3*. The Clear Event Counter command has the following format: **CR*c*<cr>** where *c* = Channel#

(1 to 6 or 0 for all).

4.3.3.4 REPORT EVENT COUNTERS COMMAND

The Report Event Counter (RC) command instructs the ADR-1(A) to report how many times an event has occurred for one or more channels since the last time a counter reset command was issued. This command does not reset the event counter. The Report Event Counter command has the following format: **RC*n*<cr>** where *n* = Channel# (1 to 6 or 0 for all).

4.3.3.5 REPORT ALL BUFFERED SWITCH/ISOLATED VOLTAGE INPUT DATA MESSAGES COMMAND

The Report All Buffered Switch/Isolated Voltage Input Data Messages (RI) command instructs the ADR-1(A) to report all data messages currently stored in the buffer of the selected channel(s). The Report All Buffered Input Data Messages command has the following format: **RI*n*<*cr*>** where *n* = Channel# (1 to 6 or 0 for all).

4.3.3.6 REPORT LATCH DATA COMMAND

The Report Latch Data (RL) command instructs the ADR-1(A) to report the active state of the initial event and the time the initial event occurred (if time tagging is enabled). This command does not reset the latch buffer. The Report Event Latch Data has the following format: **RL*n*<cr>** where *n* = Channel# (1 to 6 or 0 for all).

4.3.3.7 REPORT EVENT COUNTER AND RESET COMMAND

The Report Event Counter and Reset (RO) command instructs the ADR-1(A) to report how many times an event has occurred for one or more channels and then reset the event counter to zero. The Report Event Counter and Reset command has the following format: **RO*n*<cr>** where *n* = Channel# (1 to 6 or 0 for all).

4.3.3.8 REPORT EVENT LATCH DATA AND RESET COMMAND

The Report Event Latch Data and Reset (RR) command instructs the ADR-1(A) to report the active state of the initial event, the time the initial event occurred (if time tagging is enabled), and then reset the latch buffer. The Report Event Latch Data and Reset command has the following format: **RR*n*<cr>** where *n* = Channel# (1 to 6 or 0 for all).

4.3.3.9 SEND SWITCH/ISOLATED VOLTAGE INPUT STATUS COMMAND

The Send Switch/Isolated Voltage Input Status (SI) command reports back the current status of the switch closure inputs (continuity or high resistance) or isolated voltage inputs (voltage or no voltage). The Send Switch/Isolated Voltage Input Status command has the following format: **SIn<cr>** where n = Channel# (1 to 6 or 0 for all).

4.3.3.10 REPORT LATEST SWITCH/ISOLATED VOLTAGE INPUT DATA MESSAGE COMMAND

The Report Latest Switch/Isolated Voltage Input Data Message (SL) command reports the most recent data message in the buffer of the selected input(s). The Report Latest Switch/Isolated Voltage Input Data Message command has the following format: **SLn<cr>** where n = Channel# (1 to 6 or 0 for all).

4.3.3.11 REPORT OLDEST SWITCH/ISOLATED VOLTAGE INPUT DATA MESSAGE COMMAND

The Report Oldest Switch/Isolated Voltage Input Data Message (SO) command reports the oldest data message in the buffer of the selected input(s). The Report Latest Switch/Isolated Voltage Input Data Message command has the following format: **SOn<cr>** where n = Channel# (1 to 6 or 0 for all).

4.4 DATA MESSAGE GENERATION

Section 4.4.1 discusses analog-to-digital data message generation, *Section 4.4.2* discusses relay data message generation, and *Section 4.4.3* discusses switch closure and isolated voltage input data message generation.

4.4.1 A-TO-D DATA MESSAGE GENERATION

The ADR-1(A) generates A-to-D data messages by taking samples of the analog input voltage(s) at a specified sampling rate. The ADR-1(A) computes an average value of these samples and presents this average to the host device. The number of samples taken per data message is determined by the Number of Samples to Average. The ADR-1(A) samples analog inputs in one of three ways: Command (via command only), Immediate, and Schedule. A host module can request an A-to-D 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 ADR-1(A) samples 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 ADR-1(A) actually samples between each Sample Interval (see *Figure 3* on the following page). 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 ADR-1(A) 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 Report Interval is set to 10 minutes, the data collected during the most recent Sample Interval is reported.

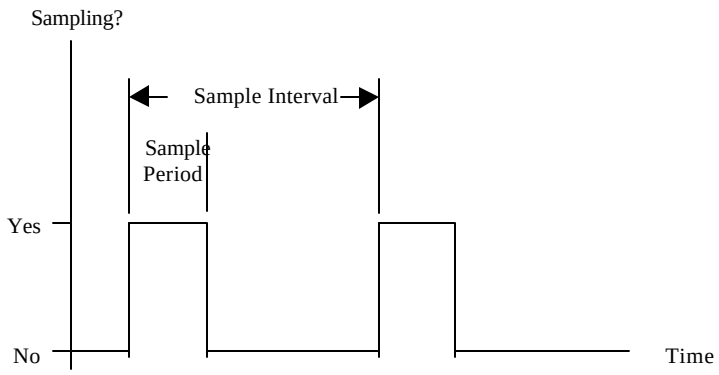


Figure 3: Sample Interval

4.4.2 RELAY DATA MESSAGE GENERATION AND CONTROL

A host computer/controller connected to a host module can receive relay data messages and control individual relays on a ADR-1(A) module. Relay data message generation depends on the Reporting Method used. When using Immediate Reporting Method, the ADR-1(A) generates a relay data message whenever a change-in-state of a relay occurs (i.e., energized to de-energized or vice versa). When using Schedule Reporting Method, the ADR-1(A) generates a relay data message whenever a change-in-state of a relay occurs after the Report Start Time has elapsed (see *Section 4.2.2.2*). When using Command Reporting Method, the ADR-1(A) generates a relay data message using RD command only (see *Section 4.3.2.3*).

