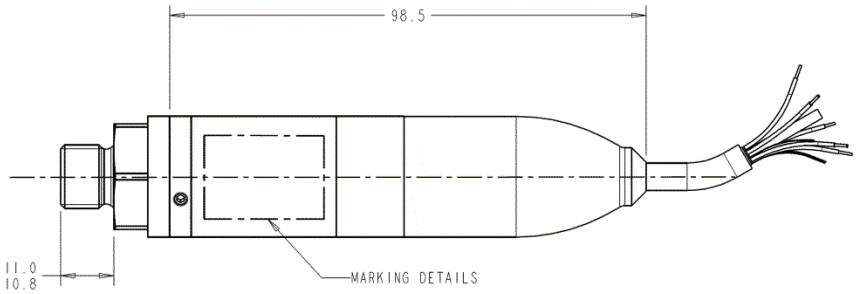
I²C Sensor Communication Overview

21 Feb 2014 Issue A

1 INTRODUCTION

1.1 OVERVIEW

The DPS 5000 sensor is a smart pressure transducer with I²C output. This document provides a brief overview of the communication sub-system of this sensor. It is designed to accompany pre-release samples and not to be full documentation.



2 COMMUNICATING WITH THE SENSOR

The sensor communicates over an I²C interface at speeds of up to 100 kHz. It appears on the bus as a slave device with a number of memory addresses containing information about the device and its environment. The electrical connections to the sensor are shown in the table below:

WIRE COLOUR	FUNCTION
RED	3.0 VDC
ORANGE	I2C - SDA
BLACK	I2C - SCL
WHITE	0 VDC
YELLOW	DO NOT USE
BLUE	DO NOT USE
SCREEN	CONNECTED TO CASE

The memory map is split into three groups: The volatile information, configuration parameters and a Flash memory block. The full layout of the memory is described in the table in section 3.

The I²C address of the supplied sensor has been pre-set to 2. This can be changed over the bus if required.

2.1 READING FROM THE DEVICE

In order to read from the device the host must first send the address of the sensor to read, followed by the single byte address of the location to read

from the sensor's memory. The host should then read the four bytes from that location.

For example, to read the status register from sensor 2 the host should follow the steps below.

Write 0 (location of the status word) to I²C device 2.
Read four bytes. This will return the 32 bit integer status register, LSB first. The contents of this register are explained in section 0.

2.2 WRITING TO THE DEVICE

In order to access the device the host must first address the sensor and then send the address of the location it wants to access followed by the data to be written to the location.

For example, to write to the access word (location 5) of sensor 2 the host should follow the steps below.

Write 5 to I²C device 2.
Write the four byte integer, LSB first, to the sensor.

2.3 READING THE COMPENSATED PRESSURE AND TEMPERATURE

When the sensor is first switched on it takes a pressure and temperature reading. It will not take another reading until instructed to do so by the host. If the sensor is used in an application where it is only turned on when a reading is needed and turned off when this reading has been read, this may be adequate, in other cases the host will need to trigger a reading when required.

To trigger a pressure reading, bit 0 of the status register should be set. The sensor will now clear that bit and begin taking a reading. This will typically take approximately 25ms. This host should poll the status register waiting for bit 0 to be set again. This indicates that the reading is available now. The host can now read locations 1 and 2 to obtain the compensated pressure and temperature values.

For example, to trigger a new reading and get the values from sensor 2 the host should follow the steps below.

- Trigger a reading.

Write 0 to I²C device 2.
Write 1 as a four byte integer, LSB first, to the sensor.

- Poll the sensor until a reading has been completed.

Write 0 to I²C device 2.
Read the four byte integer, LSB first and check bit 0. If 1, a reading has been taken. Otherwise, poll again.

- Read the compensated pressure value.

Write 1 to I²C device 2.
Read the four byte floating point number.

- Read the compensated temperature value.

Write 2 to I²C device 2.
Read the four byte floating point number.

3 MEMORY LAYOUT

Memory Layout is described in the table below.

