

# Data Formats and I/O Ranges

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## B.1 Analog Input Formats

The ADAM analog input modules can be configured to transmit data to the host in Engineering Units.

### Engineering Units

Data can be represented in Engineering Units by setting bits 0 and 1 of the data format/checksum/integration time parameter to 0.

This format presents data in natural units, such as degrees, volts, millivolts, and milliamps. The Engineering Units format is readily parsed by the majority of computer languages because the total data string length, including sign, digits and decimal point, does not exceed seven characters.

The data format is a plus (+) or minus (-) sign, followed by five decimal digits and a decimal point. The input range which is employed determines the resolution, or the number of decimal places used, as illustrated in the following table:

Input Range	Resolution
$\pm 15 \text{ mV}$ , $\pm 50 \text{ mV}$	1 $\mu\text{V}$ (three decimal places)
$\pm 100 \text{ mV}$ , $\pm 150 \text{ mV}$ , $\pm 500 \text{ mV}$	10 $\mu\text{V}$ (two decimal places)
$\pm 1 \text{ V}$ , $\pm 2.5 \text{ V}$ , $\pm 5 \text{ V}$	100 $\mu\text{V}$ (four decimal places)
$\pm 10 \text{ V}$	1 mV (three decimal places)
$\pm 20 \text{ mA}$	1 $\mu\text{A}$ (three decimal places)
Type J and T thermocouple	0.01°C (two decimal places)
Type K, E, R, S, and B thermocouple	0.1°C (one decimal place)

### Example 1

The input value is -2.65 and the corresponding analog input module is configured for a range of  $\pm 5$  V. The response to the Analog Data In command is:

-2.6500(cr)

### Example 2

The input value is 305.5°C. The analog input module is configured for a Type J thermocouple whose range is 0°C to 760°C. The response to the Analog Data In command is:

+305.50(cr)

### Example 3

The input value is +5.653 V. The analog input module is configured for a range of  $\pm 5$  V range. When the engineering units format is used, the ADAM Series analog input modules are configured so that they automatically provide an over range capability. The response to the Analog Data In command in this case is:

+5.6530(cr)

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## B.2 Analog Input Ranges - ADAM-5017 and 5018

Module	Range Code	Input Range Description	Data Formats	+F.S.	Zero	-F.S.	Displayed Resolution
ADAM-5017	08h	-10 V	Engineering Units	+10.000	-00.000	-10.000	1 mV
			% of FSR	+100.00	-000.00	-100.00	0.01%
			Two's Complement	7FFF	0000	8000	1 LSB
	09h	-5 V	Engineering Units	+5.0000	-0.0000	-5.0000	100.00 V
			% of FSR	+100.00	-000.00	-100.00	0.01%
			Two's Complement	7FFF	0000	8000	1 LSB
	0Ah	-1 V	Engineering Units	+1.0000	-0.0000	-1.0000	100.00 V
			% of FSR	+100.00	-000.00	-100.00	0.01%
			Two's Complement	7FFF	0000	8000	1 LSB
	0Bh	-500 mV	Engineering Units	+500.00	-000.00	-500.00	10 V
			% of FSR	+100.00	-000.00	-100.00	0.01%
			Two's Complement	7FFF	0000	8000	1 LSB
	0Ch	-150 mV	Engineering Units	+150.00	-000.00	-150.00	10 V
			% of FSR	+100.00	-000.00	-100.00	0.01%
			Two's Complement	7FFF	0000	8000	1 LSB
	0Dh	-20 mA	Engineering Units	+20.000	-00.000	-20.000	1 A
			% of FSR	+100.00	-000.00	-100.00	0.01%
			Two's Complement	7FFF	0000	8000	1 LSB