Regardless of the Reporting Method used, the host system can obtain a relay data message showing the present state of a relay by sending the RD command.

Individual relays can be controlled directly by a host computer/controller via command, by schedule, or both. When relays are controlled using a schedule, each energizing and de-energizing of a relay is referred to as a *relay event*. Up to 12 relay events can be programmed in the schedule. Once the relay event schedule has been programmed, you can enable, disable, or delete specific relay events.

Each relay event consists of a Start Time, Duration, Interval, and Relay Number. The Event Start Time consists of the day of the week and the hour/minute/second of the day the initial event is to occur. The Event Duration Time is the amount of time a specified relay is energized and can be programmed in hours/minutes or milliseconds. Event Interval is the desired time subsequent occurrences of the same event transpire. Event Interval consists of the desired day of the week and hour/minute/second of the day. The Relay Number is the particular relay that is energized for a specific event. For example, you could program a relay to activate a sprinkler system

starting on the following Monday at 5:00pm for one hour and then recurring every Monday, Wednesday, and Friday at 5:00pm for one hour.

4.4.3 SWITCH CLOSURE AND ISOLATED VOLTAGE INPUT DATA MESSAGE GENERATION

Event data messages generated by the switch closure or isolated voltage inputs are in response to an event. An event is defined as a change-in-state of an input channel and return to the original state. An event may be started on a rising edge (LO to HI) or a falling edge (HI to LO) as determined by the Event Polarity (see *Section 4.2.1.7*).

An ADR-1 switch closure input is considered to be at a "HI" state (1) when the switch is closed (continuity) and a "LO" state (0) when the switch is open (infinite resistance). An ADR-1A isolated voltage input is considered to be at a "HI" state (1) when there is voltage detected and a "LO" state (0) whenever there is no voltage detected.

When LO to HI Event Polarity is selected, all LO to HI transitions are reported as a "1". If HI to LO Event Polarity is selected, all HI to LO transitions are reported as a "0". If BOTH is selected for Event Polarity, all transitions are reported (LO to HI transitions are reported as "1" and HI to LO transitions are reported as "0").

An event data message is the actual data associated with an event which is calculated by the ADR-1(A) module and sent to the host computer/controller. The way an event data message is presented to the host computer/controller is described in *Section 4.5*.

Event data message reporting depends on the Reporting Method used. If Immediate Reporting Method is used, the ADR-1(A) reports an event data message whenever an event occurs. If Schedule Reporting Method is used, the ADR-1(A) reports an event data message when an event occurs after the Report Start Time has elapsed (see *Section 4.2.2.2*). If Command Reporting Method is used, the ADR-1(A) reports an event data message on command only.

The ADR-1(A) module can observe, record, and report when an event happened, how long the event lasted, and how many events occurred for each individual channel. The initial occurrence of an event sets the event latch bit and stores the associated time in the *Data Latch*. You can read the state of the initial event and the time it was recorded (if time tagging is enabled) by issuing the RL or RR commands (see *Section 4.3.3.6* and *Section 4.3.3.8* respectively).

The *Event Counter* reflects the total number of events that have occurred for

a specific input since the Event Counter was last cleared using the CC or RO commands (see *Section 4.3.3.1* or *Section 4.3.3.7* respectively). The Event Counter counts up to 65,535 and then rolls over to 0. Therefore, the Event Counter should be read and reset on a regular basis. You can read the current Event Counter value by sending the RC or RO command. The Event Counter triggers on the rising edge of a transition when LO to HI Latch Polarity is selected, on the falling edge of a transition when HI to LO Latch Polarity is selected, or on the rising and falling edge of a transition when Event Polarity is set for BOTH. Examples of using the Event Counter would include counting items moving on a conveyor belt and process control where a pre-determined number of events must take place before a defined action may take place.

NOTE: A transition must have a duration greater than one millisecond plus the current Debounce Delay time to be considered as part of a valid event and subsequently increment the Event Counter.

4.5 DATA MESSAGE PRESENTATION

Section 4.5.1 discusses A-to-D data message presentation, *Section 4.5.2* discusses relay data message presentation and control, and *Section 4.5.3* discusses isolated voltage input data presentation.

4.5.1 A-TO-D DATA MESSAGE PRESENTATION

A-to-D 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 **VVVVV MM/DD/YY HH:MM:SS**

