

# 4-Channel PC Interface Module and Data Acquisition Instrument BSC4D



BSC4D-D  
BSC4D-BT

Operating Manual

Released March 25, 2025



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## Strain gage measuring amplifier BSC4D-D



BSC4D-C M12 Connectors  
Front view sensor connection



BSC4D-D D37-Pin D-Sub  
Front view sensor connection

- 4-channels
- Power supply via USB port
- Inputs for Strain gage / 0–10 V / PT1000
- Measurement ranges 2 mV/V / 10 mV/V
- Strain gage quarter / half / full bridges
- 8 digital inputs / outputs

### Description

This 4-channel measuring amplifier for sensors with strain gages is equipped with a USB interface. The measuring amplifier can be delivered with an 37-pin D-Sub connection or with 4x M12 ports. The measuring amplifier has eight digital inputs and outputs.

On the backside 25-pin D-Sub socket, strain gage full-bridges and half-bridges 120 Ohm up to 1 kOhm as well as PT1000 temperature sensors and 1000 Ohm single grid strain gages or voltages 0 ... 5V can be connected.

The front-end M12 socket is configured by default for strain gage full-bridge connections and for voltage inputs 0 ... 5V and 0 ... 10V.

## Dimensions

Figure 1: Dimensions BSC4D-D 37-pin D-Sub

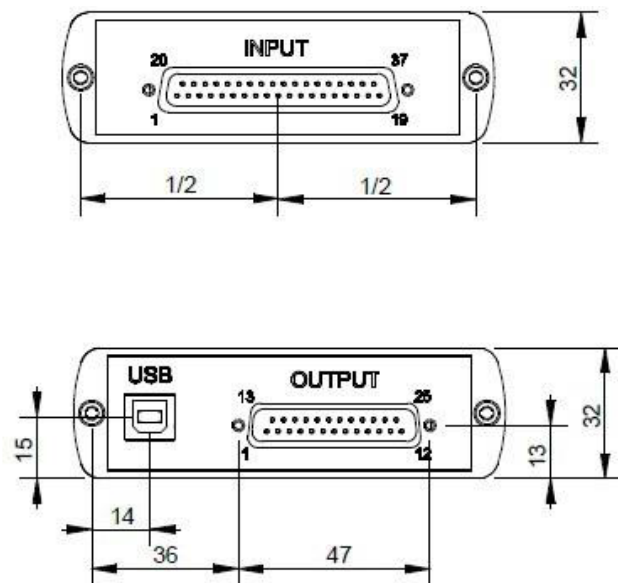
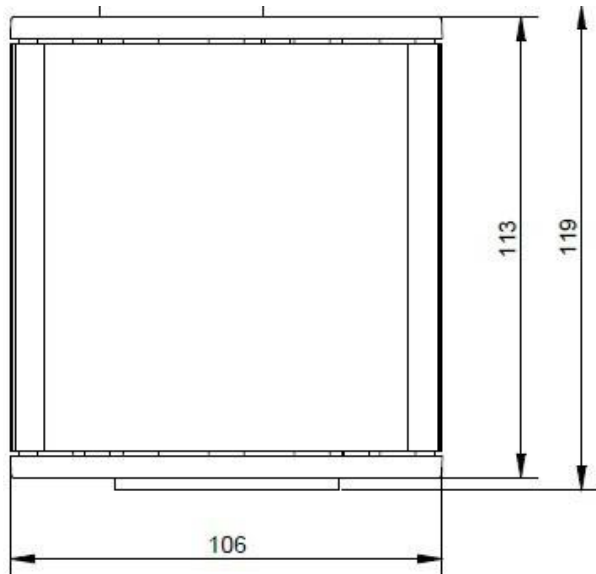
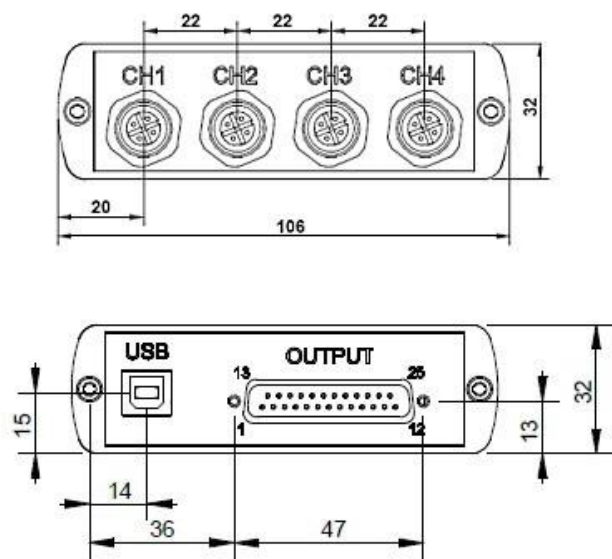
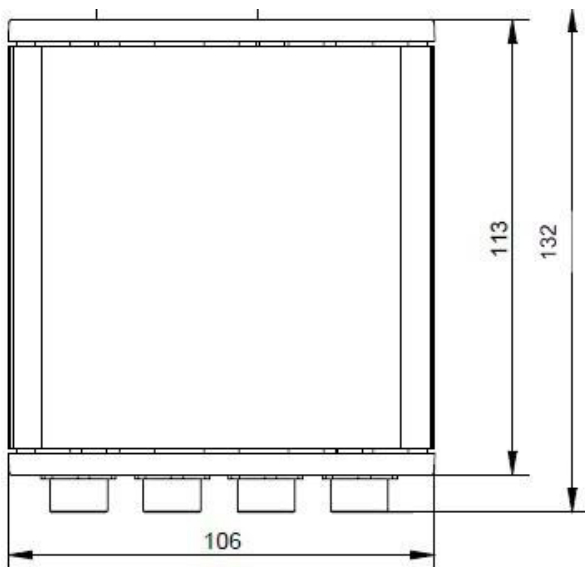


