SERIAL INTERFACE: ULP VERSION

A single command can set most commonly-used functions of the device. This is done by sending a new Command Byte to the device. The lower 7 bits (BIT6 through BIT0) are orthogonal, and hence, have no effect on one another. They can be combined together by adding bits to form single command. All Orthogonal Commands have the Special Function Bit (BIT7) set to 0.

After each data packet is transmitted, the device returns to its minimum current state until another command is received.

UART FORMAT: 8-N-1

8 data bits, 1 stop bit, no parity, no flow control: 19,200 baud

One byte commands can be sent from the host to control various functions of the device. The following commands can be sent to the device via the UART. The data encoding is HEX, not ASCII.

PACKET LENGTH CONTROL

The device can output packets of two different lengths. The Short Packet is 10 bytes long and contains the essential angle readings. The Long Packet is 36 bytes long and in addition to angle readings, contains acceleration measurements.

FILTER CONTROL

A digital moving average filter can be enabled with lengths of 2, 10, or 20 points. This feature is useful in reducing noise and improving resolution with little or no impact on power consumption. Each time the device acquires a data point, this moving average is updated. Switching the moving average setting causes the entire filter to be initialized with the next angle measurement sample. The time constant of the filter depends on the speed at which samples are requested by the host.

OVERSAMPLE CONTROL

A multipoint oversampling system can be enabled to acquire and average 2, 10, or 20 consecutive data points at a speed of Sample Rate. This feature is also useful for further reduce noise and improve resolution in some applications. In particular, a single, high resolution angle measurement can be taken by setting the oversampling to a maximum value.

SPECIAL FUNCTION COMMAND OVERVIEW

All Special Function Commands have the Special Function Bit (BIT7) set to 1. The lower bits of any Command Byte sent to the device are ignored when a Special Function Command is used.

TIMING

New commands should not be sent from the host faster than Sample Rate to avoid overwriting previous commands. The recommend method to ensure that this does not occur is to send commands in Interrogate Mode and then wait for the response packet before issuing a new command.

RESET SOURCES

Grounding the device's power pin for 200 mS will reset the device. When the device is powered on, it will revert to its default settings. On power up, a single measurement is taken and a single data packet is transmitted. Alternatively, the Reset Command may be used to force a reset.

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COMMAND BYTE

BITS	USE	BINARY	HEX	COMMAND	RESPONSE	NOTES
Bit[7]	Special Commands	1000 0011	0x83	Reset	Device reset	**Example: Acquire 1, 10 byte data packet as fast as possible –** Combine Interrogate Mode (0x01), Oversample 0, Average 0, and Packet 10 commands. To do this, send 0x01. The response will be 1 data packet after a delay of 1/Sample Rate seconds. **Example: Acquire 1, 32 byte packet, with a 2 point moving average, and 2 point oversampling** – Combine Interrogate Mode (0x01), Oversample 2 (0x04), Average 2 (0x10), and Packet 32 (0x40). To do this, send 0x55 (formed by adding 0x01 + 0x04 + 0x10 + 0x40). The response will be 1 data packet after a delay of 2*Sample Rate seconds.
Bit[6]	Packet Length Control	01XX XXXX	0x40	Long Packet	Packet length set to 32 bytes	
		00XX XXXX	NA	Short Packet	Packet length set to 10 bytes	
Bits[5:4]	Filter Control	0X11 XXXX	0x30	Average 20	Moving average length set to 20 points	
		0X10 XXXX	0x20	Average 10	Moving average length set to 10 points	
		0X01 XXXX	0x10	Average 2	Moving average length set to 2 points	
		0X00 XXXX	NA	Average 0 (default)	No moving average filtering	
Bits[3:2]	Oversample Control	0XXX 11XX	0x0C	Oversample 20	20 samples are acquired at Sample Rate and averaged in a single measurement	
		0XXX 10XX	0x08	Oversample 10	10 samples are acquired at Sample Rate and averaged in a single measurement	
		0XXX 01XX	0x04	Oversample 2	2 samples are acquired at Sample Rate and averaged in a single measurement	
		0XXX 00XX	NA	Oversample 0	No oversampling	
Bits[1:0]	Output Control	0XXX XX11	0x03	Reserved for future use	Undefined	
		0XXX XX10	0x02	Reserved for future use	Undefined	
		0XXX XX01	0x01	Interrogate Mode (default)	Replies with single data packet	

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		0XXX XX00	0x00	Reserved for future use	Undefined	