where, **UU** is the M Series Unit Number
MM is the ADR-1(A) Module Number
CC is the ADR-1(A) Channel Number
HHH is a Hex value ranging from 000 to FFF
DDDD is a Decimal value ranging from 0 to 4095
VVVVV is an Engineering unit ranging from -9.9999 to +9.9999 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 ADR-1(A) installed as Unit 1, Module 15 with Channels 1-6 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
```

UNIT#
MODULE#
CHANNEL#
DATA
DATE
TIME

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

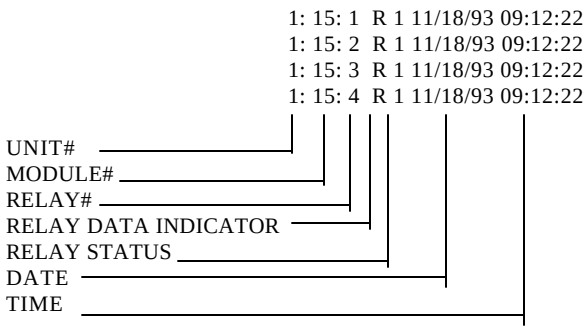
4.5.2 ~~RELAY DATA MESSAGE~~ PRESENTATION

Relay data message presentation varies slightly in format depending on module configuration. However, all data messages are presented in the same basic order of fields as follows:

UU:MM,CC R 1 or **0 MM/DD/YY HH:MM:SS**

where, **UU** is the M Series Unit Number
MM is the ADR-1(A) Module Number
CC is the ADR-1(A) Channel Number
R indicates relay data
1 indicates the relay is energized
0 indicates the relay is de-energized
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 relay data message from an ADR-1(A) installed as Unit 1, Module 15 with Channels 1-4 active using Hex Data Format and having Time Tag enabled, would appear as follows:



Data messages requested through the use of data commands might include messages from one or more relays.

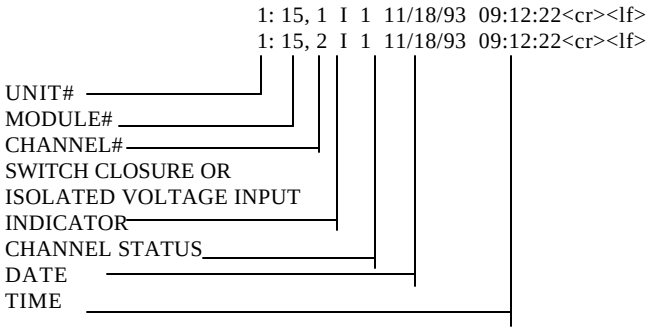
4.5.3 SWITCH CLOSURE AND ISOLATED VOLTAGE INPUT DATA MESSAGE PRESENTATION

Switch closure or isolated voltage input data message presentation varies slightly in format depending on module configuration and the actual data command(s) sent. However, all event data messages are presented in the same basic order of fields as follows:

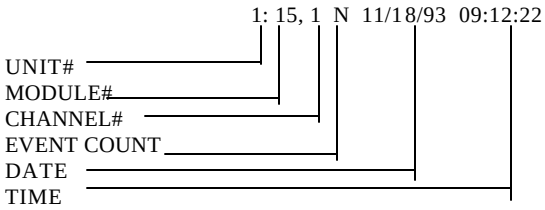
UU:MM,CC I 1 or **0 MM/DD/YY HH:MM:SS**

where, **UU** is the M Series Unit Number
MM is the ADR-1(A) Module Number
CC is the ADR-1(A) Channel Number
I indicates switch closure or isolated voltage input data
1 indicates event polarity
0 indicates event polarity
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)

The following example shows data messages received using immediate or schedule reporting where the ADR-1(A) is installed in Unit 1 Module 15 with Time Tagging enabled:

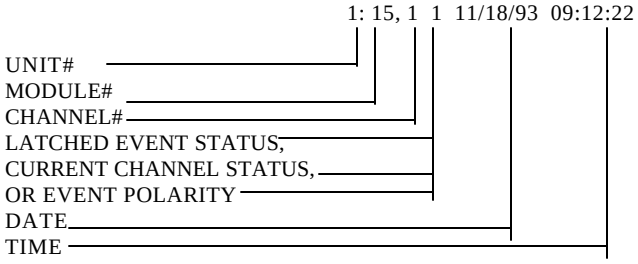


If you issue the RC (Report Event Counter) or the RO (Report Event Counter and Reset) commands, the module responds with a data message showing the Event Counter. The following example shows an Event Counter data message for Channel 1 where the ADR-1(A) is installed in Unit 1 as Module 15 with Time Tagging enabled:



In this example, N is the number of recorded events (0 to 65,535).

If you issue the SI (Send Isolated Input Status), RI (Report All Isolated Input Data Messages), SL (Report Latest Isolated Input Data Message), SO (Report Oldest Isolated Input Data Message), RR (Report Latch Data and Reset), or RL (Report Latch Data) commands, the ADR-1(A) responds with a data message similar to the following for Channel 1 where the ADR-1(A) is installed in Unit 1 as Module 15 with Time Tagging enabled:



The "Latched Event Status" field shown above is valid for the RL and RR commands. If the latch has not been set, this field is "0" and no time tag will be appended. The "Current Channel Status" field is valid for the SI command. This field is "1" if voltage is detected and "0" if no voltage is detected. The "Event Polarity" field is valid for the RI, SL, and SO data commands.

5 CONFIGURATION

You can program the ADR-1(A) 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 can 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 ADR-1(A) 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 ADR-1(A) 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 ADR-1(A) 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 is discarded and you will have to send the configuration sequence again.

To access the menu-driven configuration mode of the ADR-1(A) 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 ADR-1(A) by sending **$BAYTECH**, the desired module number (2 to 16), and *Carriage Return* or *Line Feed*.

3. Access configuration mode by sending **$CONFIG<cr>**. Following the example above, you would send **$BAYTECH2<cr>$CONFIG<cr>** to configure Module 2.

5.1.1 CONFIGURATION MAIN MENU

The ADR-1(A) installed as Module X responds 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,1995
DAC V84 ADR-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
Relay Scheduler.....6
Exit.....X

Enter Selection:
```

Enter the number corresponding to your desired choice. Each choice invokes a sub-menu. Each sub-menu is described in the following sections. When you exit a sub-menu, you are returned to the configuration main menu. When "Exit" is selected from the main menu, the ADR-1(A) exits from configuration mode and go into an active data collection mode.

