

## 4.5 Analog Output Module Command

Command Syntax	Command Name	Description	I/O Module
%AANNTTCFF	Configuration	Sets the address, output range, baud rate, data format, slew rate and/or checksum status	4021
#AA(data)	Analog Data Out	Directs output data to a specified module	4021
\$AA4	Start-Up Output Current or Voltage Configuration	Stores a default output value in a specified module. The output value will take effect upon startup	4021
\$AA3 (number of counts)	Trim Calibration	Trims specified module a number of units up/down	4021
\$AA0	4 mA Calibration	Tells the module to store parameters for 4mA Calibration	4021
\$AA1	20 mA Calibration	Tells the module to store parameters for 20 mA Calibration	4021
\$AA2	Configuration Status	Reads the configuration of specified module	4021
\$AA6	Last Value Readback	Returns either last value sent to specified module by #AA command, or start-up output current/voltage	4021
\$AA8	Current Readback	Returns measured value of the current/voltage flowing through current loop	4021
\$AA5	Reset Status	Checks if module has been reset since the last \$AA5 command	4021
\$AAF	Read Firmware Version	Returns the firmware version code from the specified analog output module	4021
\$AAM	Read Model Name	Return the module name from specified analog output module	4021

%AANNTTCCFF

- Name** Configuration
- Description** Sets address, input range, baud rate, data format, checksum status, and/or integration time for an analog output module.
- Syntax** %AANNTTCCFF(cr)
- % is a delimiter character.
- AA (range 00-FF) represents the 2-character hexadecimal address of the analog output module to be configured.
- NN represents the new hexadecimal address of the analog output module. Range is from 00h to FFh.
- TT represents the type (output range) code. (See table 4-4)
- CC represents the baud rate code. (See table 4-3).
- FF is a hexadecimal number that equals the 8-bit parameter representing the status of data format, slew rate, and checksum. The layout of the 8-bit parameter is shown in figure 4-2.
- Bit 7 is not used and must be set to 0.
- (cr) is the terminating character, carriage return (0Dh).

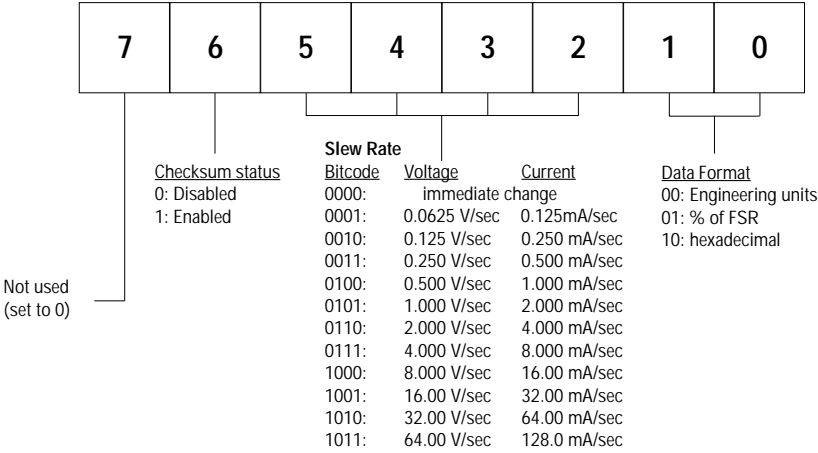


Figure 4-2 Data format for 8-bit parameter

%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 exists.

                      ! delimiter character indicating a valid command was received.

                      ? delimiter character indicating the command was invalid.

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

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

**Table 4-3**  
*Baudrate 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

**Table 4-4**  
*Output Range Code (Type Code)*

Output Range Code (Hex)	Output Range for ADAM 4021
30	0 to 20 mA
31	4 to 20 mA
32	0 to 10 V

**NOTICE:** *An analog output module requires a maximum of 20 milliseconds to perform auto calibration and ranging after it is reconfigured. During this time span, the module can not be addressed to perform any other actions.*

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

**%AANNTTCCFF**

**Example**      command:      %310A310610(cr)  
                 response:      !24(cr)

The analog input module at addresses 31h is configured to a new address 0Ah, output range 4 to 20 mA, baud rate 9600, engineering units data format, a slew rate of 1.0 mA/sec and no checksum checking.

The response indicates that the command has been received.

**#AA**

**Name** Analog Data Out

**Description** Send a value to the addressed analog output module. Upon receipt, the analog output module will output this value.

