

**MDS FAMILY****COMPASS ALTIMETER MODULE**

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***I. Magnetic sensors placement:***

Place the magnetoresistive sensors such a way that their x or y axis passes through the center of the battery. Please refer to the data sheet for more information.

***II. Getting the correct pressure/altitude from MDS module:***

The pressure is temperature compensated. So it is strongly recommended to read the temperature before reading pressure/altitude to get an accurate reading.

***III. Getting a good communication with MDS module:******Important information need to be read before communicating with the MDS:***

The module will enter standby mode after power on reset, reset by RESET pin or executing a command. The power on reset duration is 100ms.

- The reset of MDS will be active when the RESET pin goes to HIGH for at least 10ms. When the RESET pin goes to LOW, the MDS will enter reset cycle and enter standby mode after finishing reset cycle. If the reset is applied, the MDS will re-load all calibrated data from the internal EEPROM and it will then enter standby mode within 100ms. This loading operation must not be interrupted in any case i.e. by another reset.
- It is important that the host MCU stops all its communication (especially the communication that makes the MDS access the internal eeprom such as offset storing or setting sea level pressure, ...) with the MDS before power off the whole system or sending a new reset command. **Any interruption of the eeprom reading or writing operation could corrupt its data.**
- To wake up the module from sleep mode, the host MCU must reset the MDS. The module will start and enter standby mode within 100ms. Then, the host MCU can send a new command.
- For each byte, MSB is sent first and LSB at the end.
- The data is in hexadecimal format. Negative number is in 2's complement.



- When the module enters Sleep Mode, all calibration data will be saved in EEPROM. This mode can be used to reduce current consumption when the host MCU stops reading the MDS module for a long time. In this mode the oscillator is stopped.
- The maximum delay between active low of ME pin and active high of DOUT pin is 4ms.
- When communicating with MDS module, if the Host MCU writes code or data to MDS module, the MDS module will receive data at the rising edge of SCLK. If the Host MCU receives the data from MDS module, it should receive data at the falling edge of SCLK.

### Port configuration of the Host MCU:

It is recommended to configure all communication ports of the Host MCU as the below table to avoid the collision of port setting.

MDS mode	MDS port	Status of port	Host MCU port	Status of port
SLEEP MODE	ME	Input pull high	ME	Input HZ
	SCLK	Output low	SCLK	Input HZ
	DIN	Output low	DIN	Input HZ
	DOUT	Output low	DOUT	Input HZ
	RESET	Input pull low	RESET	Input HZ
STAND-BY MODE	ME	Input pull high	ME	Input HZ
	SCLK	Output low	SCLK	Input HZ
	DIN	Output low	DIN	Input HZ
	DOUT	Output low	DOUT	Input HZ
	RESET	Input pull low	RESET	Input HZ
ACTIVE MODE	ME	Input pull high	ME	Output low
	SCLK	Input pull high	SCLK	Output
	DIN	Input pull high	DIN	Output
	DOUT	Output	DOUT	Input HZ
	RESET	Input pull low	RESET	Input HZ
RESET BY RESET PIN	ME	Not defined	ME	Input HZ
	SCLK	Not defined	SCLK	Input HZ
	DIN	Not defined	DIN	Input HZ
	DOUT	Not defined	DOUT	Input HZ
	RESET	Input pull low	RESET	Output high

### Communication sequence:



For all commands, the host MCU must follow the following communication sequence. It includes 3 steps as shown below:

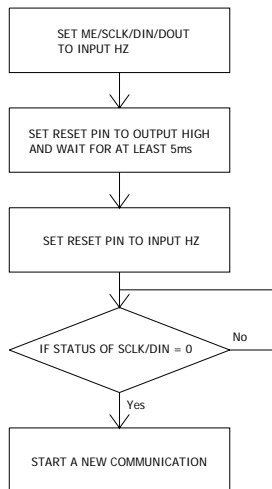
**Step 1:** wake up the MDS by ME pin.