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

NOTE: All commands must be in uppercase.

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 can review the current configuration status. The ADR-1(A) responds with a menu similar to the following:

```
MODULE STATUS

Sampling Method.....COMMAND
Sample Start Time.....HH:MM
Sample Interval.....HH:MM:SS
Sample Rate.....1S/sec
No. of Samples to Average.....10
Debounce Delay (Milliseconds X 10).1
Event Polarity.....LO to HI
Reporting Method.....COMMAND
Reporting Start Time.....24:00

Press a key to continue or X to Exit...

MODULE STATUS

Report Interval.....24:00
Relay Operating Schedule.....DISABLED
Host Address.....1:1,1
```

```
Data Format.....HEX
Time Tag.....DISABLED
Terminating Character(s).....0D0A
Dynamic Configuration Commands.....DISABLED

Press a key to continue or X to Exit...

Analog channel configuration:

        CHANNEL  ACTIVE    MODE    RANGE

          1      NO        UN      0-10
          2      NO        UN      0-10
          3      NO        UN      0-10
          4      NO        UN      0-10
          5      NO        UN      0-10
          6      NO        UN      0-10
          7      NO        UN      0-10
          8      NO        UN      0-10

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 can program how the ADR-1(A) samples the A-to-D and switch closure/isolated voltage input signals. The items you can program are *Sampling Method, Sample Start Time, Sample Interval, Sample Rate, Number of Samples to Average, Debounce Delay, and Event Polarity.* The operational functionality of these items is discussed in *Section 4.2.1*. The ADR-1(A) responds 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
Debounce Delay.....6
Event Polarity.....7
Exit.....X

Enter Selection:
```

If you respond to one of the above selections with 1 to 7, a sub-menu is presented for that item. After making any necessary changes under sub-menus 1 to 7, you be returned to the Sampling Setup menu. The "Exit" selection returns 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 can program the method in which A-to-D sampling is initiated. The ADR-1(A) responds 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 ADR-1(A) provides three A-to-D 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 ADR-1(A) samples only when the **SAn** command is issued (see *Section 4.3.1.4*). One data message is read at the programmed Sampling Rate and No. of Samples to Average and reported to the host device for each channel specified. The **SAn** command can be issued to the ADR-1(A) in any of the three Sampling Methods.

When Immediate Sampling Method is selected, the ADR-1(A) samples 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 ADR-1(A) begins sampling at the programmed Sample Start Time (see *Section 5.1.3.2*). Sampling occurs 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 & date clock time.

IMPORTANT: If you program the ADR-1(A) 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 contains all data sampled and buffered until reporting is initiated.

NOTE: When a "Command" sample is requested by entering the **SAn** data command, the Reporting Method and Sampling Method currently programmed are overridden and a single data message is read and reported. Multiple **SAn** commands can 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 33 with "2" (Sample Start Time), you can program when the ADR-1(A) begins A-to-D sampling when using Schedule Sampling Method. The ADR-1(A) responds 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 & date 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 is 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 ADR-1(A) starts sampling data at 10:45 at 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 resumes 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 33 with "3" (Sample Interval), you can program the ADR-1(A) to do A-to-D sampling continuously or sample in repetitive periods when using Immediate or Schedule Sampling Methods. The ADR-1(A) responds 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 occurs where the ADR-1(A) samples 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 4.4.1*.

5.1.3.4 SAMPLE RATE

By responding to the *Enter Selection:* message at the end of the Sampling Setup Menu on page 33 with "4" (Sample Rate), you can program the rate of A-to-D sampling as a function of samples/sec. The ADR-1(A) responds 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 33 with "5" (Number of Samples to Average), you can program the how many samples the ADR-1(A) averages for each data message. The ADR-1(A) responds 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.

IMPORTANT: The Number of Samples to Average is limited by data transfer rate and is automatically increased to a minimum number based on the Sample Rate. The minimum Number of Samples to Average as a function of Sample Rate is shown in the table below:

SAMPLE RATE (S/Sec)	MINIMUM # OF SAMPLES TO AVERAGE
4000-3004	450
3003-2005	340
2004-1002	230
1001-501	120
500-251	60
250-101	30
100-51	12
50-26	6
25-11	3
10-1	1

5.1.3.6 DEBOUNCE DELAY

By responding to the *Enter Selection:* message at the end of the Sampling Setup Menu on page 33 with "6" (Debounce Delay), you can program the Debounce Delay of the switch closure and isolated voltage inputs in milliseconds to prevent the accidental registering of noise spikes, relay bounce, etc., as actual events. The ADR-1(A) responds with the following menu:

```
DEBOUNCE DELAY

Debounce Delay (Milliseconds X 10)..1
```

```
Enter Delay (0-60000 Milliseconds X 10)<cr>, or X to EXIT:
```

Enter the desired Debounce Delay. Debounce Delay is entered in 10ms intervals with the trailing digit not displayed. For example, if you enter "1", the Debounce Delay is 10ms, if you enter "30, the Debounce Delay is 300ms, etc..

5.1.3.7 EVENT POLARITY

By responding to the *Enter Selection:* message at the end of the Sampling Setup Menu on page 33 with "7" (Event Polarity), you can program individual optically isolated voltage inputs to detect events on positive-going (LO to HI) transitions, negative-going (HI to LO) transitions, or both. Event Polarity also defines the start of event counters, event duration, and event reporting. The ADR-1(A) responds with the following menu:

```
SET EVENT POLARITY

Event Polarity.....HI TO LO

Low to Hi Transitions only.....1
Hi to Low Transitions only.....2
Both.....3
Exit.....X

Enter Selection:
```

Enter the desired Event Polarity or "X" to exit.