Address	Type	Name	Volatile?	Description
0	uint32	Status	Y	Status Word. Shows various aspects of the sensors operation including Reading available, pressure valid, and temperature valid. Also used to start a new conversion.
1	Float	Compensated Pressure	Y	Pressure reading in bar
2	Float	Compensated Temperature	Y	Temperature reading in °C
5	uint32	Access Word	Y	The access word is used to enable writing of permanent information.
66	uchar	I²C Address	-	The address of the sensor on the bus.
77	uint32	Serial Number	-	The serial number of the sensor
79	uint32	Version	-	Software version. nn.nn.nn.nn
128	Float	K00	-	Coefficients (IEEE Float)
129	Float	K01	-	Coefficients (IEEE Float)
130	Float	K02	-	Coefficients (IEEE Float)
131	Float	K03	-	Coefficients (IEEE Float)
132	Float	K04	-	Coefficients (IEEE Float)
133	Float	K10	-	Coefficients (IEEE Float)
134	Float	K11	-	Coefficients (IEEE Float)
135	Float	K12	-	Coefficients (IEEE Float)
136	Float	K13	-	Coefficients (IEEE Float)
137	Float	K14	-	Coefficients (IEEE Float)
138	Float	K20	-	Coefficients (IEEE Float)
139	Float	K21	-	Coefficients (IEEE Float)
140	Float	K22	-	Coefficients (IEEE Float)
141	Float	K23	-	Coefficients (IEEE Float)
142	Float	K24	-	Coefficients (IEEE Float)

143	Float	K30	-	Coefficients (IEEE Float)
144	Float	K31	-	Coefficients (IEEE Float)
145	Float	K32	-	Coefficients (IEEE Float)
146	Float	K33	-	Coefficients (IEEE Float)
147	Float	K34	-	Coefficients (IEEE Float)

3.1 STATUS (ADDRESS 0)

The status register represents a bit map that reports on the status of the sensor. It is also used to trigger a new reading.

Bits 31 to 8 are unused.

7	6	5	4	3	2	1	0
0	ERASE FLASH	WRITE	ADCPWR	WENAB	TVAL	PVAL	CONV

3.1.1 ERASE FLASH

Erase the upper flash region of memory. This will only work when WENAB is set.

3.1.2 WRITE

When this bit is set and WENAB is set, the current configuration will be written to the Flash memory.

3.1.3 ADCPWR.

Read only. The ADC is powered up.

3.1.4 WENAB.

Read only. The sensor is in customer write enable mode.

3.1.5 TVAL.

Read only. The temperature reading is valid i.e. between the min and max values of the ADC count. In addition, CONV must be 1.

3.1.6 PVAL.

Read only. The pressure reading is valid i.e. between the min and max values of the ADC count. In addition, CONV must be 1.

3.1.7 CONV.

Read write. When read, a 1 indicates that a reading has been completed. When 1 is written a new conversion will be started.

3.2 COMPENSATED PRESSURE VALUE (ADDRESS 1)

The most recently requested reading of the pressure.

3.3 COMPENSATED TEMPERATURE VALUE (ADDRESS 2)

The most recently requested reading of the temperature.

3.4 ACCESS WORD (ADDRESS 5)

This word controls access permissions to the other locations in the memory map. Writing the number 4118 to this register will enable writing of the I^2C address.

3.5 I^2C ADDRESS (ADDRESS 66).

The address used to access the sensor. This has been pre-set as described in section 2 above. In order to change this value, the correct value should be written into the access word above, the new address written here and the **WRITE** bit set in the status word.

3.6 SERIAL NUMBER (ADDRESS 77)

The sensor's serial number.

3.7 VERSION (ADDRESS 79)

The version of the software within the sensor. This is held as 4 hex bytes and gives a value of the form xx.xx.xx.

3.8 COEFFICIENTS (ADDRESSES 128+)

This section of the memory holds the coefficients/compensation data for the sensor.