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PI Command and Telemetry Handbook

For the COSMOS Demo Project



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Commands

PI PUMP

Set pump voltage

Item Name	Description	Min	Max	Default	Bit Offset	Bit Size	Data Type	Units
LENGTH	Length of packet in bytes, must be 9	9	9	9	0	32	UINT	
CMD_ID	ID of command, must be 0x30 Id Value: 48	48	48	48	32	8	UINT	
VOLTAGE	Voltage given to pump, between 0 and 12V	0.0	12.0	0.0	40	32	FLOAT	

PI ZERO_PRESSURE_SENSORS

Set pump voltage

Item Name	Description	Min	Max	Default	Bit Offset	Bit Size	Data Type	Units
LENGTH	Length of packet in bytes, must be 17	17		17	17	0	32	UINT
CMD_ID	ID of command, must be 0x01 Id Value: 1 Write Conversion: ZeroPressureSensors	1		1	1	32	8	UINT
V_ZERO	Zero value for Venturi Pressure	-3.402823e+38	3.402823e+38	0.0	40	32	FLOAT	
P_ZERO	Zero value for Pump Pressure	-3.402823e+38	3.402823e+38	0.0	72	32	FLOAT	
S_ZERO	Zero value for Static Pressure	-3.402823e+38	3.402823e+38	0.0	104	32	FLOAT	

Telemetry Packets

PI HOUSEKEEPING

housekeeping telemetry

Item Name	Description	Bit Offset	Bit Size	Data Type	Units	Format
RECEIVED_TIMESECONDS	COSMOS Received Time (UTC, Floating point, Unix epoch) Read Conversion: ReceivedTimeSecondsConversion	0	0	DERIVED		%0.6f
RECEIVED_TIMEFORMATTED	COSMOS Received Time (Local time zone, Formatted string) Read Conversion: ReceivedTimeFormattedConversion	0	0	DERIVED		
RECEIVED_COUNT	COSMOS packet received count Read Conversion: ReceivedCountConversion	0	0	DERIVED		
LENGTH	length of packet in bytes	0	32	UINT		
PKT_ID	packet id which must be 0xFF Id Value: 255	32	8	UINT		
TIMESTAMP	system time in seconds since epoch Read Conversion: Timestamp	40	64	UINT		%0.6f
QUEUE_SIZE	size of telemetry queue	104	16	UINT		
CPU_TEMP	temperature of CPU (degrees C)	120	32	FLOAT		



CPU_LOAD	one minute cpu load average	152	32	FLOAT
MEM_USAGE	bytes of memory in use	184	32	UINT

PI LEVEL

Level sensor packet

Item Name	Description	Bit Offset	Bit Size	Data Type	Units Format
RECEIVED_TIMESECONDS	COSMOS Received Time (UTC, Floating point, Unix epoch) Read Conversion: ReceivedTimeSecondsConversion	0	0	DERIVED	%0.6f
RECEIVED_TIMEFORMATTED	COSMOS Received Time (Local time zone, Formatted string) Read Conversion: ReceivedTimeFormattedConversion	0	0	DERIVED	
RECEIVED_COUNT	COSMOS packet received count Read Conversion: ReceivedCountConversion	0	0	DERIVED	
LEVEL_VOLTS	ADC voltage measurement of level sensor Read ProcessorConversion L_CONVERSIONS Conversion: LEVEL_VOLTS	0	0	DERIVED	V
LEVEL_INCHES	level of liquid level sensor in inches Read ProcessorConversion L_CONVERSIONS Conversion: LEVEL_INCHES	0	0	DERIVED	in
LENGTH	length of packet in bytes	0	32	UINT	
PKT_ID	packet id which must be 0x40 Id Value: 64	32	8	UINT	
TIMESTAMP	system time in seconds since epoch Read Conversion: Timestamp	40	64	UINT	%0.6f
LEVEL_RAW	raw liquid level sensor value	104	32	UINT	

PI POWER

Pump power packet

Item Name	Description	Bit Offset	Bit Size	Data Type	Units Format
RECEIVED_TIMESECONDS	COSMOS Received Time (UTC, Floating point, Unix epoch) Read Conversion: ReceivedTimeSecondsConversion	0	0	DERIVED	%0.6f
RECEIVED_TIMEFORMATTED	COSMOS Received Time (Local time zone, Formatted string) Read Conversion: ReceivedTimeFormattedConversion	0	0	DERIVED	
RECEIVED_COUNT	COSMOS packet received count Read Conversion: ReceivedCountConversion	0	0	DERIVED	
VOLTAGE	measurement of voltage used to drive pump Read ProcessorConversion Conversion: POWER_CONVERSIONS VOLTAGE	0	0	DERIVED	V
AMPERAGE	measurement of amperage pulled by pump Read ProcessorConversion Conversion: POWER_CONVERSIONS AMPERAGE	0	0	DERIVED	A
WATTS	measurement of power consumed by pump Read ProcessorConversion	0	0	DERIVED	W