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 can program how the ADR-1(A) reports data messages to the host device and the format in which the data messages appears. The items you can 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 ADR-1(A) responds 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 is 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 returns 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 on the previous page with "1" (Reporting Method), you can program how the ADR-1(A) reports data messages to the host device. The ADR-1(A) responds 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 ADR-1(A) 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 ADR-1(A) reports data messages to the host module only when the **RAn**, **RCn**, **RDn**, **RIn**, **RLn**, **ROn**, **RRn**, **RSn**, or **SAn** commands are issued (see *Section 4.3*). These commands may be issued to the ADR-1(A) in any of the three Reporting Methods.

When Immediate Reporting Method is selected, the ADR-1(A) reports 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 ADR-1(A) begins 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 an A-to-D data message is requested by entering the **RAn**, **RSn**, or **SAn** 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 40 with "2" (Report Start Time), you can program the time the ADR-1(A) starts reporting when using Schedule Reporting Method. The ADR-1(A) responds 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 ADR-1(A) starts 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 <u>not</u> 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 ADR-1(A) is initially reporting, if you enter into the menu-driven mode of configuration and

exit, the ADR-1(A) does not resume reporting data messages until the programmed Report Start Time elapses. You can program the ADR-1(A) 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 40 with "3" (Report Interval), you can program the time interval between reporting periods when using Schedule Reporting Method. The ADR-1(A) responds 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 is reached, the ADR-1(A) reports all buffered data messages to the designated host module until the buffer is empty. The ADR-1(A) continues 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 ADR-1(A) reports 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 40 with "4" (Host Address), you can 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 ADR-1(A) responds 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 are 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 40 with "5" (Data Format), you can program how the ADR-1(A) presents sampled data to the designated host module. The ADR-1(A) responds with the Select Data Format menu as follows:

```
SELECT DATA FORMAT

Data Format.....HEX

Hexadecimal.....1
Decimal.....2
Engineering Units-Volts.....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 counts 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 40 with "6" (Time Tag), you can program the ADR-1(A) to append a time tag to the end of data samples automatically. The ADR-1(A) responds 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 40 with "7" (Terminating Character(s)), you can 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 ADR-1(A) responds 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 can program the various measurement features of the ADR-1(A) inputs. The items you can program in the Channel Input Setup include *Range*, *Unipolar/Bipolar*, and *Enable/Disable*. The operational functionality of these items is discussed in *Section 4.2.3*. The ADR-1(A) responds with the current Channel Input Setup menu similar to the following:

```
CHANNEL INPUT SETUP

CHANNEL   ACTIVE   MODE    RANGE

   1      YES      UN      0-10
   2      NO       UN      0-10
   3      NO       UN      0-10
   4      NO       UN      0-10
   5      NO       UN      0-10
   6      NO       UN      0-10
   7      NO       UN      0-10
   8      NO       UN      0-10

Enter Channel Number<cr> to Configure or X to EXIT:
```

Type the desired channel number (1 to 8) followed by *Carriage Return*. The ADR-1(A) responds with the following menu:

```
Range.....1
Unipolar / Bipolar.....2
Enable / Disable.....3
Exit.....X

Enter Selection:
```

If you respond to one of the above selections with 1 to 3, a sub-menu is presented for that item as described in *Section 5.1.5.1* through *Section 5.1.5.3*. After making any necessary changes under sub-menus 1 to 3, you are returned to the Channel Input Setup menu. The "Exit" selection returns 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 can program the operating voltage range for the ADR-1(A) channel inputs. The ADR-1(A) responds with the Select Input Voltage Range menu as follows:

```
Range.....10 Volts

10 Volt.....1
5 Volt.....2
2.5 Volt.....3
1.25 Volt.....4
Exit.....X

Enter Selection:
```

Enter the number (1 to 4) corresponding to the desired Range.

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 47 with "2" (Unipolar / Bipolar), you can program the operating voltage polarity of the channel inputs. The ADR-1(A) responds 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 ENABLE / DISABLE

By responding to the *Enter Selection:* message at the end of the Channel Input Setup Menu on page 47 with "3" (Enable/Disable), you can program which input channels on the ADR-1(A) are active for data acquisition. The ADR-1(A) responds with the Select Active Channels menu as follows:

```
CHANNEL ACTIVE/INACTIVE

Channel Status.....ACTIVE
```

```
Inactive.....1
Active.....2
Exit.....X

Enter Selection:
```

Type "1" to de-activate the selected channel, "2" to activate the selected channel, or "X" to return to the menu shown on the bottom of page 47.

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 can program the ADR-1(A) to respond to dynamic configuration (non-verbose) commands. The ADR-1(A) responds 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 ADR-1(A) to be programmed by downloading dynamic (on-the-fly) commands. See *Section 5.2* for the procedure to program the ADR-1(A) via dynamic configuration and a description of the available configuration commands.

5.1.7 RELAY SCHEDULER

By responding to the *Enter Selection:* message at the end of the Configuration Main Menu (see *Section 5.1.1*) with "6" (Relay Scheduler), you can program the relay schedule. The ADR-1(A) responds with the following menu:

```
RELAY OPERATING SETUP

List Current Schedule.....1
Create/Modify Schedule.....2
Enable/Disable Events.....3
Delete Events/Schedule.....4
Exit.....X

Enter Selection:
```

Type the number corresponding to your desired choice. The "List Current Schedule" choice displays the current relay schedule, the "Create/Modify Schedule" choice allows you to program individual relay events. The "Enable/Disable Events" choice allows you to enable or disable individual relay events once they are programmed. The "Delete Events/Schedule" choice

allows you delete individual programmed relay events or the entire schedule. *Section 5.1.7.1* through *Section 5.1.7.4* describes these items in more detail. Type "X" to return to the Configuration Main Menu (see *Section 5.1.1*).

5.1.7.1 LIST CURRENT SCHEDULE

If you select "1" from the *Enter Selection:* prompt at the end of the Relay Operating Setup menu (List Current schedule), you can review the current relay schedule. The ADR-1(A) responds with:

```
CURRENT SCHEDULE


 EVENT   START  DURATION    INTERVAL   RELAY
  NO.    TIME                 NO.