Figure 2: Dimensions BSC4D-C M12



## Technical data

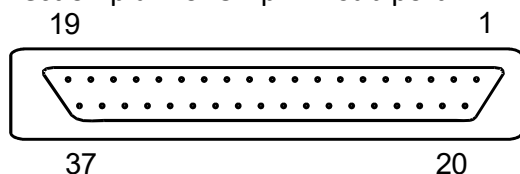
|                             |                             |              |
|-----------------------------|-----------------------------|--------------|
| Accuracy class              | 0.05                        | %            |
| Inputs                      |                             |              |
| Resolution                  | 16                          | Bit          |
| Strain gage inputs          |                             |              |
| Full bridge                 | 89-5000                     | Ohm          |
| Half bridge                 | 89-5000                     | Ohm          |
| Quarter bridge              | 120 / 350 / 1000            | Ohm          |
| Common mode rejection       |                             |              |
| at 60 Hz common-mode signal | 95–110                      | dB           |
| Measurement frequencies     |                             |              |
| Data frequency              | 0 – 500                     | Hz           |
| Sampling frequency          | 1.92                        | MHz          |
| Cut-off frequency           |                             |              |
| analog                      | 450                         | Hz           |
| digital                     | Notch filter                | Hz           |
| Outputs                     |                             |              |
| Bridge supply voltage       | 2.5                         | Volt         |
| Current load capacity       | 30                          | mA           |
| Fixed voltage output        | 5                           | V            |
| Current load capacity       | 20                          | mA           |
| Switching outputs/inputs    | TTL level                   |              |
| I/O 1-8                     | 5 (active High)             | V            |
| Current load capacity:      | 5                           | mA           |
| Interface                   | USB 1.1, USB 2.0 compatible |              |
| Supply voltage              |                             |              |
| Nominal range               | 4.5... 5.5 via USB port     | V DC         |
| Isolation voltage           | 1000                        | Vrms         |
| Current consumption         | < 200                       | mA           |
| Temperature range           |                             |              |
| Nominal temperature range   | -10...+65                   | °C           |
| Storage temperature range   | -40...+85                   | °C           |
| Zero point drift            | < 0.05                      | %/10°C       |
| Sensitivity drift           | < 0.01                      | %/10°C       |
| Dimensions                  |                             |              |
| L x W x H                   | 106 x 119 (132) x 32        | mm x mm x mm |
| Protection type / Weight    |                             |              |
| Protection type             | IP40                        |              |