**Syntax** #AA(data)(cr)

# is a delimiter character.

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

(data) is the value that has to be output through the analog output module. Range and value depend on the module's configured data format. Possible formats are: engineering units, % of FSR or hexadecimal. (See also Appendix B, Data Formats and I/O Ranges.)

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

**Response**

>(cr) if the command was valid.

?AA(cr) if a value was sent that is out of range. Note that when the analog output module receives such a value, it will try to use a value that is close to the one received, but within the module's configured range.

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

>delimiter character.

?delimiter character indicating the command was invalid.

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

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

**#AA****Example**

command: #3315.000(cr)

response: >(cr)

The command sends the value 15 mA to the analog output module at address 33h that is configured for engineering units.

The analog output module responds that the command was valid. Its output value will be 15 mA.

command: #0A+030.00(cr)

response: >(cr)

The module is configured for a 4 to 20 mA output range and a percent of span data format. The command sends the value 8.8 mA ( $4\text{ mA} + 0.30 \times 16\text{ mA} = 8.8\text{ mA}$ ) 30% of the span to the analog output module at address 0Ah.

The analog output module responds that the command was valid. Its output value is set to 8.8 mA.

command: #1B7FF(cr)

response: >(cr)

The command sends the hexadecimal value 7FF to the analog output module at address 1Bh. The module is configured for a 0 to 20 mA output range and a hexadecimal data format. It will output 10 mA ( $(7FFH/FFFH) \times 20\text{ mA} = 10\text{ mA}$ ).

**\$AA4**

<b>Name</b>	Start-up Voltage/Current Output Configuration
<b>Description</b>	Stores the present output value of an analog output module with address AA in the module’s non-volatile register. The output value will take effect upon start-up or after a brownout.
<b>Syntax</b>	<p>\$AA4(cr)</p> <p>\$ is a delimiter character.</p> <p>AA (range 00-FF) represents the 2-character hexadecimal address of the analog output module whose output current is to be set.</p> <p>4 is the Start-up Output Current Configuration command.</p> <p>(cr) is the terminating character, carriage return (0Dh).</p>
<b>Response</b>	<p>!AA(cr) if the command is valid.</p> <p>?AA(cr) if an invalid command was issued.</p> <p>There is no response if the module detects a syntax error or communication error or if the specified address does not exists.</p> <p>! delimiter character indicating a valid command was received.</p> <p>? delimiter character indicating the command was invalid.</p> <p>AA (range 00-FF) represents the 2-character hexadecimal address of the analog output module.</p> <p>(cr) is the terminating character, carriage return (0Dh).</p>
<b>Example</b>	<p>command:       \$0A4(cr)</p> <p>response:       !0A(cr)</p> <p>Presume the present output value of the analog output module with address 0A is 9.4 mA. The command tells the analog output module store the present output value, in its non-volatile memory. When the module is powered up or reset, its default output value will be 9.4mA.</p> <p>The response of the analog output module indicates that the command has been received.</p>

**NOTICE:** *An analog output module requires a maximum of 6 milli-seconds after it received a Startup Voltage/Current Output Configuration command to let the settings take effect . During this interval, the module can not be addressed to perform any other actions.*

## \$AA3

<b>Name</b>	Trim Calibration
<b>Description</b>	Trims the addressed analog output module a specified number of units up or down.
<b>Syntax</b>	<p>\$AA3(number of counts)(cr)</p> <p>\$ is a delimiter character.</p> <p>AA (range 00-FF) represents the 2-character hexadecimal address of the analog output module to be calibrated.</p> <p>3 is the trim calibration command.</p> <p>(number of counts) is the 2-character twos complement hexadecimal value that represents the number of counts by which to increase or decrease the output current. Each count equals approximately 1.5 <math>\mu</math>A. Values range from 00 to 5F and from A1 to FF (hexadecimal), where 00 represents 0 counts, 5F represents +95 counts, A1 represents -95 counts and FF represents -1 count. Negative values decrease and positive numbers increase the output current according to the number of counts.</p> <p>(cr) is the terminating character, carriage return (0Dh).</p>
<b>Response</b>	<p>!AA(cr) if the command is valid.</p> <p>There is no response if the module detects a syntax error or communication error or if the specified address does not exist.</p> <p>! delimiter character indicating a valid command was received</p> <p>AA (range 00-FF) represents the 2-character hexadecimal address of the analog output module.</p> <p>(cr) is the terminating character, carriage return (0Dh)</p>



**\$AA3**

**Example**            command:        \$07314(cr)  
                      response:        !07(cr)

The command tells the analog output module at address 07h to increase its output value by 20 (14h) counts which is approximately 30  $\mu$ A.