     DD HH:MM:SS  HH:MM    D HH:MM:SS
                  NNNNN


01    00:00:00  00:00    0 00:00:00    0
02    00:00:00  00:00    0 00:00:00    0
03    00:00:00  00:00    0 00:00:00    0
04    00:00:00  00:00    0 00:00:00    0
05    00:00:00  00:00    0 00:00:00    0
06    00:00:00  00:00    0 00:00:00    0
07    00:00:00  00:00    0 00:00:00    0
08    00:00:00  00:00    0 00:00:00    0
09    00:00:00  00:00    0 00:00:00    0
10    00:00:00  00:00    0 00:00:00    0
11    00:00:00  00:00    0 00:00:00    0
12    00:00:00  00:00    0 00:00:00    0

Press any key to EXIT
```

Press any key to return to the Relay Operating Setup menu shown on the previous page.

NOTE: A capital "E" appears adjacent to the event number when that event is enabled.

5.1.7.2 CREATE/MODIFY SCHEDULE

If you select "2" from the *Enter Selection:* prompt at the end of the Relay Operating Setup menu (Create/Modify Schedule), you can edit the existing relay schedule. The ADR-1(A) responds with:

```
EVENT NUMBER

Enter Event Number (1-12) <cr>, or X to EXIT:
```

Type the desired Event Number (1 to 12) followed by <ENTER>. The ADR-1(A) responds with the Event Start Time menu. The Event Start Time consists of the day of the week and time of day the initial occurrence of the

selected relay event happens. The ADR-1(A) responds with:

```
EVENT START TIME

Event Start Time.....SU 00:00:00
Current Date, Day-of-Week and Time.MM/DD/YY D HH:MM:SS

Enter Day-of-Week (0=Any, 1=SUN, 2=MON....7=SAT)<cr>, or X to EXIT:
```

Type the desired day of the week for the initial relay event (1 to 7) or 0 for any day followed by <ENTER>. For example if you enter "1" for Monday, the ADR-1(A) responds with:

```
Enter Hours (0-23)<cr>, or X to EXIT:
```

Type the desired hour for the initial relay event followed by <ENTER>. For example, if you enter "14" for 2:00pm, the ADR-1(A) responds with:

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

Type the desired minute of the selected hour for the initial relay event followed by <ENTER>. For example, type "0" to start at the top of the selected hour. After you enter in the desired Event Start Time, the ADR-1(A) responds with the Event Duration menu which allows you to program how long the selected relay stays energized once the Event Start Time elapses. The Event Start Time can be programmed in hours and minutes or in milliseconds. The ADR-1(A) responds with:

```
EVENT DURATION

Event Duration.....00:00

Select Duration in (H)ours and Minutes or (M)illiseconds
 (H/M), or X to EXIT:
```

Type "H" to program the Event Duration in Hours and Minutes or "M" for milliseconds. For example, if you type "M" for milliseconds, the ADR-1(A) responds with:

```
Enter Duration (10-60000 Milliseconds)<cr>, or X to EXIT:
```

Type the desired number of milliseconds you want the selected relay to remain energized followed <ENTER>. The ADR-1(A) then prompts you to enter the desired relay number that you wish the selected event to energize. The ADR-1(A) responds with:

```
Enter Relay Number (1-8)<cr>, or X to EXIT:
```

Type the desired relay number (1 to 4) followed by <ENTER>. The ADR-1(A) responds with:

```
DATA CORRECT (Y/N)?
```

If the data displayed for the selected Event Number is correct, type "Y". The ADR-1(A) returns to the Relay Operating Setup menu shown on page 49. If you type "N", the ADR-1(A) returns to the Event Start Time menu shown on

the previous page.

5.1.7.3 ENABLE/DISABLE EVENTS

If you select "3" from the *Enter Selection:* prompt at the end of the Relay Operating Setup menu on page 49 (Enable/Disable Events), you can enable or disable individual relay events. The ADR-1(A) responds with:

```
ENABLE/DISABLE EVENTS

Event Number(s)   0 ENABLED

Enter Event Number (1-12, 0=ALL)<cr>, or X to exit:
```

This menu shows the current Event Numbers enabled and prompts you to type the desired Event Number to enable or disable followed by <ENTER>. Enter the desired Event Number to enable or disable.

The ADR-1(A) responds with:

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

Enter Selection:
```

Type "1" to enable the selected relay event or "2" to disable the selected relay event. The ADR-1(A) returns to the Relay Operating Setup menu shown on page 49.

5.1.7.4 DELETE EVENTS/SCHEDULE

If you select "4" from the *Enter Selection:* prompt at the end of the Relay Operating Setup menu on page 49 (Delete Events/Schedule), you can delete individual relay events or the entire schedule. The ADR-1(A) responds with:

```
DELETE EVENTS

Enter Event Number (1-12, 0=ALL)<cr>, or X to exit:
```

Type the Event Number you wish to delete or "0" for the entire schedule followed by <ENTER>.