|                             |     |   |
|-----------------------------|-----|---|
| Weight BSC4D-D 37-pin D-Sub | 239 | g |
|-----------------------------|-----|---|

Table 1: Technical data BSC4D-D

## Connection assignment

Connection plan for 37-pin D-sub port



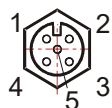
|        | BSC4D-D assignment             | 37-pin D-sub port (PIN No.) |           |           |           |
|--------|--------------------------------|-----------------------------|-----------|-----------|-----------|
|        |                                | Channel 1                   | Channel 2 | Channel 3 | Channel 4 |
| +US    | positive sensor supply         | 20                          | 2         | 11        | 29        |
| +UD    | positive differential input    | 22                          | 4         | 13        | 31        |
| QB1000 | quarter bridge extension 1kOhm | 23                          | 5         | 14        | 32        |
| HB     | half bridge extension          | 24                          | 6         | 15        | 33        |
| -UD    | negative differential input    | 25                          | 7         | 16        | 34        |
| -US    | negative sensor supply         | 27                          | 9         | 18        | 36        |
| UE     | analog input                   | 28                          | 10        | 19        | 37        |
|        | screen                         | 1                           | 1         | 1         | 1         |

Table 2: analog inputs

## Connection assignment for BSC4D-C M12

5-pin port M12x1, type 763

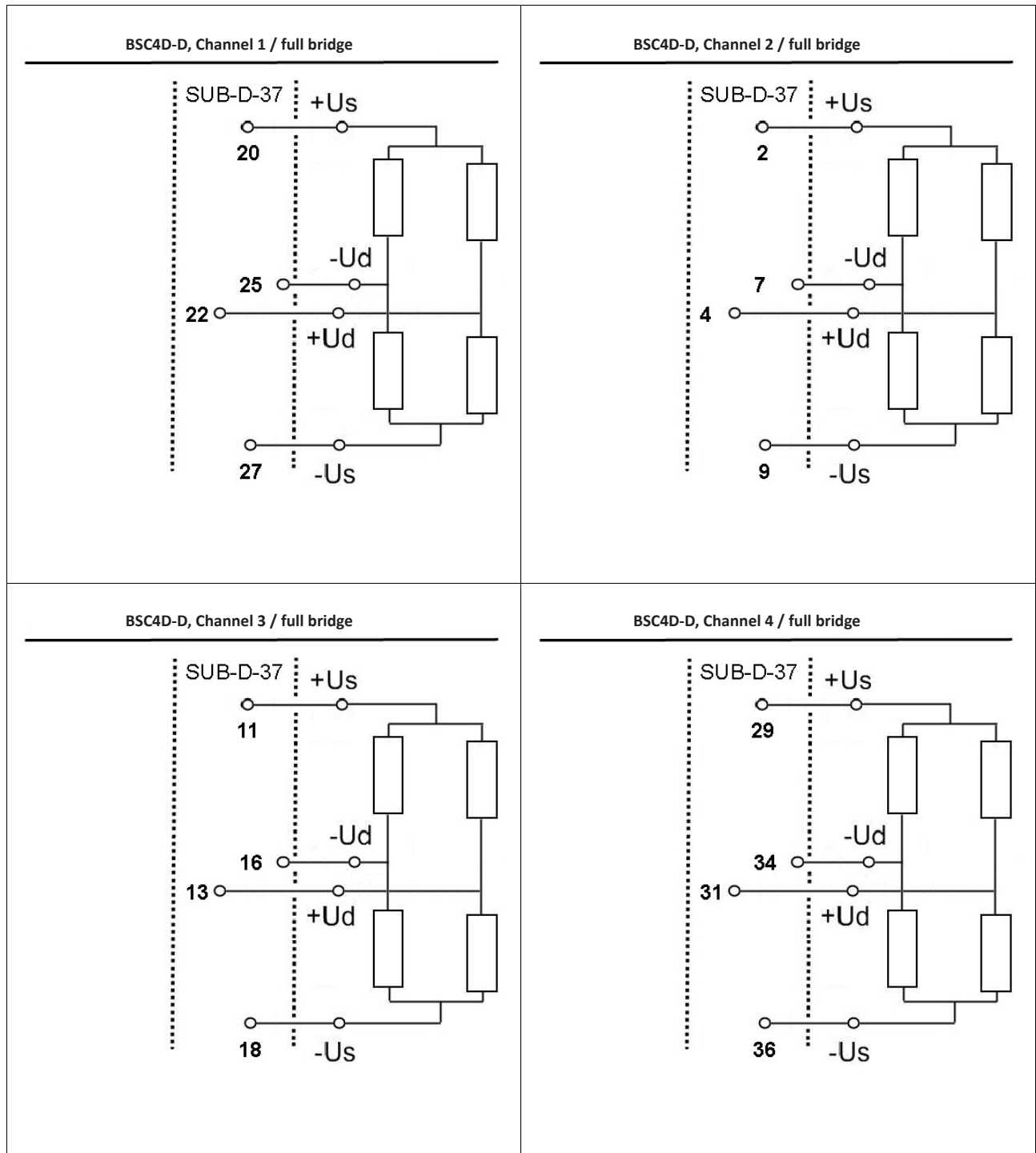
Top view:



| 5-pin | Description                     | Color code for cables |
|-------|---------------------------------|-----------------------|
| 2     | -US negative bridge supply      | white                 |
| 1     | +US positive bridge supply      | brown                 |
| 3     | +UD positive differential input | blue                  |
| 4     | -UD negative differential input | black                 |
| 5     | AUX in input without cable      | grey                  |

