APPLICATION NOTE

AN1804-1

Application Note

I²C Interface for

Digital CO2 Measurement Module

Rev. 1.0 04/2018

Relevant for:

This application note applies to EE894

Introduction:

EE894 supports the standard I²C specification. For details please see NXP UM10204 „I²C-bus specification and user manual“, Rev. 6, 4 April 2014; https://www.nxp.com/docs/en/user-guide/UM10204.pdf.

CONTENT

1 Setup

The I²C interface of EE894 supports the “Standard-Mode” up to 100 kbit/s, 8-bit oriented, where the I²C slave address is 7 bit long.

The slave address is **0x33**. Accordingly, the address byte **0x67** is used to read and **0x66** to write, please refer to
§ 3.1.10 in the NXP specs.

The I²C interface of EE894 module is used only for reading measured data. There are two 2-byte commands for telling the module which measurand is to be read.

- *Command 1:* ***0xE000***
  Read the temperature value in Kelvin and relative humidity value in %.

START	I²C ADDRESS - 0x66 (W)								ACK	CMD MSB - 0xE0								ACK	CMD LSB - 0x00								ACK	STOP
S	0	1	1	0	0	1	1	0		1	1	1	0	0	0	0	0		0	0	0	0	0	0	0	0		P

- *Command 2:* ***0xE027***
  Read the averaged CO2 value in ppm, the raw CO2 value in ppm and ambient pressure in mbar

START	I²C ADDRESS - 0x66 (W)								ACK	CMD MSB - 0xE0								ACK	CMD LSB - 0x27								ACK	STOP
S	0	1	1	0	0	1	1	0		1	1	1	0	0	0	0	0		0	0	1	0	0	1	1	1		P

1.1 Peculiarities of the I²C interface of EE894:

- There are 16-bit unsigned integers in the form of 2 bytes each
- The MSB (most significant byte) comes first, then the LSB (least significant byte)
- After each 2 data bytes, a CRC byte ("CRC8") is sent to ensure that the data has been transferred correctly. This CRC8 is calculated from the 2 data bytes.

Property	**Value**
Width	8 bit
Polynomial	0x31 ($x_8 + x_5 + x_4 + 1$)
XOR input	0xFF
Reflect input	False
Reflect output	False
XOR output	0x00

- If the data readout is cancelled (after "CO2 average value" for instance) then the rest of the data will not be read.

1.2 Example for CRC8 calculation:

```
#define CRC8_ONEWIRE_POLY 0x31
#define CRC8_ONEWIRE_START2 0xff

static unsigned char i2cCalcCRC8 (unsigned char buf[], unsigned char from, unsigned char to)
{
  unsigned char crcVal = CRC8_ONEWIRE_START2;
  unsigned char i = 0;
  unsigned char j = 0;
  unsigned char curval = 0;

  for (i = from; i < to; i ++)
  {
    int curVal = buf[i];
    for (j = 0; j < 8; j ++)
    {
      if (((crcVal ^ curVal) & 0x80) != 0) // If MSBs are not equal
      {
        crcVal = ((crcVal << 1) ^ CRC8_ONEWIRE_POLY);
      }
      else {
        crcVal = (crcVal << 1);
      }
      curVal = curVal << 1;
    }
  }
  return crcVal;
}
```