5.1.8 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 ADR-1(A) exits the menu-driven configuration mode. If changes are made to any configuration parameter, the ADR-1(A) responds 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 ADR-1(A) responds with:

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

5.2 DYNAMIC CONFIGURATION PROCEDURE AND COMMANDS

ADR-1(A) 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 ADR-1(A) recognizes 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 ADR-1(A):

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

2. Once the ADR-1(A) is selected, it goes into *Command Mode* and allow you to send dynamic configuration commands. The ADR-1(A) 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 ADR-1(A) module, you can disconnect from the ADR-1(A), by sending **$BT<cr>**. You can disconnect from the ADR-1(A) and select a different module or the base unit by sending **$BTX<cr>**, where X is the desired module number or 0 for the base unit.

The following sections describe the dynamic configuration commands supported by the ADR-1(A). *Appendix A* provides these commands as a quick reference.

NOTE: Multiple configuration commands can be sent while the ADR-1(A) is in command mode. Each command should be terminated with a *Carriage Return*. For example: **AV300<cr>VR1<cr>SM1<cr>**. Please see the following subsections for a description of the AV, VR, and SM commands.

5.2.1 A-TO-D AVERAGE COMMAND

The Average (AV) command programs the Number of Samples to Average of the A-to-D channels 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 seconds. If you enter an interval less than the time required to average the selected number of samples, the ADR-1(A) 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 is not 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 A-TO-D ENABLE CHANNEL COMMAND

The Enable Channel (CE) command is used to enable or disable specified A-to-D channels. The Enable Channel command has the following format: **CEc,n<cr>** where c is the desired A-to-D channel (1 to 8 or 0 for all) and n is either 1 to enable the specified channel(s) or 2 to disable the specified channel(s).

5.2.3 SWITCH CLOSURE/ISOLATED VOLTAGE INPUT DEBOUNCE DELAY TIME

The Debounce Delay (DB) command programs the switch closure and isolated voltage input Debounce Delay Time (see *Section 4.2.1.6* and *Section 5.1.3.6*) in 10 millisecond increments. The Debounce Delay command has the following format: **DB*n*<cr>** where *n* = 0 to 6000.

5.2.4 A-TO-D GET AVERAGE COMMAND

The A-to-D Get Average (GA) command returns the current configuration status of the Number of Samples to Average. The Get Average command has the following format: **GA<cr>**. The current Number of Samples to Average in effect is returned in the following format: **u:m:0 01:AVERAGE IS nnnn<cr>** where u is the unit number, m is the module number of the ADR-1(A), 0 indicate a text message, 01 indicates a samples-to-average message, and nnnn is the Number of Samples to Average (1 to 4000).

5.2.5 A-TO-D GET SAMPLE RATE COMMAND

The A-to-D Get Sample Rate (GR) command returns the current Sample Rate configuration status. The Get Sample Rate command has the following format: **GR<cr>**. The current Sample Rate in effect is returned in the following format:
u:m:0 02:SAMPLE RATE IS NNNN<cr> where u is the unit number, m is the module number of the ADR-1(A), 0 indicate a text message, 02 indicates a sample rate message, and nnnn is the Sample Rate (1 to 4000 samples per second).

5.2.6 REPORTING METHOD COMMAND

The Reporting Method (RM) command programs the ADR-1(A) 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.

5.2.7 A-TO-D SAMPLING METHOD COMMAND

The A-to-D Sampling Method (SM) command programs the ADR-1(A) Sampling Method (see *Section 4.2.2.1* and *Section 5.1.3.1*). The Reporting Method command has the following format: **SM*n*<cr>** where *n* = 1 to 3. 1 = Command, 2 = Immediate and 3 = Schedule.

5.2.8 A-TO-D SAMPLE INTERVAL COMMAND

The A-to-D Sample Interval (SP) command programs the ADR-1(A) Sample Interval (see *Section 4.2.1.3* and *Section 5.1.3.3*). The Sample Interval command has the following format: **SPn<cr>** where n is either 1 for continuous or 2 for time.

5.2.9 A-TO-D SAMPLE RATE COMMAND

The A-to-D Sample Rate (SR) command programs the ADR-1(A) Sample Rate (see *Section 4.2.1.4* and *Section 5.1.3.4*). The Sample Rate command has the following format: **SRn<cr>** where n = 1 to 4000 samples per second.

5.2.10 SAVE CONFIGURATION COMMAND

The Save Configuration (SV) command allows the user to save all dynamic configuration changes as power-up defaults and may be issued at any time. The Save Configuration command has the following format: **SV<cr>**.

5.2.11 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.

5.2.12 A-TO-D UNIPOLAR/BIPOLAR COMMAND

The A-to-D Unipolar/Bipolar command programs the ADR-1(A) 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: **UBc,n<cr>** where c is the desired A-to-D channel(s) (1 to 8 or 0 for all) and n is either 1 (unipolar) or 2 (bipolar).

5.2.13 A-TO-D VOLTAGE RANGE COMMAND

The A-to-D Voltage Range command is used to program the desired operating voltage range of the ADR-1(A) channel inputs as described in *Section 4.2.3.1* and *Section 5.1.5.1*. The Voltage Range command has the following format: **VRc,n<cr>** where c is the desired A-to-D channel(s) (1 to 8 or 0 for all) and n = 1 to 4. 1 = 10 volts, 2 = 5 volts, 3 = 2.5 volts, and 4 = 1.25 volts.