## Connection of full bridge with BSC4D-D 37-pin D-Sub version

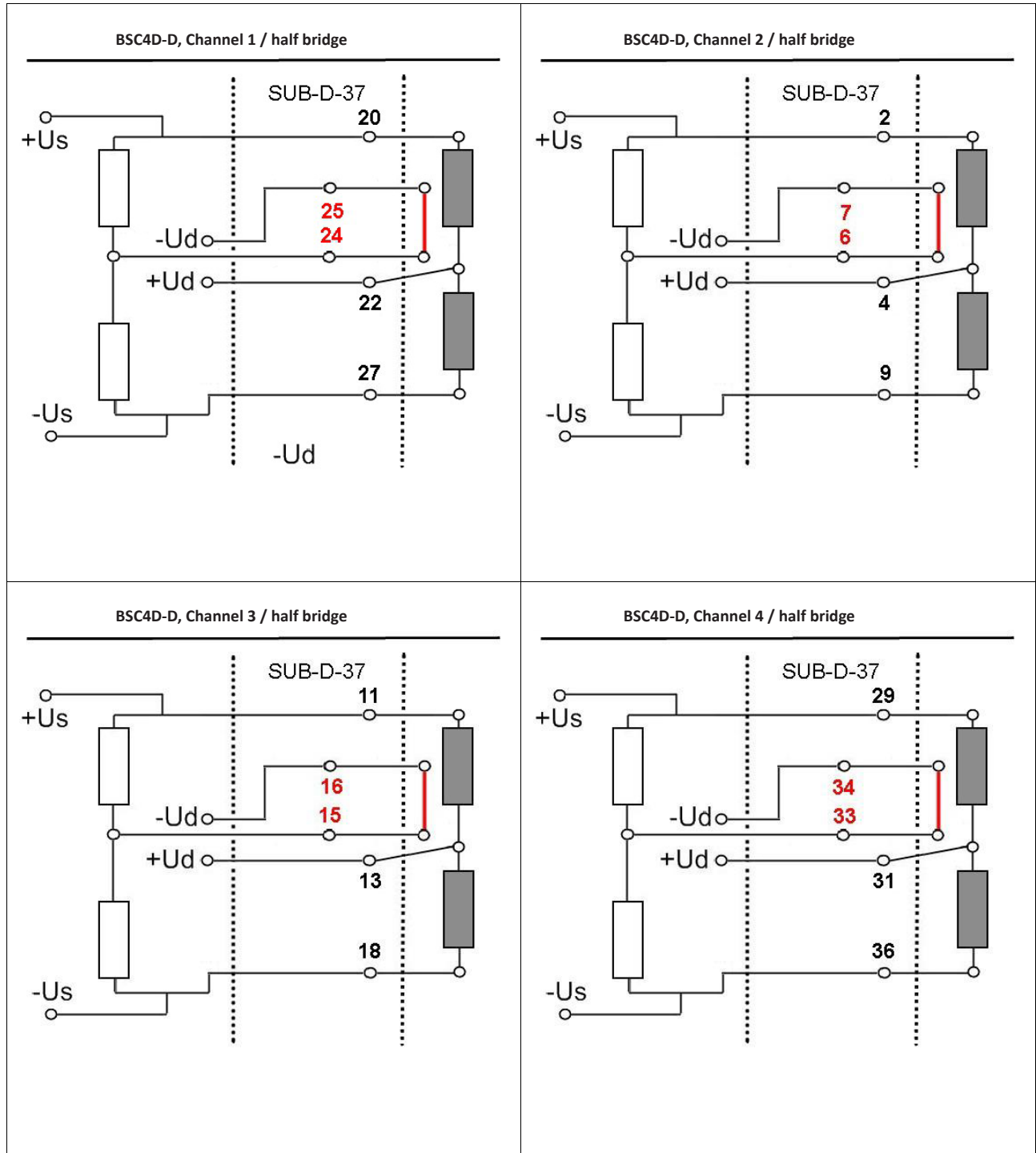
The following graphics show the connection of a full bridge to channel 1 through to channel 4.



## Connection of half bridge with BSC4D-D 37-pin D-Sub version

The following graphics show the connection of a half bridge to channel 1 through to channel 4.

