DZ NAGANO
Sensortechnik

Serial Communication
via I²C

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Gesellschaft für Sensortechnik

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APPLICATION NOTE

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EI-000021-B

■ I²C Protocol Description

1. General

The I²C protocol has been developed and specified by Philips. The pressure transducers made by ADZ NAGANO GmbH conform to the protocol without the 10bit address extension. The pressure transducer can be operated as a slave only.

2. List of abbreviations

I²C	Inter-integrated circuit bus
SDA	Serial data
SCL	Serial clock (serial cycle)
ACK	Acknowledge bit

3. 3 Bus structure / topology of the I²C-bus

The I²C-bus has been designed as a line structure (cf. 1). The data is sent and received synchronously via the SDA line. The SCL line is used for synchronizing the bus participant.

In a bus system, the two lines need to be provided once with pull-up resistors. The pull-up resistors are to be dimensioned in accordance with the bus capacity. 2 can be used as a reference. Please, obtain further information from the specification [1].
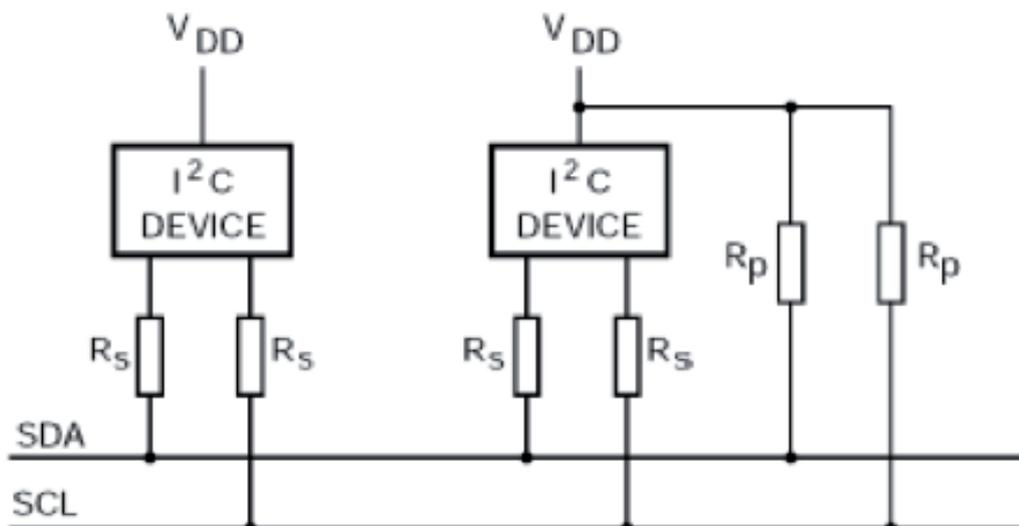

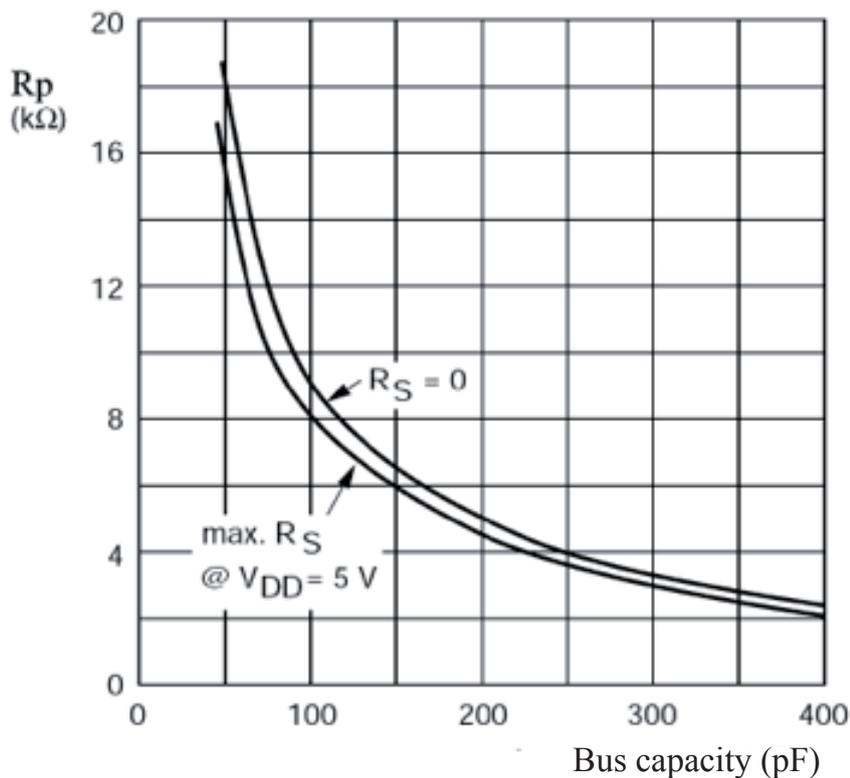*Figure 1: I²C-bus in line structure with pull-up resistors [1]*