SERIAL PACKET FORMAT – SHORT PACKET (10 BYTES): ULP VERSION

	BYTE	DUAL AXIS MODE	SINGLE AXIS MODE	NOTES
Header	0	Sync byte 1	Sync byte 1	0xFE
	1	Sync byte 2	Sync byte 2	0xFE
Payload	2	X Tilt (high byte)	Z Rotation (high byte)	Format: 16-bit, unsigned integer *Output_Value* = *Measured_Angle* × 10. For example, a measured angle of 127.5 º results in an output value of 1275.
	3	X Tilt (low byte)	Z Rotation (low byte)	
	4	Y Tilt (high byte)	Z Tilt (high byte)	
	5	Y Tilt (low byte)	Z Tilt (low byte)	
	6	Factory	Factory	Undefined
	7	Factory	Factory	Undefined
Checksum	8	Checksum (high)	Checksum (high)	Format: 16-bit, unsigned integer sum of the 16 bit unsigned integer payload values. The checksum **does not** include the two sync bytes (0xFE 0xFE).
	9	Checksum (low)	Checksum (low)	

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SERIAL PACKET FORMAT – LONG PACKET (36 BYTES): ULP VERSION

	BYTE	DUAL AXIS MODE	SINGLE AXIS MODE	NOTES
Header	0	Sync byte 1	Sync byte 1	0xFE
	1	Sync byte 2	Sync byte 2	0xFE
Payload	2	X Tilt (high byte)	Z Rotation (high byte)	Format: 16-bit, unsigned integer *Output_Value* = *Measured_Angle* × 10. For example, a measured angle of 127.5 º results in an output value of 1275.
	3	X Tilt (low byte)	Z Rotation (low byte)	
	4	Y Tilt (high byte)	Z Tilt (high byte)	
	5	Y Tilt (low byte)	Z Tilt (low byte)	
	6	Factory	Factory	Undefined
	7	Factory	Factory	Undefined
	8	X Acceleration (high byte)	X Acceleration (high byte)	Format: 16-bit, unsigned integer. Output_Value = Acceleration (g)*1000. For example, a measured acceleration of 0.851 g results in an output value of 851.
	9	X Acceleration (low byte)	X Acceleration (low byte)	
	10	Y Acceleration (high byte)	Y Acceleration (high byte)	Same as above
	11	Y Acceleration (low byte)	Y Acceleration (low byte)	
	12	Factory	Factory	Format: 16-bit, unsigned integer.
	13	Factory	Factory	
	14-33	Factory	Factory	Same as above
Checksum	34	Checksum (high)	Checksum (high)	Format: 16-bit, unsigned integer sum of the 16 bit unsigned integer payload values. The checksum **does not** include the two sync bytes (0xFE 0xFE).
	35	Checksum (low)	Checksum (low)	

ULP- 3.5-RC4 RELEASE NOTES:

1) Sample Rate = 45 mS
2) Powering down the device may result in a noise signal being transmitted out the UART which can be misinterpreted by the host as a byte being received. It is recommended that you clear the receive buffer on the host side after powering down the device so erroneous bytes do not remain in the host's input buffer.

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LIMITATIONS AND WARNINGS

LIFE SAFETY

This product is not designed for use in life support and/or safety equipment where malfunction of the product can reasonably be expected to result in personal injury or death. Buyer uses this product in such applications at Buyer's own risk and agrees to defend, indemnify, and hold harmless SignalQuest, LLC from any and all damages, claims, suits, or expenses resulting from such misuse.

DYNAMIC ENVIRONMENTS

The device is designed to be used to measure angles in a quasi-static environment where external vibrations and accelerations are kept to a minimum. Digital and analog signal processing methods are employed to reduce the effects of transient acceleration and small vibrations on the angle reading; however, under dynamic conditions where external accelerations or vibrations are present, the sensor's performance may be degraded.

VARIATIONS IN EARTH'S GRAVITY

This device is designed to be used near the earth's surface only. Substantial changes in gravity will degrade the performance of the sensor. This device is not intended or qualified to be used in aviation.

TESTING

The performance of each system is verified through build-time testing. Each system is tested before and after factory calibration to ensure reliable performance.

SYSTEM INTEGRATION TESTING

Thorough testing should be carried out prior to product release to insure system integration has not introduced unforeseen problems. The system integrator assumes the ultimate responsibility for the safety of the target application.

NOTICE

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FURTHER INFORMATION

For pricing, deliveries, and ordering information, please contact SignalQuest at (603) 448-6266
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