The analog output module confirms the increase.

In order to perform this trim calibration, either a millimeter or a resistor and voltmeter should be connected to the module's output. (See also the 4 mA Calibration command and the 20 mA Calibration command of the analog output module's command set. Refer also to Chapter 5, Calibration for a detailed description.)

## \$AA0

<b>Name</b>	4 mA Calibration command
<b>Description</b>	Stores the current output value of the addressed analog output module as 4 mA reference.
<b>Syntax</b>	<p>\$AA0(cr)</p> <p>\$ is a delimiter character.</p> <p>AA (range 00-FF) represents the 2-character hexadecimal address of the analog output module who's data is to be sent.</p> <p>0 is the 4 mA Calibration command.</p> <p>(cr) is the terminating character, carriage return (0Dh).</p>
<b>Response</b>	<p>!AA(cr) if the command was valid.</p> <p>?AA(cr) if an invalid command was issued.</p> <p>There is no response if the module detects a syntax error or communication error or if the specified address does not exist.</p> <p>! delimiter character indicating a valid command was received.</p> <p>? delimiter character indicating the command was invalid.</p> <p>AA (range 00-FF) represents the 2-character hexadecimal address of the analog output module that is responding.</p> <p>(cr) is the terminating character, carriage return (0Dh).</p>

Before issuing the 4 mA Calibration command, the analog output module should be trimmed to the correct value with the Trim Calibration command. Either a millimeter or a resistor and voltmeter should be connected to the module's output. (See also the analog output module's Trim Calibration command and Chapter 5, Calibration, for a detailed description.)

**\$AA1**

<b>Name</b>	20 mA Calibration command
<b>Description</b>	Stores the current output value of the addressed analog output module as 20 mA reference.
<b>Syntax</b>	<p>\$AA1(cr)</p> <p>\$ is a delimiter character.</p> <p>AA (range 00-FF) represents the 2-character hexadecimal address of the analog output module who's data is to be sent.</p> <p>1 is the 20 mA Calibration command.</p> <p>(cr) is the terminating character, carriage return (0Dh).</p>
<b>Response</b>	<p>!AA(cr) if the command was valid.</p> <p>?AA(cr) if an invalid command was issued.</p> <p>There is no response if the module detects a syntax error or communication error or if the specified address does not exists.</p> <p>! delimiter character indicating a valid command was received.</p> <p>? delimiter character indicating the command was invalid.</p> <p>AA (range 00-FF) represents the 2-character hexadecimal address of the analog output module that is responding.</p> <p>(cr) is the terminating character, carriage return (0Dh).</p>

Before issuing the 20 mA Calibration command, the analog output module should be trimmed to the correct value with the Trim Calibration command. Either a millimeter or a resistor and voltmeter should be connected to the module's output. (See also the analog output module's Trim Calibration command and Chapter 5, Calibration, for a detailed description.)

## \$AA2

<b>Name</b>	Read Configuration Status command
<b>Description</b>	Instruct the addressed analog output module to return its configuration data.
<b>Syntax</b>	<p>\$AA2(cr)</p> <p>\$ is a delimiter character.</p> <p>AA (range 00-FF) represents the 2-character hexadecimal address of the analog output module to be interrogated.</p> <p>2 is the Read Configuration Status command.</p> <p>(cr) is the terminating character, carriage return (0Dh).</p>
<b>Response</b>	<p>!AATTCCFF(cr) if the command is valid.</p> <p>?AA(cr) if an invalid command was issued.</p> <p>There is no response if the module detects a syntax error or communication error or if the specified address does not exist.</p> <p>! delimiter character indicating a valid command was received.</p> <p>? delimiter character indicating the command was invalid.</p> <p>AA (range 00-FF) represents the 2-character hexadecimal address of an analog output module.</p> <p>TT represents the type code, which determines the output range.</p> <p>CC represents the baud rate code.</p> <p>FF is a hexadecimal number that equals the 8-bit parameter representing the data format, slew rate, and checksum status.</p> <p>(cr) is the terminating character, carriage return (0Dh)</p> <p>For tables, reference the %AANNTTCCFF Configuration command.</p>
<b>Example</b>	<p>command:       \$452(cr)</p> <p>response:       !45300614(cr)</p> <p>The command asks the analog output module at address 45h to send its configuration data.</p> <p>The analog output module at address 45h responds with output range 0 to 20 mA, baud rate 9600, engineering units as the currently configured data format, slew rate 2 mA per second, and no checksum checking.</p>

**\$AA6**

**Name** Last Value Readback

**Description** The addressed analog output module is instructed to return the latest output value it received from an Analog Data Out command. If the module hasn't received an Analog Data Out command since startup, it will return its Start-up Output value.

