4.4 Analog Input Module Command

4.4.1 Analog Input Command Set

Command Syntax	Command Name	Description	I/O Module
%AANNTTCCFF	Configuration	Sets the address, input range, baud rate, data format, checksum status, and/or integration time for a specified analog input module	4011, 4011D, 4012, 4013, 4014D, 4016, 4017, 4018, 4018M
$AA2	Configuration Status	Returns the configuration parameters for the specified analog input module	4011, 4011D, 4012, 4013, 4014D, 4016, 4017, 4018, 4018M
$AAF	Read Firmware Version	Returns the firmware version code from the specified analog input module	4011, 4011D, 4012, 4013, 4014D, 4016, 4017, 4018, 4018M
$AAM	Read Module Name	Returns the module name from the specified analog input module	4011, 4011D, 4012, 4013, 4014D, 4016, 4017, 4018, 4018M
#AA	Analog Data In	Returns the input value from a specified analog input moudule in the currently configured data format	4011, 4011D, 4012, 4013, 4014D, 4016, 4017, 4018
#AAN	Read Analog Input from Channel N	Returns the input value from channel number n of the specified analog input module	4017, 4018, 4018M
#AA5VV	Enable/Disable Channels for Multiplexing	Enables/disables multiplexing simultaneously for separate channels of the specified input module	4017, 4018, 4018M

(continued on following page)

Command Syntax	Command Name	Description	I/O Module
$AA6	Read Channel Status	Ask the specified input module to return the status of all eight channels	4017, 4018, 4018M
$AA0	Span Calibration	Calibrate the analog input module to correct for gain errors	4011, 4011D, 4012, 4013, 4014D, 4016, 4017, 4018, 4018M
$AA1	Offset Calibration	Calibrate the analog input module to correct for offset errors.	4011, 4011D, 4012, 4013, 4014D, 4016, 4017, 4018, 4018M
#**	Synchronized Sampling	Orders all analog input modules to sample their input values and store them in special registers	4011, 4011D, 4012, 4013, 4014D, 4016, 4017, 4018, 4018M
$AA4	Read Synchronized Data	Returns the value that was stored in the specified module's register after the #** command	4011, 4011D, 4012, 4013, 4014D, 4016, 4017, 4018, 4018M
$AAB	Open Thermocouple Detection	Ask the module to respond whether the thermocouple is open or closed	4011D
$AA3	CJC Status	Returns the value of the CJC sensor for a specified analog input module	4011, 4011D, 4018, 4018M
$AA9	CJC Offset Calibration	Calibrates the CJC sensor for offset errors	4011, 4011D, 4018, 4018M

%AANNTTCCFF

Name Configuration

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

Syntax %AANNTTCCFF(cr)

% is a delimiter character.

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

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

TT represents the type (input range) code.

CC represents the baud rate code.

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

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

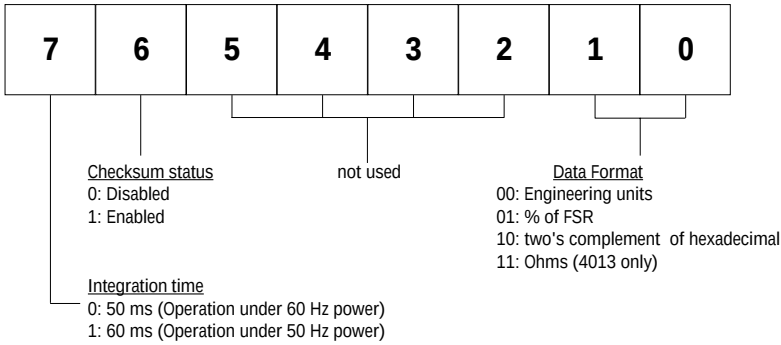

Figure 4-1 *Data format for 8-bit parameter*

%AANNTTCCFF

Response

!AA(cr) if the command is valid.

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

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

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid

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

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

Example

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

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

The response indicates that the command was received.

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

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

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

Table 4-1 *Input Range Codes (Type Code)*

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

Input Range Code(Hex)	Input Range for 4012,4014D,4017
08	± 10 V
09	± 5 V
0A	± 1 V
0B	± 500 mV
0C	± 150 mV
0D	± 20 mA[1]

Note[1]: The input range requires the useage of a 125 Ω current conversion resistor (except ADAM-4014D)

(continued on following page)

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

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

Table 4-2 *Baud Rate Codes*

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

$AA2

Name Configuration Status

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

Syntax $AA2(cr)

$ is a delimiter character.

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

2 is the Configuration Status command.

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

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

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

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

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid.

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

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

CC represents the baud rate code.

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

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

(Also see the %AANNTTCCFF configuration command)

$AA2

Example

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

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

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

$AAF

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

$AAM

Name	Read Module Name
Description	The command requests the analog input module at address AA to return its name
Syntax	$AAM (cr) $ is a delimiter character. AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module that you want to interrogate. M is the Read Module Name command. (cr) is the terminating character, carriage return (ODh)
Response	!AA(Module Name)(cr) if the command is valid. There is no response if the module detects a syntax error or communication error, or if the specified address does not exist. ! is a delimiter character indicating a valid command was received. AA (range 00-FF) represents the 2-character hexadecimal address of an analog input module. (Module Name) is the name of the module at address AA. For example: 4014D (cr) is the terminating character, carriage return (ODh).