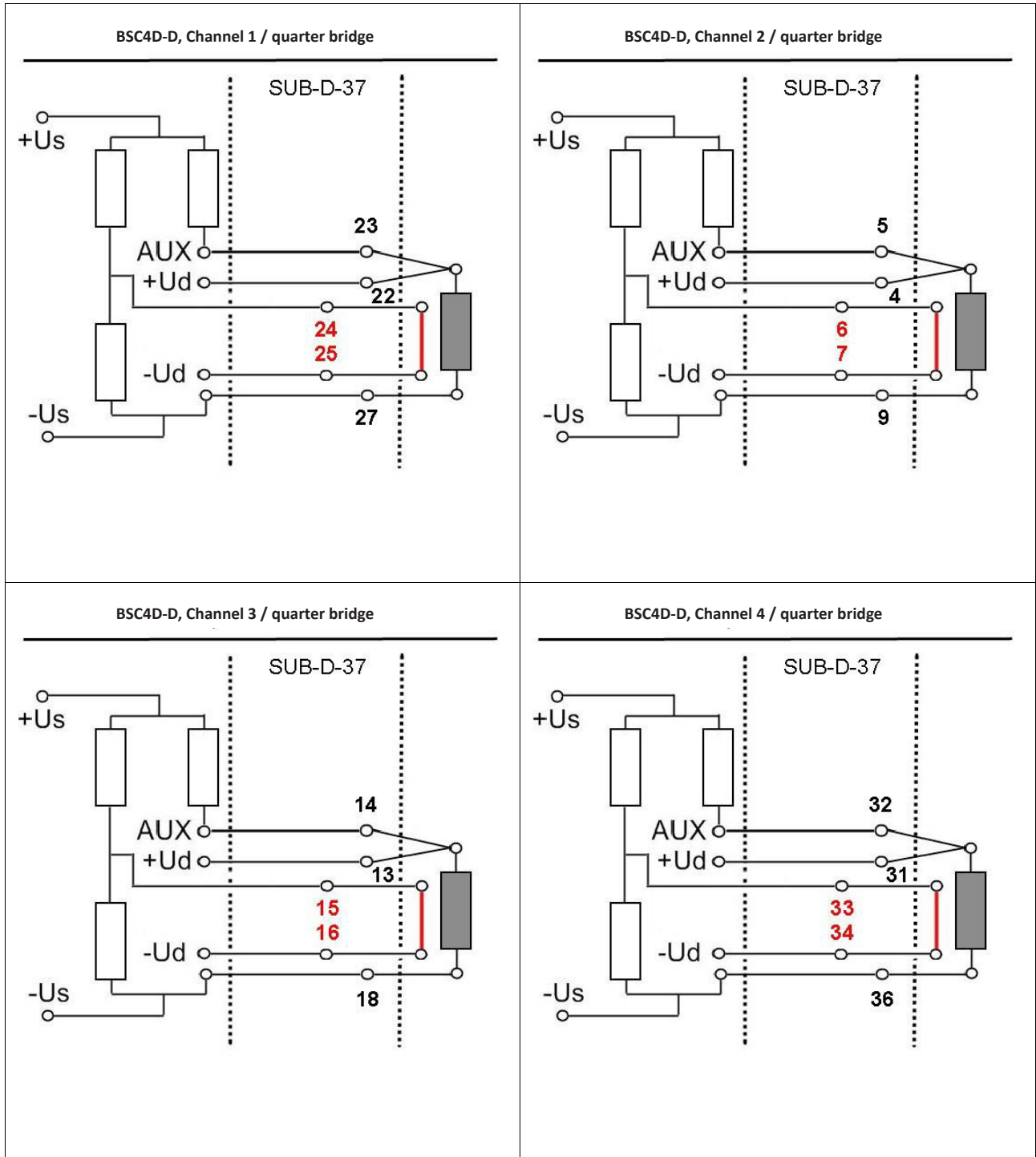
The bridge extension should be adapted depending on the application.



## Connection of quarter bridge with BSC4D-D 37-pin D-Sub version

The following graphics show the connection of a quarter bridge to channel 1 through to channel 4.

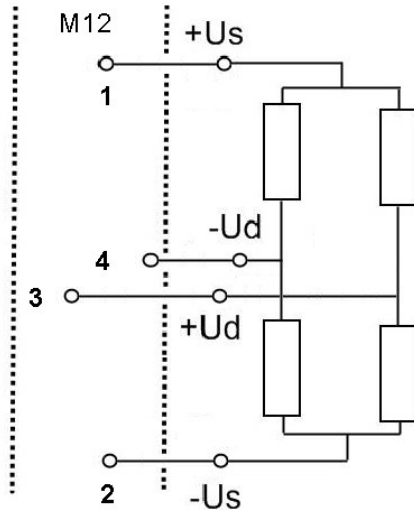
The bridge extension should be adapted depending on the application.



## Connection of full bridge with BSC4D-C M12 version

The following graphic shows the connection of a full bridge for the M12 version.

