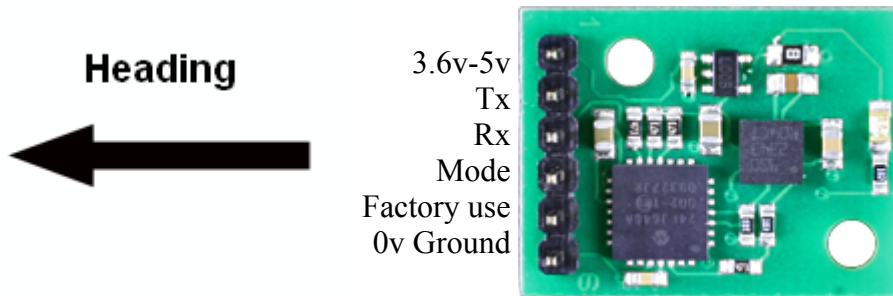


# CMPS11 - Tilt Compensated Compass Module

## Serial mode

### Connections



To use the serial mode of operation the mode pin must be connected to ground.

### Communication settings

The Serial mode operates over a link with a default baud rate of 9600 bps (no parity, 2 stop bits) and 3.3v-5v signal levels.

This is not RS232. Do not connect RS232 to the module, the high RS232 voltages will irreversibly damage the module.

### Commands

Below is a table describing commands that can be sent to the CMPS11 and the data it will respond with.

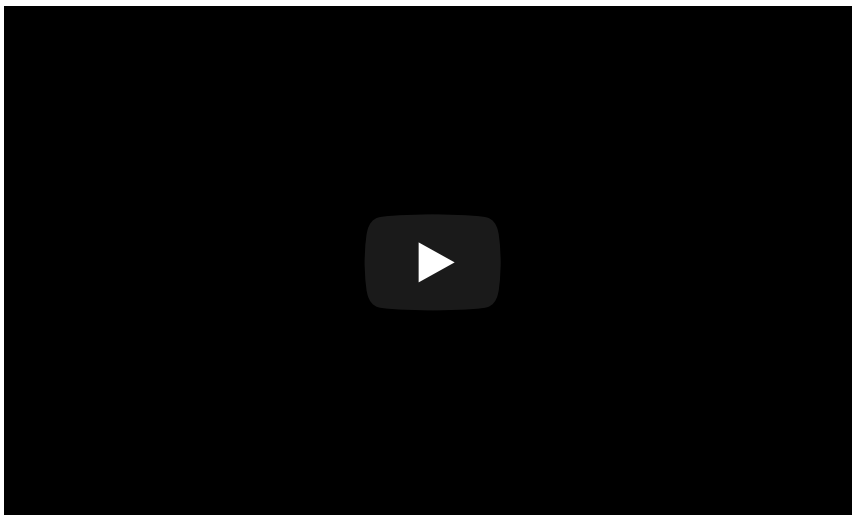
#### Commands for Serial

Command	Name	Bytes returned	Returned data description
0x11	GET VERSION	1	Software version
0x12	GET ANGLE 8 BIT	1	Angle as a single byte 0-255
0x13	GET ANGLE 16 BIT	2	Angle as two bytes, high byte first 0-3599
0x14	GET PITCH	1	Pitch angle +/- 0-85° Kalman filtered
0x15	GET ROLL	1	Roll angle +/- 0-85° Kalman filtered
0x16	GET PITCH NO KAL	1	Pitch angle +/- 0-85° no Kalman filter
0x17	GET ROLL NO KAL	1	Roll angle +/- 0-85° no Kalman filter
0x19	GET MAG RAW	6	Raw magnetic data, 16 bit signed: X high, X low, Y high, Y low, Z high, Z low
0x20	GET ACCEL RAW	6	Raw accelerometer data, 16 bit signed: X high, X low, Y high, Y low, Z high, Z low
0x21	GET GYRO RAW	6	Raw gyro data, 16 bit signed: X high, X low, Y high, Y low, Z high, Z low
0x22	GET TEMP	2	Temperature as two bytes, high byte first 0. Typical resolution 8 LSB/°C
0x23	GET ALL	4	angle high, angle low (0-3599), pitch (+/- 0-85), roll (+/- 0-85)
0xF0	CALIBRATE BYTE 1	1	returns ok (0x55)
0xF5	CALIBRATE BYTE 2	1	returns ok (0x55)
0xF6	CALIBRATE BYTE 3 FULL	1	returns ok (0x55)

