

MICRO-ISU BP3010

A Fully Calibrated MEMS Inertial Measurement Unit with Serial I/O.



Actual Size

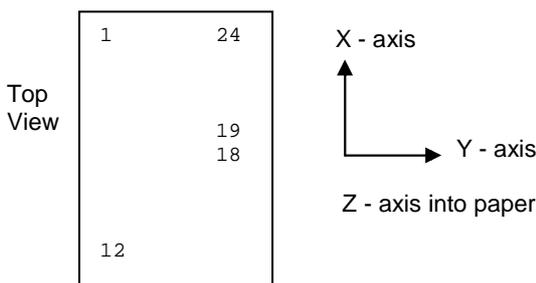
Description

The MICRO-ISU BP3010 is a complete 6-degrees-of-freedom **inertial measurement unit**, with 2 built-in internally regulated power supplies for powering separate analogue and digital electronics and is calibrated for operation over its temperature range of -40°C to +85°C. It performs accurately with angular rates up to +/-300°/s and accelerations up to +/-6g.

The unit transmits output data as angular incremental and velocity incremental data in serial frames of 16 bytes at one of the user-selectable frequencies of 64 Hz, 32 Hz, 16 Hz or 8 Hz. Serial data is transmitted and received in standard UART format as asynchronous bytes at 38,400 baud with 1 start bit, 8 data bits, 1 stop bit and no parity.

The MICRO-ISU fits onto the footprint of a 24 DIP socket (0.6" socket width, pin spacings 0.1") and has 5 pins defined as follows:

- Pin 1. +5V +/- 0.3V Power
- Pin 12. Power and signal ground (0V)
- Pin 18. Serial Input (may be left unconnected)
- Pin 19. Serial Output
- Pin 24. Reset (low for reset, may be left unconnected)



At power-on the MICRO-ISU automatically performs an internal reset and the Reset pin, which has an internal pull-up resistor may be left unconnected or connected to +5V if not required. A minimum of 10ms (high-low-high pulse) is recommended when applying a reset.

Serial input and output signals use standard CMOS +5V / 0V voltage transitions. The no-data transmission voltage is +5V. The Serial Input pin may be left unconnected if frequency selection is not required.

After power-on, output data is automatically transmitted at the default frame transmission frequency of 64 Hz. To select one of the transmission frequencies a 2-byte frame must be sent to the serial input pin. The 2 bytes are defined as follows:

FREQUENCY	BYTE 1	BYTE 2
64 Hz	7B Hex	88 Hex
32 Hz	7B Hex	89 Hex
16 Hz	7B Hex	8A Hex
8 Hz	7B Hex	8B Hex

The serial receiver of the MICRO-ISU BP3010 does not contain a FIFO for storing input data. Instead the serial input port is periodically polled to test for serial input data.

The frequency at which it polls the receiver port is 3072 Hz (every 325.5µs). The period between polling is therefore slightly longer than the interval between continuous bytes at the 38400 baud rate. If bytes are transmitted with no interval between bytes, there is a possibility that the incoming message is not properly received. To ensure that the message is always received, it is recommended that the two bytes have a break of minimum 75µs and maximum 1000µs between the two-byte transmissions.

Serial Output data is transmitted as a frame of 16 bytes. The data is transmitted as signed scaled 16-bit integers. The frame is defined as follows:

BYTE	DESCRIPTION	UNITS LS-BIT
1	78 Hex 1st identification byte	
2	87 Hex 2nd identification byte	
3	Status byte	
4	dTHx LS byte	1/65536 rad
5	dTHx MS byte	
6	dTHy LS byte	1/65536 rad
7	dTHy MS byte	
8	dTHz LS byte	1/65536 rad
9	dTHz MS Byte	
10	dVx LS byte	0.001 m/s
11	dVx MS byte	
12	dVy LS byte	0.001 m/s
13	dVy MS byte	
14	dVz LS byte	0.001 m/s
15	dVz MS byte	
16	XOR checksum of bytes 1 to 15	

The Status byte defines the validity of the output data: (See Amendment on Page 2)

BIT	WHEN 0	WHEN 1
7 MSB	Not used, always = 0	Not applicable
6	Not applicable	Send flag, always = 1
5	dVz within range	dVz out of range
4	dVy within range	dVy out of range
3	dVx within range	dVx out of range
2	dTHz within range	dTHz out of range
1	dTHy within range	dTHy out of range
0 LSB	dTHx within range	dTHx out of range

For an angular increment, the "range" is defined as the maximum allowed angular increment for an angular rate with the maximum value of +/-300°/s. The range is reduced at low frame frequencies to avoid overflows. For a velocity increment the "range" is defined as the maximum allowed velocity increment at the maximum acceleration of 6g. The range is also reduced at low frame frequencies to avoid overflows.

Physical dimensions	35 mm x 22 mm x 12 mm
Weight	30 g approximately
Power Consumption	0.5 Watt
Scale Factor Accuracy	0.3 %
Residual Bias Error	0.5 °/s (gyro) 10mg (accel)
Misalignment Error	0.5 degree
Output Noise (rms)	0.03° (dTh) 0.010 m/s (dV)

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Amendment to BP3010 Status Byte

From Serial number 10-100 onwards, a change has been implemented in the status byte of the MICRO-ISU BP3010 to include a checksum status.

Bit 6 of the status byte will now be used to indicate whether the flash memory in the 3 built-in microcontrollers contains an error.

When power is applied to the BP3010 an internal XOR checksum of the flash memory is performed by each microcontroller on its own flash memory. All memory addresses except the last two bytes in flash memory are summed. The last byte, which is the security byte and the next-last byte, which contains the checksum value are not summed. The result of the XOR sum is stored in internal RAM.

Every 64 Hz cycle each microcontroller compares the sum value in RAM with the checksum value from flash memory. If the two values in any microcontroller are different, then a checksum error will be indicated in the status byte.

In normal operation bit 6 will be set to 1 and the other bits 5-0 will indicate the gyro and accelerometer statuses.

If a checksum error is detected bit 6 will be cleared to 0 and bits 2-0 will be used to indicate which microcontroller has a check sum error. Bits 5-3 will still indicate accelerometer status.

Case: Checksum Good

BIT	WHEN 0	WHEN 1
7 MSB	Not used, always = 0	Not applicable
6	-	1
5	dVz within range	dVz out of range
4	dVy within range	dVy out of range
3	dVx within range	dVx out of range
2	dTHz within range	dTHz out of range
1	dTHy within range	dTHy out of range
0 LSB	dTHx within range	dTHx out of range

Case: Checksum Error

BIT	WHEN 0	WHEN 1
7 MSB	Not used, always = 0	Not applicable
6	0	-
5	dVz within range	dVz out of range
4	dVy within range	dVy out of range
3	dVx within range	dVx out of range
2	MP3 OK	MP3 Checksum Error
1	MP2 OK	MP2 Checksum Error
0 LSB	MP1 OK	MP1 Checksum Error

Checksum Test

The checksum value in each microcontroller can be individually complemented using a two-byte serial message at the serial input pin. In this way, the checksum function of each microcontroller can be tested.

TEST	BYTE 1	BYTE 2
Complement CP1 Checksum	7B Hex	81 Hex
Complement CP2 Checksum	7B Hex	82 Hex
Complement CP3 Checksum	7B Hex	83 Hex

By sending any message once the respective checksum value will be complemented and the checksum error will be permanently indicated.

By sending the same message again the checksum value will be returned to its original value and the checksum error will be removed if originally there was no checksum error.

The checksum test can be done or repeated any time.