Figure 2: Size of the pull-up resistor depending on the bus capacity [1]

4. Transfer rates
Standardized transfer rates between 100kHz and 400kHz are supported.

5. Structure of the I²C message
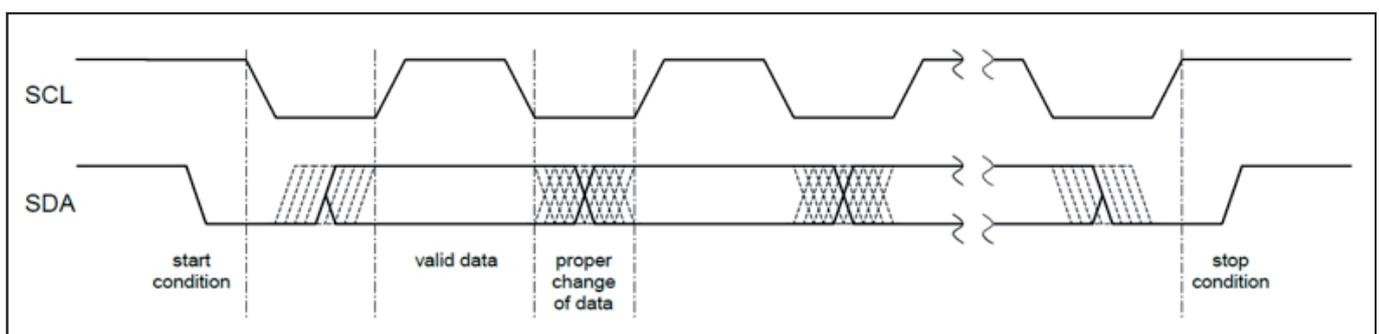The structure of the I²C message is shown in 3.

Figure 3: Structure of the I²C message

An I²C message always starts with a start condition. This is followed by the address byte with the read/Write bit that indicates the direction of the data. The receipt of the first byte is confirmed by the acknowledge bit. Now, the data is sent. The recipient acknowledges receipt of the byte by the ACK. In the event of unsuccessful transfer, sending the message is disrupted. A message is ended by sending a stop condition.

5.1 Start condition
The start condition is displayed on the bus by pulling the SDA signal to LOW, while SCL remains HIGH.

5.2 Stop condition
The stop condition is displayed on the bus by pulling the SDA signal to HIGH, while SCL remains HIGH.

5.3 Data transfer
During data transfer, the level of the SDA line can only be changed when the SCL signal is LOW. The start and stop conditions are an exception. The SCL line is driven by the master.

6. Data format
Four bytes can be read from the pressure transducer. The first two bytes contain the pressure value, the last two bytes contain the temperature value. The data must be interpreted as Big Endian. Scaling can be learned from the data sheet, as it always depends on the pressure range set.

7. Standard settings of the pressure transducer
The following table describes the standard settings. They may deviate from the respective default setting of the article. The data sheet that specifies an article is imperative.

Parameter	Value	Meaning
SCL clock frequency	100 kHz	Data transfer rate
Address	0x78	
Value range 60.4	1000-31000 digits	Value range to which the pressure range has been scaled
Value range 60.14	50-26500 digits	Value range to which the pressure range has been scaled
Value range 60.15	1000-30000 digits	Value range to which the pressure range has been scaled

8. Error values
If bit 15 has been set in the pressure message, that value shall be interpreted as an error. The following errors are recognized and displayed.

Error value	Meaning
0xCAAA	Speicherfehler EEProm
0xCF0F	Speicherfehler RAM
0xCE38	Speicherfehler Register
0xCCCC	Speicherfehler EEProm
0xC1C7	Fehler bei der Berechnung
0xC5555	Auslösung Watchdog
0xCFCF	Sensorbrücke ist beschädigt

9. Bibliography
[1] Philips Seminconductors (Hrsg.): The I²C-bus specification.: Philips Seminconductors 2000