#AA

Name Analog Data In

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

Syntax #AA(cr)

is a delimiter character.

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

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

Response >(data)(cr)

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

> is a delimiter character.

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

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

Example command: #33(cr)

response: >+5.8222(cr)

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

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

Example command: #21(cr)

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

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

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

#AA

Example command: #DE(cr)

response: >FF5D(cr)

The analog input module at address DEh has an input value of FF5D. (The configured data format of the analog input module

	Twos complement	% of Span	Engineering units
under-limit	0000	-0000	-0000
over-limit	FFFF	+9999	+9999

is twos complement)

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

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

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

Example command: #D1(cr)

response: >+9999(cr)

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

#AAN

Name Read Analog Input from Channel N

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

Syntax #AAN(cr)

is a delimiter character.

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

N identifies the channel you want to read. The value can range from 0 to 7.

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

Response >(data)(cr)

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

> is a delimiter character.

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

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

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

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

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

$AA5VV

Name Enable/disable channels for multiplexing

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

Syntax $AA5VV(cr)

$ is a delimiter character.

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

5 is the enable/disable channels command.

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

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

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

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

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

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid.

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

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

Example

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

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

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

$AA6

Name Read Channel Status

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

Syntax $AA6(cr)

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

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

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

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

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

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid.

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

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

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

Example

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

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

$AA0

Name	Span Calibration
Description	Calibrates an analog input module to correct for gain errors.
Syntax	$AA0(cr) $ is a delimiter character. AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module which is to be calibrated. 0 represents the span calibration command. (cr) is the terminating character, carriage return (0Dh).
Response	!AA(cr) if the command was valid. ?AA(cr) if an invalid operation was entered. There is no response if the module detects a syntax error or communication error or if the specified address does not exist. ! delimiter character indicates a valid command was received. ? delimiter character indicates the command was invalid. AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module. (cr) represents terminating character, carriage return (0Dh).

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

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

$AA1

Name	Offset Calibration.
Description	Calibrates an analog input module to correct for offset errors.
Syntax	$AA1(cr) $ is a delimiter character. AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module you want to calibrate. 1 represents the offset calibration command. (cr) is the terminating character, carriage return (0Dh).
Response	!AA(cr) if the command is valid. ?AA(cr) if an invalid operation was entered. There is no response if the module detects a syntax error or communication error or if the specified address does not exist. ! delimiter character indicates a valid command was received. ? delimiter character indicates the command was invalid. AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module. (cr) represents terminating character, carriage return (0Dh).

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

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

#**

Name	Synchronized Sampling
Description	Orders all analog input modules to sample their input values and store the values in special registers.
Syntax	#** # is a delimiter character. ** is the actual synchronized sampling command. The terminating character, in the form of a carriage return (0Dh), is not required.
Response	The analog input modules will send no response after executing the synchronized sampling command. In order to retrieve the data, a separate Read Synchronized Data command has to be issued for every analog input module.

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

$AA4

Name Read Synchronized Data

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

Syntax $AA4(cr)

$ is a delimiter character.

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

4 is the Read Synchronized Data command.

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

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

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

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

! delimiter character indicates a valid command was received.

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

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

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

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

Example

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

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

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

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

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

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

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

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

$AAB

Name Open Thermocouple Detection Command

Description The command asks the module to respond whether the thermocouple on its input channel is open or not.

Syntax $AAB(cr)

$ is a delimiter character

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

B is the open thermocouple detection command.

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

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

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

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

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

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid.

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

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

$AA3

Name CJC Status command

Description Instructs the addressed analog input module to read its CJC (Cold Junction Compensation) sensors and return the acquired data.

Syntax $AA3(cr)

$ is a delimiter character.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module which contains the CJC Status you wish to retrieve.

3 is CJC Status command.

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

Response >data(cr) if the command is valid.

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

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

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid

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

(data) is the value that is retrieved by the module by reading its CJC sensor. The data format, in degrees Celsius, consists an "+" or "-" sign followed by five decimal digits and a fixed decimal point. The resolution of the data is 0.1 °C.

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

Example

command: $093(cr)
response: >+0036.8(cr)

The command request the analog input module at address 09h to read its CJC sensor and return the data. The analog input module at address 09h responds with: 36.8° C.

$AA9

Name CJC Offset Calibration

Description Calibrates an analog input module to adjust for offset errors of its CJC (Cold Junction Compensation) sensors.

Syntax $AA9S(number of counts)(cr).

$ is a delimiter character.

AA (range 00-FF) represents the 2-character hexadecimal address of the analog input module which contains the CJC Status you wish to retrieve.

9 is CJC Status command.

S sign, + or -, indicates whether to increase or decrease the CJC offset value.

(number of counts) a four character hexadecimal "count" value. Each count equals approximately 0.009° C. The value can range from 0000 to FFFF.

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

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

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

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

! delimiter character indicates a valid command was received.

? delimiter character indicates the command was invalid.

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

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

Example command: $079+0042(cr)
response: !07(cr)

The command increases the CJC offset value of the analog input module at address 07h with 66 counts (42 hex) which equals about 0.6° C.

NOTICE: *An analog input module requires a maximum of 2 seconds to perform auto calibration and ranging after it received an CJC Calibration command . During this interval, the module can not be addressed to perform any other actions.*