## Appendix B

Module	Range Code	Input Range Description	Data Formats	+F.S.	Zero	-F.S.	Displayed Resolution
ADAM-5018	00h	–15 mV	Engineering Units	+15.000	–00.000	–15.000	1 V
			% of FSR	+100.00	–000.00	–100.00	0.01%
			Two's Complement	7FFF	0000	8000	1 LSB
	01h	–50 mV	Engineering Units	+50.000	–00.000	–50.000	1 V
			% of FSR	+100.00	–000.00	–100.00	0.01%
			Two's Complement	7FFF	0000	8000	1 LSB
	02h	–100 mV	Engineering Units	+100.00	–000.00	–100.00	10 V
			% of FSR	+100.00	–000.00	–100.00	0.01%
			Two's Complement	7FFF	0000	8000	1 LSB
	03h	–500 mV	Engineering Units	+500.00	–000.00	–500.00	10 V
			% of FSR	+100.00	–000.00	–100.00	0.01%
			Two's Complement	7FFF	0000	8000	1 LSB
	04h	–1 V	Engineering Units	+1.0000	–0.0000	–1.0000	100 V
			% of FSR	+100.00	–000.00	–100.00	0.01%
			Two's Complement	7FFF	0000	8000	1 LSB
	05h	–2.5 V	Engineering Units	+2.5000	–0.0000	–2.5000	100 V
			% of FSR	+100.00	–000.00	–100.00	0.01%
			Two's Complement	7FFF	0000	8000	1 LSB
	06h	–20 mA	Engineering Units	+20.000	–00.000	–20.000	1 A
			% of FSR	+100.00	–000.00	–100.00	0.01%
			Two's Complement	7FFF	0000	8000	1 LSB
	07h	Not Used					

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Module	Range Code	Input Range Description	Data Formats	Maximum Specified Signal	Minimum Specified Signal	Displayed Resolution
ADAM-5018	0Eh	Type J	Engineering Units	+760.00	+000.00	0.1°C
		Thermocouple	% of FSR	+100.00	+000.00	0.01%
		0°C to 760°C	Two's Complement	7FFF	0000	1 LSB
	0Fh	Type K	Engineering Units	+1000.0	+0000.0	0.1°C
		Thermocouple	% of FSR	+100.00	+000.00	0.01%
		0°C to 1000°C	Two's Complement	7FFF	0000	1 LSB
	10h	Type T	Engineering Units	+400.00	-100.00	0.1°C
		Thermocouple	% of FSR	+100.00	-025.00	0.01%
		-100°C to 400°C	Two's Complement	7FFF	E000	1 LSB
	11h	Type E	Engineering Units	+1000.0	+0000.0	0.1°C
		Thermocouple	% of FSR	+100.00	+000.00	0.01%
		0°C to 1000°C	Two's Complement	7FFF	0000	1 LSB
	12h	Type R	Engineering Units	+1750.0	+0500.0	0.1°C
		Thermocouple	% of FSR	+100.00	+028.57	0.01%
		500°C to 1750°C	Two's Complement	7FFF	2492	1 LSB
	13h	Type S	Engineering Units	+1750.0	+0500.0	0.1°C
		Thermocouple	% of FSR	+100.00	+028.57	0.01%
		500°C to 1750°C	Two's Complement	7FFF	2492	1 LSB
	14h	Type B	Engineering Units	+1800.0	+0500.0	0.1°C
		Thermocouple	% of FSR	+100.00	+027.77	0.01%
		500°C to 1800°C	Two's Complement	7FFF	2381	1 LSB