**Step 2:** send 8 bits command to MDS.

**Step 3:** the 8 bits data command sent in step 2 allows the host MCU to read data from the MDS or write data to the MDS (please refer to the data sheet for the detail of each command)

### ***Reset the MDS by RESET pin:***

The MDS can be reset by applying a reset signal to the RESET pin. The under flowcart will show the detail of the reset sequence:

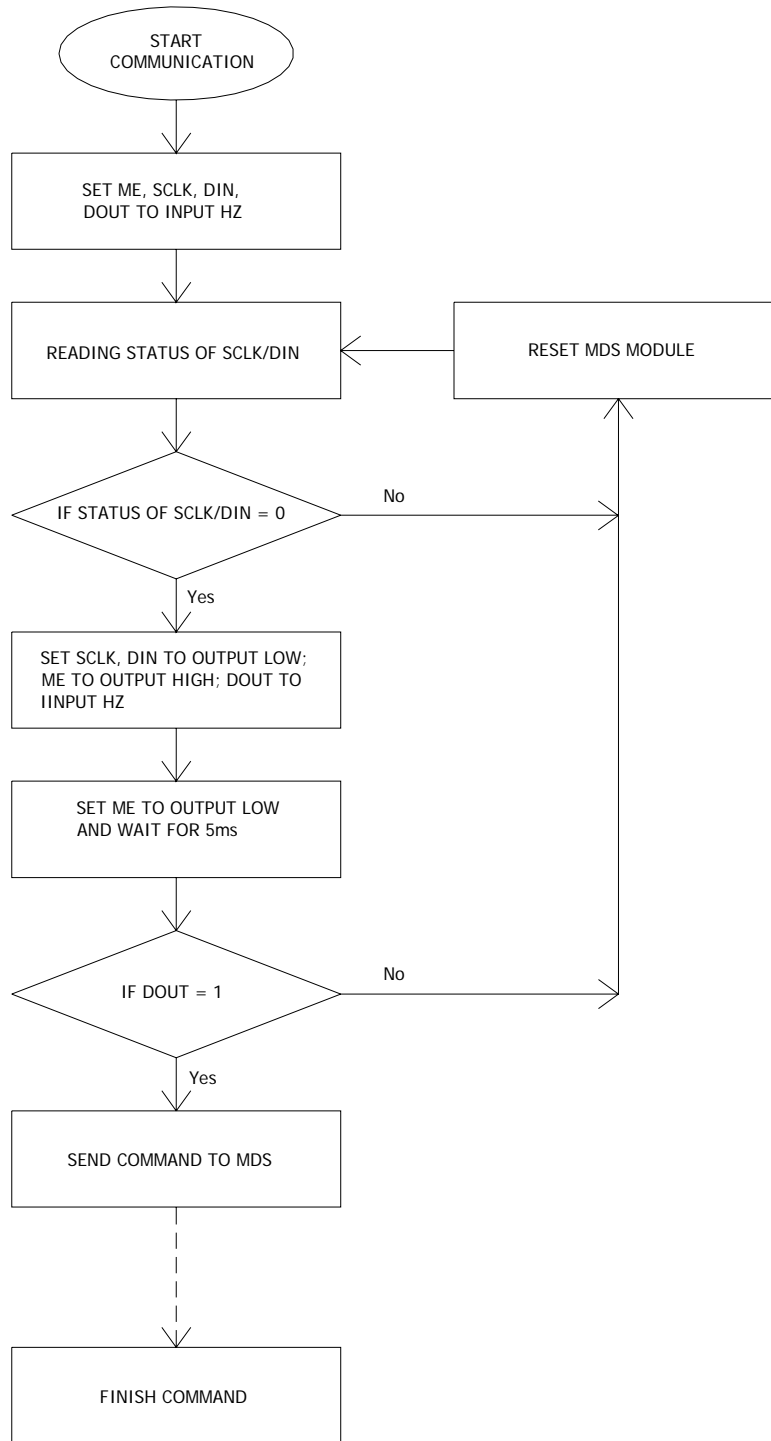


After set the host MCU's reset interface pin is set to input HZ, the host MCU can check the status of SCLK/DIN before starting a new command.

After resetting the MDS, the SCLK/DIN will go to LOW within 100ms.

### ***Waking up the MDS module from SLEEP MODE/STAND-BY MODE:***

Hereunder is the flowchart to wake up the MDS module correctly from sleep mode, stand-by mode and to avoid error during the communication cycle due to unknown reasons (such as the Host MCU does not complete the communication cycle, ...).