	Conversion: POWER_CONVERSIONS POWER				
LENGTH	length of packet in bytes	0	32	UINT	
PKT_ID	packet id which must be 0x50 Id Value: 80	32	8	UINT	
VOLTAGE_TIMESTAMP	voltage - system timestamp in seconds since epoch Read Conversion: Timestamp	40	64	UINT	%.6f
VOLTAGE_RAW	raw measurement of voltage used to drive pump	104	32	UINT	
AMPERAGE_TIMESTAMP	amperage - system timestamp in seconds since epoch Read Conversion: Timestamp	136	64	UINT	%.6f
AMPERAGE_RAW	raw measurement of amperage pulled by pump	200	32	UINT	

PI PRESSURE

pressure sensor readings

Item Name	Description	Bit Offset	Bit Size	Data Type	Units	Format
RECEIVED_TIMESECONDS	COSMOS Received Time (UTC, Floating point, Unix epoch) Read Conversion: ReceivedTimeSecondsConversion	0	0	DERIVED		%.06f
RECEIVED_TIMEFORMATTED	COSMOS Received Time (Local time zone, Formatted string) Read Conversion: ReceivedTimeFormattedConversion	0	0	DERIVED		
RECEIVED_COUNT	COSMOS packet received count Read Conversion: ReceivedCountConversion	0	0	DERIVED		
VENTURI_VOLTS	voltage measurement of venturi ADC Read ProcessorConversion P_CONVERSIONS Conversion: VENTURI_VOLTS	0	0	DERIVED	V	
VENTURI_CURRENT	current measurement of venturi ADC Read ProcessorConversion P_CONVERSIONS Conversion: VENTURI_CURRENT	0	0	DERIVED	mA	
VENTURI_PRESSURE	differential pressure measurement of venturi Read ProcessorConversion P_CONVERSIONS Conversion: VENTURI_PRESSURE	0	0	DERIVED	psid	
VENTURI_FLOW	flow rate measurement of venturi Read ProcessorConversion P_CONVERSIONS Conversion: VENTURI_FLOW	0	0	DERIVED	mL/min	
PUMP_VOLTS	voltage measurement of ADC from differential pressure across pump Read ProcessorConversion P_CONVERSIONS Conversion: PUMP_VOLTS	0	0	DERIVED	V	
PUMP_CURRENT	current measurement of ADC from differential pressure across pump Read ProcessorConversion P_CONVERSIONS Conversion: PUMP_CURRENT	0	0	DERIVED	mA	
PUMP_PRESSURE	pressure differential across pump Read ProcessorConversion P_CONVERSIONS Conversion: PUMP_PRESSURE	0	0	DERIVED	psid	
STATIC_VOLTS	voltage measurement of static pressure ADC Read ProcessorConversion P_CONVERSIONS	0	0	DERIVED	V	



Conversion: STATIC_VOLTS					
current measurement of static pressure ADC					
STATIC_CURRENT	Read ProcessorConversion P_CONVERSIONS Conversion: STATIC_CURRENT	0	0	DERIVED mA	
pressure measurement of static pressure					
STATIC_PRESSURE	Read ProcessorConversion P_CONVERSIONS Conversion: STATIC_PRESSURE	0	0	DERIVED psig	
LENGTH	length of packet in bytes	0	32	UINT	
PKT_ID	packet id which must be 0x00 Id Value: 0	32	8	UINT	
VENTURI_TIME	venturi pressure timestamp in seconds since epoch Read Conversion: Timestamp	40	64	UINT	%.6f
VENTURI_RAW	venturi meter ADC code	104	32	UINT	
VENTURI_ZERO	zero value for venturi pressure	136	32	FLOAT	
PUMP_TIME	pump pressure timestamp in seconds since epoch Read Conversion: Timestamp	168	64	UINT	%.6f
PUMP_RAW	measured ADC code from pump pressure sensor	232	32	UINT	
PUMP_ZERO	zero value for pump pressure	264	32	FLOAT	
STATIC_TIME	static pressure timestamp in seconds since epoch Read Conversion: Timestamp	296	64	UINT	%.6f
STATIC_RAW	measured ADC code from static pressure sensor	360	32	UINT	
STATIC_ZERO	zero value for static pressure	392	32	FLOAT	