## B.3 Analog Input Ranges of ADAM-5017H

Range Code	Input Range	Data Formats	+Full Scale	Zero	-Full Scale	Displayed Resolution
00h	-10 V	Engineering	11	0	-11	2.7 mV
		Two's Comp	0FFF	0	FFFF	1
01h	0-10 V	Engineering	11	0	Don't care	2.7 mV
		Two's Comp	0FFF	0	Don't care	1
02h	-5 V	Engineering	5.5	0	-5.5	1.3 mV
		Two's Comp	0FFF	0	FFFF	1
03h	0-5 V	Engineering	5.5	0	Don't care	1.3 mV
		Two's Comp	0FFF	0	Don't care	1
04h	-2.5 V	Engineering	2.75	0	-2.75	0.67 mV
		Two's Comp	0FFF	0	FFFF	1
05h	0-2.5 V	Engineering	2.75	0	Don't care	0.67 mV
		Two's Comp	0FFF	0	Don't care	1
06h	-1 V	Engineering	1.375	0	-1.375	0.34 mV
		Two's Comp	0FFF	0	FFFF	1
07h	0-1 V	Engineering	1.375	0	Don't care	0.34 mV
		Two's Comp	0FFF	0	Don't care	1
08h	-500 mV	Engineering	687.5	0	-687.5	0.16 mV
		Two's Comp	0FFF	0	FFFF	1
09h	0-500 mV	Engineering	687.5	0	Don't care	0.16 mV
		Two's Comp	0FFF	0	Don't care	1
0ah	4-20 mA	Engineering	22	4.0	Don't care	5.3 A
		Two's Comp	0FFF	02E9	Don't care	1
0bh	0-20 mA	Engineering	22	0	Don't care	5.3 A
		Two's Comp	0FFF	0	Don't care	1

**Note:** *The full scale values in this table are theoretical values for your reference; actual values will vary.*

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## B.4 Analog Output Formats

You can configure ADAM analog output modules to receive data from the host in Engineering Units.

### Engineering Units

Data can be represented in engineering units by setting bits 0 and 1 of the data format/checksum/integration time parameter to 0.

This format presents data in natural units, such as milliamps. The Engineering Units format is readily parsed by the majority of computer languages as the total data string length is fixed at six characters: two decimal digits, a decimal point and three decimal digits. The resolution is 5  $\mu$ A.

### Example:

Channel 1 of the analog output module in slot 0 of an ADAM-5000 system at address 01h is configured for a 0 to 20 mA range. If the output value +4.762 mA is desired, the format of the Analog Data Out command would be #01S0C14.762<cr>

## B.5 Analog Output Ranges

Range Code (hex)	Output Range Description	Data Formats	Maximum Specified Signal	Minimum Specified Signal	Displayed Resolution
30h	0 to 20 mA	Engineering Units	20.000	00.000	5 $\mu$ A
		% of Span	+100.00	+000.00	5 $\mu$ A
		Hexadecimal Binary	FFF	000	5 $\mu$ A
31h	4 to 20 mA	Engineering Units	20.000	04.000	5 $\mu$ A
		% of Span	+100.00	+000.00	5 $\mu$ A
		Hexadecimal Binary	FFF	000	5 $\mu$ A
32h	0 to 10 V	Engineering Units	10.000	00.000	2.442 mV
		% of Span	+100.00	+000.00	2.442 mV
		Hexadecimal Binary	FFF	000	2.442 mV

**B.6 ADAM-5013 RTD Input Format and Ranges**

Range Code (hex)	Input Range Description	Data Formats	Maximum Specified Signal	Minimum Specified Signal	Displayed Resolution
20h	100 Ohms Platinum RTD -100 to 100 C a=0.00385	Engineering Units	+100.00	-100.00	+0.1 C
21h	100 Ohms Platinum RTD 0 to 100 C a=0.00385	Engineering Units	+100.00	+000.00	+0.1 C
22h	100 Ohms Platinum RTD 0 to 200 C a=0.00385	Engineering Units	+200.00	+000.00	+0.2 C
23h	100 Ohms Platinum RTD 0 to 600 C a=0.00385	Engineering Units	+600.00	+000.00	+0.6 C
24h	100 Ohms Platinum RTD -100 to 100 C a=0.00392	Engineering Units	+100.00	-100.00	+0.1 C
25h	100 Ohms Platinum RTD 0 to 100 C a=0.00392	Engineering Units	+100.00	+000.00	+0.1 C
26h	100 Ohms Platinum RTD 0 to 200 C a=0.00392	Engineering Units	+200.00	+000.00	+0.2 C
27h	100 Ohms Platinum RTD 0 to 600 C a=0.00392	Engineering Units	+600.00	+000.00	-0.6 C
28h	120 Ohms Nickel RTD -80 to 100 C	Engineering Units	+100.00	-80.00	-0.1 C
29h	120 Ohms Nickel RTD 0 to 100 C	Engineering Units	+100.00	+000.00	-0.1 C



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