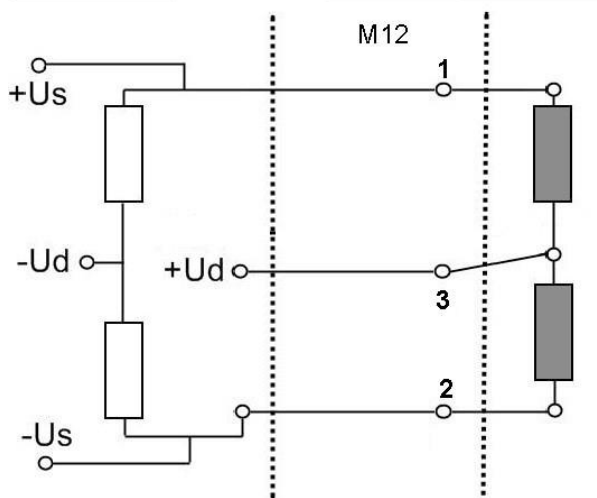
BSC4D-C, full bridge | M12



## Connection of half bridge with BSC4D-C M12 version

The following graphic shows the connection of a half bridge for the M12 version. The bridge extension should be adapted depending on the application.

BSC4D-C, half bridge | M12



■ HB1

Please close the jumper on the printed circuit board

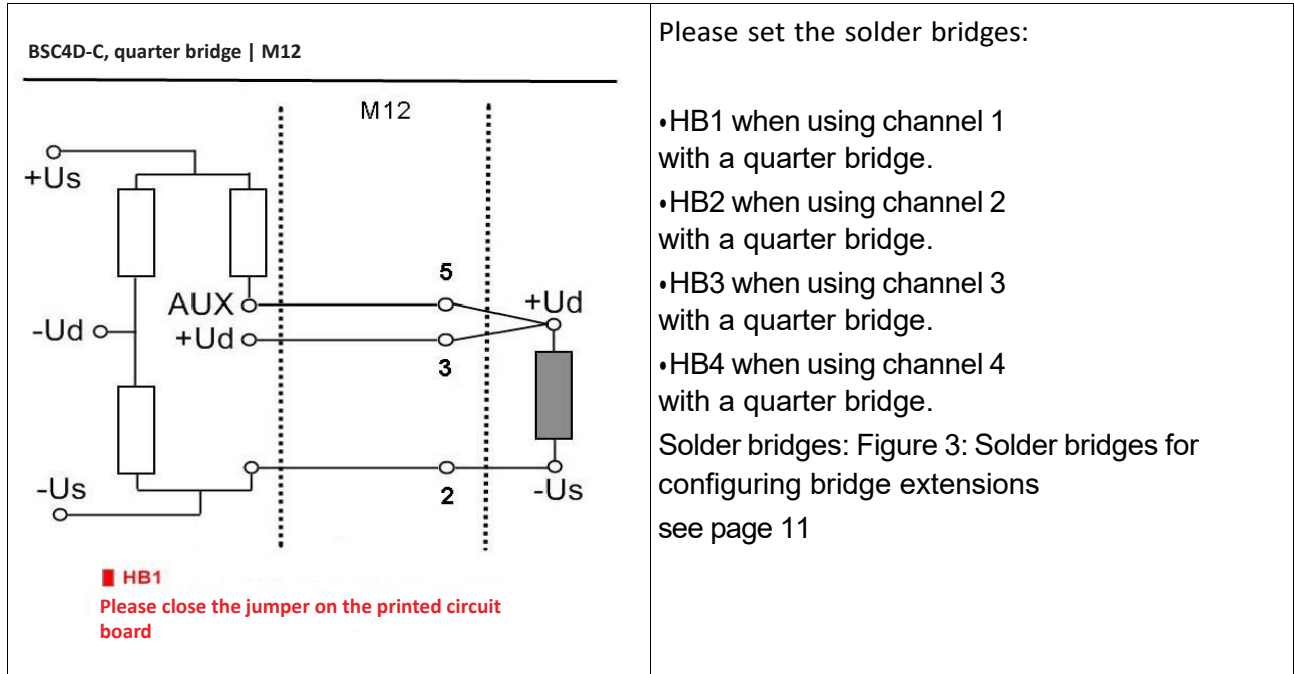
Please set the solder bridges:

- HB1 when using channel 1 with a half bridge.
- HB2 when using channel 2 with a half bridge.
- HB3 when using channel 3 with a half bridge.
- HB4 when using channel 4 with a half bridge.