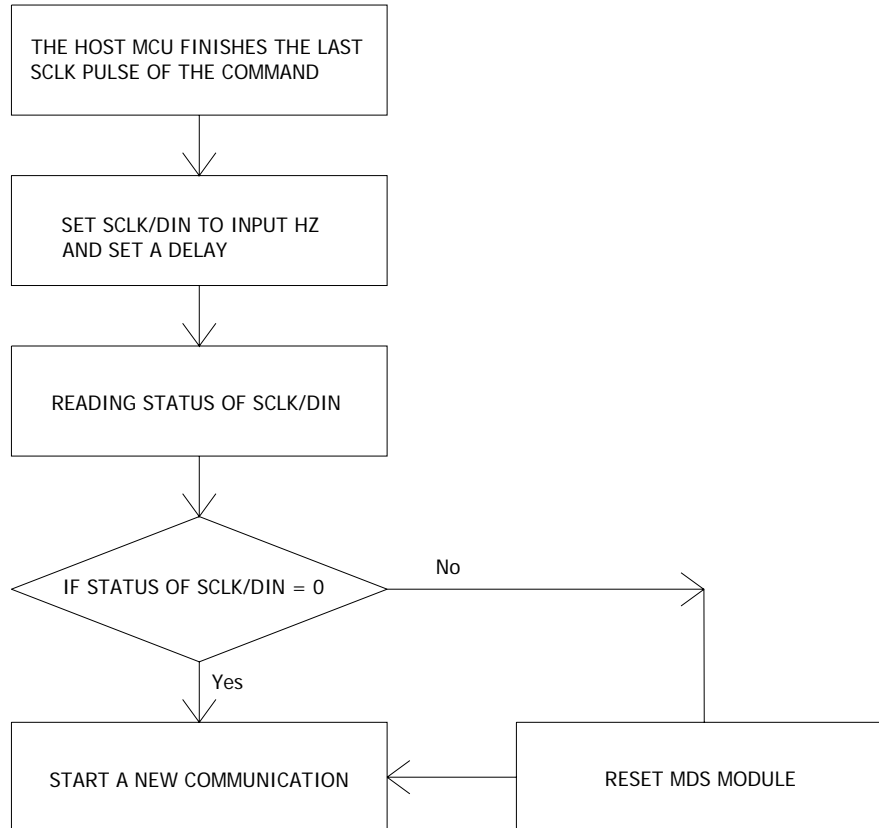


**Check if the command is finished or not:**

Normally, the MDS will enter stand-by mode within 20us after the last SCLK pulse (the final clock in the step 3 in section 3.2) except these storing commands (4Dh, 4Eh, 47h, 53h). For these storing commands (4Dh, 4Eh, 47h, 53h) the MDS needs time to store data from host MCU to the internal EEPROM.



The duration MDS module needed to enter stand-by mode from the last SCLK pulse of the command is depending on the command. The Host MCU only can start a communication if the MDS is in stand-by mode. The below flowchart will show how to know that the command is finished and the MDS module is ready in the stand-by mode. This flowchart should be used when the host MCU wants to start a new communication right after the previous communication is finished.



***Using sleep mode of MDS:***

Sleep mode of the MDS is used when the Host MCU stops reading the MDS module for a long time. Using the Sleep mode will reduce the current consumption of the MDS. The MDS will enter Sleep mode after executing the command 43H (for more information about the command 43H please refer to MDS data sheet).

The MDS module is only waked up from Sleep mode by a reset signal from RESET pin. After the MDS is waked up from Sleep mode it will then enter Stand-by mode and the Host MCU can start a new communication.

***Using sea level pressure with MDS:***



The altitude calculated by MDS module is based on the current pressure and the sea level pressure. The readout altitude is the relative altitude to the sea level with assumption that the altitude is zero when the current pressure is equal to the sea level pressure.

If the current pressure is larger than the sea level pressure the readout altitude will be negative. If the current pressure is less than the sea level pressure the readout altitude will be positive.

The host MCU can set the sea level pressure by 47H, 57H, 5BH commands (please refer to the MDS data sheet for detail) to the MDS. After receiving new sea level pressure, the MDS will store this value in eeprom and it is non-volatile.

### ***Compass calibration with MDS:***

The procedure to get correct compass calibration is as follow:

**Step 1:** Send start compass calibration command 4AH once to the MDS, the MDS module will return 004AH to host MCU to indicate the the compass calibration has been started successful.

**Step 2:** The user must turn the MDS module slowly in the horizontal plane at least one turn and during turning the MDS the host MCU must send calibraton command 4BH continuously (4 times per second is recommended). The more command 4BH is sent per second the more compass heading is correct. The MDS module will return 004BH each time it receives the command 4BH.

**Step 3:** after step 2, the end compass calibration command 49H must be sent to the MDS to end compass calibration, the MDS will then return 0049H to the host MCU indicate that the compass calibration is finished.

After these above steps, the host MCU can get the heading from the MDS by sending 4CH command (please refer to the data sheet for detail of 4CH command).

**During the compass calibration, it is important not to reset the MDS module.** If the compass calibration is interrupted at any above steps, the compass calibration must be restarted from step 1 again.