1.3 Example: Read all available data

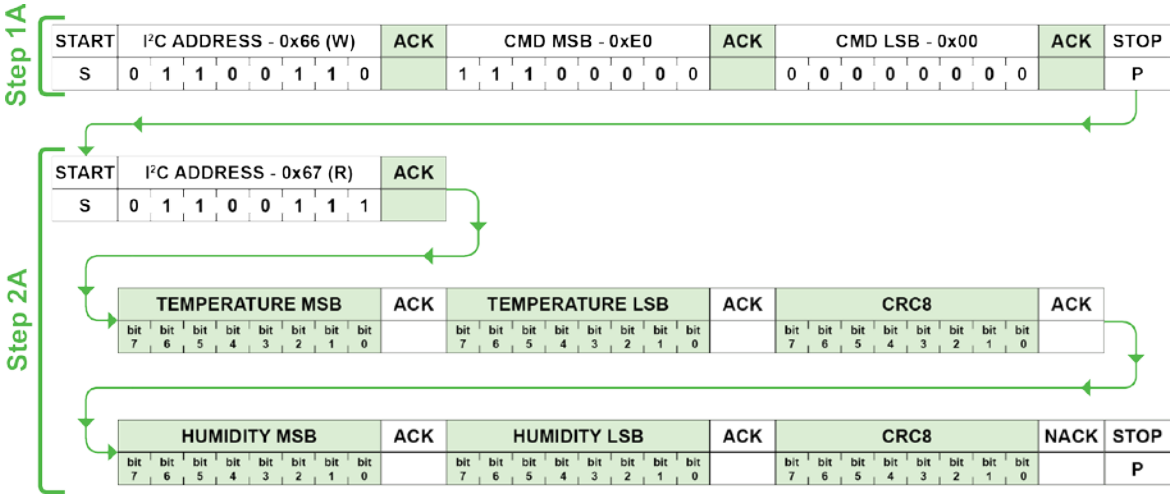
The green marked content comes from the module, other commands are sent by the master. First, the EE894 needs to be initialized on which two measurands shall be read.

Step 1A:

Initialize command 1 or switch from command 2 to command 1 for reading the temperature and relative humidity data.

Step 2A:

Now the temperature and the relative humidity data can be read.

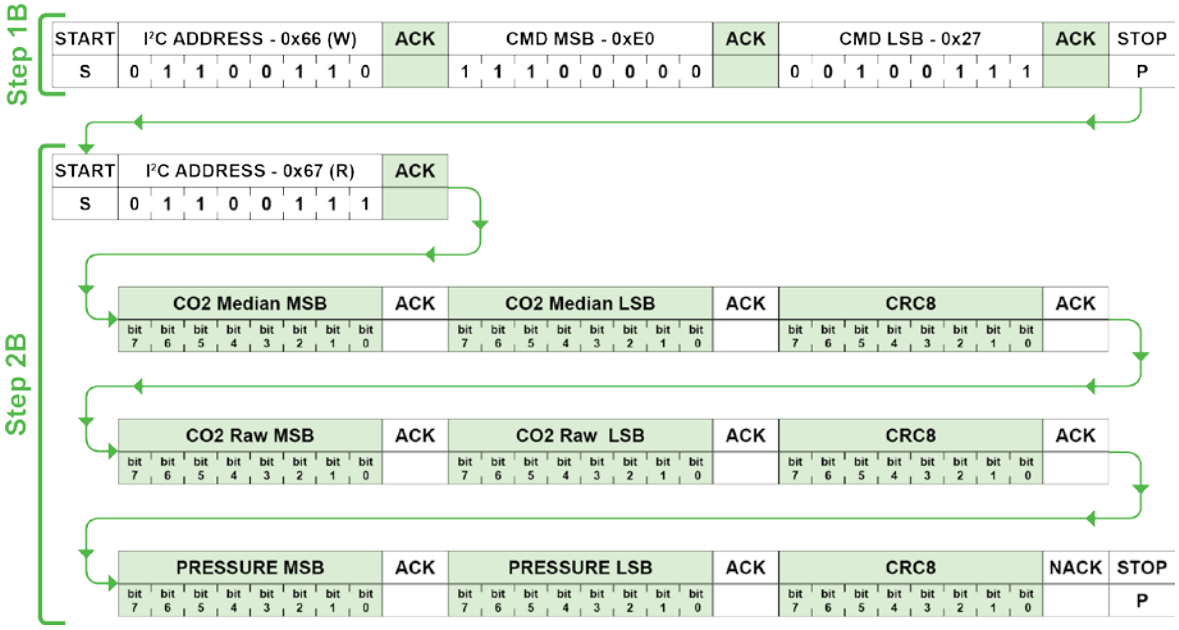


Step 1B:

Initialize command 2 or switch from command 1 to command 2 for reading the CO2 and the pressure data

Step 2B:

Now the CO2 and ambient pressure data can be read:



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