PI RPM

RPM of the pump

Item Name	Description	Bit Offset	Bit Size	Data Type	Units Format
RECEIVED_TIMESECONDS	COSMOS Received Time (UTC, Floating point, Unix epoch) Read Conversion: ReceivedTimeSecondsConversion	0	0	DERIVED	%.6f
RECEIVED_TIMEFORMATTED	COSMOS Received Time (Local time zone, Formatted string) Read Conversion: ReceivedTimeFormattedConversion	0	0	DERIVED	
RECEIVED_COUNT	COSMOS packet received count Read Conversion: ReceivedCountConversion	0	0	DERIVED	
LENGTH	length of packet in bytes	0	32	UINT	
PKT_ID	packet id which must be 0x20 Id Value: 32	32	8	UINT	
TIMESTAMP	system time in seconds since epoch Read Conversion: Timestamp	40	64	UINT	%.6f
VALUE	measured RPM of the pump	104	16	UINT	

PI TEMPERATURE

temperature sensor reading

Item Name	Description	Bit Offset	Bit Size	Data Type	Units Format
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RECEIVED_TIMESECONDS	COSMOS Received Time (UTC, Floating point, Unix epoch)	0	0	DERIVED	%0.6f
	Read Conversion: ReceivedTimeSecondsConversion				
RECEIVED_TIMEFORMATTED	COSMOS Received Time (Local time zone, Formatted string)	0	0	DERIVED	
	Read Conversion: ReceivedTimeFormattedConversion				
RECEIVED_COUNT	COSMOS packet received count	0	0	DERIVED	
	Read Conversion: ReceivedCountConversion				
TEMP1_OHMS	calculated ohmage of temperature sensor #1				
	Read ProcessorConversion TEMP_CONVERSIONS	0	0	DERIVED	ohms
	Conversion: TEMP1_OHMS				
	calculated temperature of temperature sensor #1				
TEMP1	Read ProcessorConversion	0	0	DERIVED	C
	Conversion: TEMP_CONVERSIONS TEMP1				
	calculated ohmage of temperature sensor #2				
TEMP2_OHMS	Read ProcessorConversion TEMP_CONVERSIONS	0	0	DERIVED	ohms
	Conversion: TEMP2_OHMS				
	calculated temperature of temperature sensor #1				
TEMP2	Read ProcessorConversion	0	0	DERIVED	C
	Conversion: TEMP_CONVERSIONS TEMP2				
	calculated ohmage of temperature sensor #3				
TEMP3_OHMS	Read ProcessorConversion TEMP_CONVERSIONS	0	0	DERIVED	ohms
	Conversion: TEMP3_OHMS				
	calculated temperature of temperature sensor #1				
TEMP3	Read ProcessorConversion	0	0	DERIVED	C
	Conversion: TEMP_CONVERSIONS TEMP3				
	calculated ohmage of temperature sensor #4				
TEMP4_OHMS	Read ProcessorConversion TEMP_CONVERSIONS	0	0	DERIVED	ohms
	Conversion: TEMP4_OHMS				
	calculated temperature of temperature sensor #1				
TEMP4	Read ProcessorConversion	0	0	DERIVED	C
	Conversion: TEMP_CONVERSIONS TEMP4				
LENGTH	length of packet in bytes	0	32	UINT	
PKT_ID	packet id which must be 0x10 Id Value: 16	32	8	UINT	
TIME1	temp1 timestamp in seconds since epoch	40	64	UINT	%0.6f
	Read Conversion: Timestamp				
TEMP1_RAW	measured value from temperature sensor #1	104	16	UINT	
TIME2	temp2 timestamp in seconds since epoch	120	64	UINT	%0.6f
	Read Conversion: Timestamp				
TEMP2_RAW	measured value from temperature sensor #2	184	16	UINT	
TIME3	temp3 timestamp in seconds since epoch	200	64	UINT	%0.6f
	Read Conversion: Timestamp				
TEMP3_RAW	measured value from temperature sensor #3	264	16	UINT	
TIME4	temp4 timestamp in seconds since epoch	280	64	UINT	%0.6f
	Read Conversion: Timestamp				
TEMP4_RAW	measured value from temperature sensor #4	344	16	UINT	