**Syntax** \$AA6(cr)  
\$ is a delimiter character.  
AA (range 00-FF) represents the 2-character hexadecimal address of the analog output module whose value you want to return.  
6 is the Last Value Readback command.  
(cr) is the terminating character, carriage return (0Dh).

**Response** !AA(data)(cr) if the command was 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 indicating a valid command was received.  
?delimiter character indicating the command was invalid.  
AA (range 00-FF) represents the 2-character hexadecimal address of the analog output module.  
(data) is the value that is returned by the analog output module. The format of the data depends on the module's configured data format.  
(cr) is the terminating character, carriage return (0Dh).

**Example** command: \$0A6(cr)  
response: !0A03.000(cr)

The command tells the analog output module at address 0Ah to return the last output value it received from an Analog Out command.

The analog output module returns the value 3.000 mA.

## \$AA8

<b>Name</b>	Current Readback
<b>Description</b>	The addressed analog output module is instructed to measure the current flowing through its current/voltage loop and return the measured data in the module's configured data format. The value returned may be a rough estimate of the real value.
<b>Syntax</b>	<p>\$AA8(cr)</p> <p>\$ is a delimiter character.</p> <p>AA (range 00-FF) represents the 2-character hexadecimal address of the analog output module that you want to measure, its current/voltage loop and return the measured value.</p> <p>8 is the Current Readback command.</p> <p>(cr) is the terminating character, carriage return (0Dh).</p>
<b>Response</b>	<p>!AA(data)(cr) if the command was valid.</p> <p>?AA(cr) if an invalid command was issued.</p> <p>There is no response if the module detects a syntax error or communication error or if the specified address does not exist.</p> <p>! delimiter character indicating a valid command was received.</p> <p>? delimiter character indicating the command was invalid.</p> <p>AA (range 00-FF) represents the 2-character hexadecimal address of the analog output module.</p> <p>(data) is the value returned by the analog output module.</p> <p>(cr) is the terminating character, carriage return (0Dh).</p>
<b>Example</b>	<p>command:       \$0A8(cr)</p> <p>response:       !0A18.773(cr)</p> <p>The command tells the analog output module at address 0Ah to measure its current loop and return the measured value.</p> <p>The analog output module returns the value 18.773 mA.</p>

**\$AA5**

<b>Name</b>	Reset Status command
<b>Description</b>	Checks the Reset Status of the addressed analog output module to see whether it has been reset since the last Reset Status command was issued to the module.
<b>Syntax</b>	<p>\$AA5(cr)</p> <p>\$ is a delimiter character.</p> <p>AA (range 00-FF) represents the 2-character hexadecimal address of the analog output module whose Reset Status is to be returned.</p> <p>5 is the Reset Status command.</p> <p>(cr) is the terminating character, carriage return (0Dh).</p>
<b>Response</b>	<p>!AAS(cr) if the command was valid.</p> <p>?AA(cr) if an invalid command was issued.</p> <p>There is no response if the module detects a syntax error or communication error or if the specified address does not exist.</p> <p>! delimiter character indicating a valid command was received.</p> <p>? delimiter character indicating the command was valid.</p> <p>AA (range 00-FF) represents the 2-character hexadecimal address of the analog output module.</p> <p>S represents the Status bit that is returned by the analog output module. If S=1, the module has been reset since the last time it was issued a Reset Status command. If S=0, the module has not been reset since the last Reset Status command was issued.</p> <p>(cr) is the terminating character, carriage return (0Dh).</p>
<b>Example</b>	<p>command:       \$395(cr)</p> <p>response:       !391(cr)</p> <p>The analog output module at address 39h was reset or powered up after the last execution of the Reset Status command. When executed once more the analog output module will reply with:</p> <p>!390(cr)</p>

**\$AAF**

**Name** Read Firmware Version

**Description** The command requests the analog output 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 output 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 output 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 output 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 output 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 output module.

(Module Name) is the name of the module at address AA.

For example: 4021

(cr) is the terminating character, carriage return (ODh).