5.3 FRONT PANEL CONFIGURATION

The LCD display and associated front panel controls can provide the configuration status of the ADR-1(A). All the parameters shown in the LCD status message are fully described in *Section 5.1.2*.

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

Bay Technical Assoc

Select Module
00

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

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

V84 ADR-1 MODULE XX

Display Status
Exit Module Menus

Highlight "Display Status" with the arrow keys and press *SELECT*. The LCD responds 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 Int. HH:MM:SS
Sample Rate 50 S/s
# to Average XXX
Relay Op Sk  DISABLED
Report Method COMMAND
Report Start HH:MM
Report Int. HH:MM
Host Address   1:1,1
Data Format  HEX
Time Tagging ENABLE
Term Characters 0D0A
Range    VARIOUS
Chn         11100000
Dyna Cfg Cmd ENABLE
```

To exit the configuration status mode, press the SELECT key at any time. You are returned to the ADR-1(A)'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 V84 ADR-1(A) I/O module:

V84 ADR-1(A) A-TO-D DATA COMMAND SUMMARY	
Command	**Description**
CB*n*<cr> (*n*=Ch# 1 to 8, 0=all*)	Clear Buffer. Clears all old data from the buffer when a new data set is started.
RA*n*<cr> (*n*=Ch# 1 to 8, 0=all*)	Report All Buffered Samples.
RS*n*<cr> (*n*=Ch# 1 to 8, 0=all*)	Report Single Sample if Available
SA*n*<cr> (*n*=Ch# 1 to 8, 0=all)*	Sample. Read and report sample at programmed setup.
* Multiple channels are selected using 4 formats. Examples: **SA1,2,3,4,5,6,7,8<cr>**, **SA1-8<cr>**, **SA0<cr>**, **SA1,2,4-8<cr>**	

V84 ADR-1(A) SWITCH CLOSURE/ISOLATED VOLTAGE INPUT COMMAND SUMMARY	
Command	**Description**
CC*n*<cr> (*n*=Ch# 1 to 8, 0=all)	Clear Event Counter(s)
CI*n*<cr> (*n*=Ch# 1 to 8, 0=all)	Clear Switch Closure/Isolated Voltage Input Buffer
CR*n*<cr> (*n*=Ch# 1 to 8, 0=all)	Clear Event Latch Data
RC*n*<cr> (*n*=Ch# 1 to 8, 0=all)	Report Event Counter(s)
RI*n*<cr> (*n*=Ch# 1 to 8, 0=all)	Read All Switch Closure/Isolated Voltage Input Data Buffers
RO*n*<cr> (*n*=Ch# 1 to 8, 0=all)	Report Event Counter and Reset
RR*n*<cr> (*n*=Ch# 1 to 8, 0=all)	Report Event Latch Data
SI*n*<cr> (*n*=Ch# 1 to 8, 0=all)	Send Switch Closure/Isolated Voltage Input Status
SL*n*<cr> (*n*=Ch# 1 to 8, 0=all)	Report Latest Event
SO *n*<cr> (*n*=Ch# 1 to 8, 0=all)	Report Oldest Switch Closure/Isolated Voltage Input Event
* Multiple channels are selected using 4 formats. Examples: **SL1,2,3,4,5,6,7,8<cr>**, **SL1-8<cr>**, **SL0<cr>**, **SL1,2,4-8<cr>**	

V84 ADR-1(A) RELAY DATA COMMAND SUMMARY	
Command	**Description**
DR*n*<cr> (*n*=Relay# 1 to 4, 0=all*)	De-energize Relay(s)
ER*n*<cr> (*n*=Relay# 1 to 4, 0=all*)	Energize Relay(s)
RD*n*<cr> (*n*=Relay# 1 to 4, 0=all*)	Send Relay Data
* Multiple channels are selected using 4 formats. Examples: **RD1,2,3,4,5,6,7,8<cr>**, **RD1-8<cr>**, **RD0<cr>**, **RD1,2,4-8<cr>**	

V84 ADR-1(A) DYNAMIC CONFIGURATION COMMAND SUMMARY	
Command	**Description**
AV*n*<cr> (*n*=1 to 4,000)	Number of Samples to Average
CEc,*n*<cr> (c=0 to 8 & *n*=1 or 2)	Enable Channel
DB*n*<cr> (*n*=0 to 6000)	Debounce Delay Time
GA<cr>	Get Average
GR<cr>	Get Sample Rate
RMn<cr> (*n*=1 to 3)	Reporting Method. 1=Command, 2=Immediate, and 3=Schedule.
SM*n*<cr> (*n*=1 to 3)	Sampling Method. 1=Command, 2=Immediate, and 3=Schedule.
SP*n*<cr> (*n*=1 or 2)	Sample Period. 1=Continuous and 2=Time.
SR*n*<cr> (*n*=1 to 4000)	Sample Rate (Samples/Sec)
SV<cr>	Save Configuration
TT*n*<cr> (*n*=1 or 2)	Time Tag. 1=Enable and 2=Disable.
UB*c,n*<cr> (*c*=0 to 8, *n*=1 or 2)	Unipolar/Bipolar. 1=unipolar and 2=bipolar.
VR*c,n*<cr> (c=0 to 8, *n*=1 to 4)	Set Voltage Range. 1=10 volts, 2=5 volts, 3=2.5 volts and 4=1.25 volts.

APPENDIX B
EPROM UPGRADE

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

Flat blade 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 ADR-1(A) mechanical layout (see *Appendix C*) and locate socket *D14*. 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
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