0xF7	CALIBRATE BYTE 3 FLAT	1	returns ok (0x55)
0xF8	CALIBRATE EXIT	1	returns ok (0x55)
0x6A	RESTORE 1	1	returns ok (0x55)
0x7C	RESTORE 2	1	returns ok (0x55)
0x81	RESTORE 3	1	returns ok (0x55)
0xA0	BAUD 19200	1	returns ok (0x55)
0xA1	BAUD 38400	1	returns ok (0x55)

### Calibration of the CMPS11

Please do not do this until you have serial communication fully working. I would recommend evaluating the CMPS11 performance first before implementing this function. Its purpose is to remove sensor gain and offset of both magnetometer and accelerometer and achieves this by looking for maximum sensor outputs. First of all you need to enter the calibration mode by sending a 3 byte sequence of 0xF0,0xF5 and then 0xF6 (reading the acknowledge byte after each one). The LED will then extinguish and the CMPS11 should now be rotated in all directions in 3 dimensions, if a new maximum for any of the sensors is detected then the LED will flash, when you cannot get any further LED flashes in any direction then exit the calibration mode with a command of 0xF8. Please make sure that the CMPS11 is not located near to ferrous objects as this will distort the magnetic field and induce errors in the reading. While calibrating rotate the compass slowly. Remember the axis of the magnetic field is unlikely to be horizontal, it dips into the earth at an angle which varies depending on your location. At our offices in the UK it dips into the earth at 67 degrees and that is the orientation each axis of the compass needs to be to find the maximums. You need to find both positive and negative maximums for each axis so there are 6 points to calibrate. The accelerometer is also calibrated at the same time, so the module should also be positioned horizontal, inverted, and on all 4 sides to calibrate the 6 accelerometer points. Each accelerometer point needs to be stable for 200mS for its reading to be used for calibration. This delay is deliberate so that light taps to the module do not produce disruptive accelerometer readings which would mess up the pitch and roll angles. There is no delay for the magnetic points. The performance of the module is directly related to how well you perform calibration so do this slowly and carefully.



### Calibration of the CMPS11 for horizontal only operation

If the compass does not require the tilt compensation then a simple calibration may be used that can be implemented by a rotation on the horizontal plane only. First of all you need to enter the calibration mode by sending a 3 byte sequence of 0xF0,0xF5 and then 0xF7 (reading the acknowledge byte after each one). The LED will then extinguish and the CMPS11 should now be rotated in all directions on a horizontal plane, if a new maximum for any of the sensors is detected then the LED will flash, when you cannot get any further LED flashes in any direction then exit the calibration mode with a command of 0xF8. Please make sure that the CMPS11 is not located near to ferrous objects as this will distort the magnetic field and induce errors in the reading. While calibrating rotate the compass slowly. Only the X and Y magnetometer axis are calibrated in this mode.

**Restore of factory calibration of the CMPS11**

To perform a restore of the factory calibration write a sequence of 3 commands in the correct order. The sequence is 0x6A,0x7C,0x81 (reading the acknowledge byte after each one).

**Changing the baud rate**

The default serial baud rate of 9600 can be changed. There are two other baud rates that can be used, for 19200 just send 0xA0 or alternatively for 38400 send 0xA1. Please note that the CMPS11 will always default to its 9600 bps rate after power cycling and after setting a new baud rate the ok response (0x55) will be sent at the newly selected speed.