Solder bridges: Figure 3: Solder bridges for configuring bridge extensions see page 11

## Connection of quarter bridge or PT1000 with M12 version

The following graphic shows the connection of a quarter bridge for the M12 version. The bridge extension should be adapted depending on the application.



## Adaptation of the bridge extension for BSC4D Opening the device

1. Remove both screw covers from the input side and remove the fastening screws from the front cover.
2. The two hexagonal bolts on the 37-pin D-Sub port must be loosened using a socket spanner (5 mm).
3. The printed circuit board is pulled out on the side of the 25-pin D-Sub port.

## Adaptation of the bridge extension with M12 version

The bridge extension can be individually adapted for each channel, for this purpose the device must be opened and, according to the following figures 1 - 5, the desired soldering bridge must be added. For PT1000 probes, the additional resistance 1kOhm is selected.

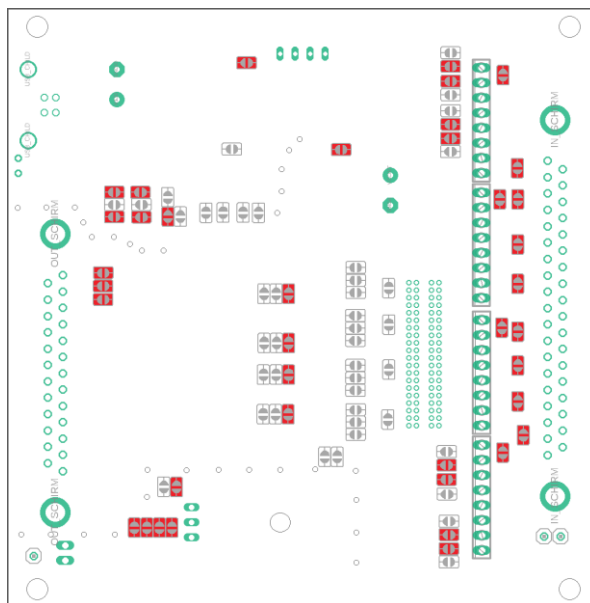


Figure 1: M12\_standard variant

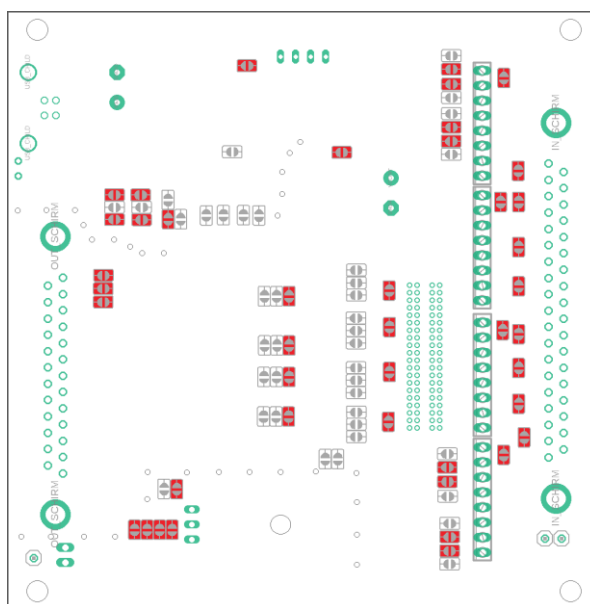


Figure 2: M12\_half bridge

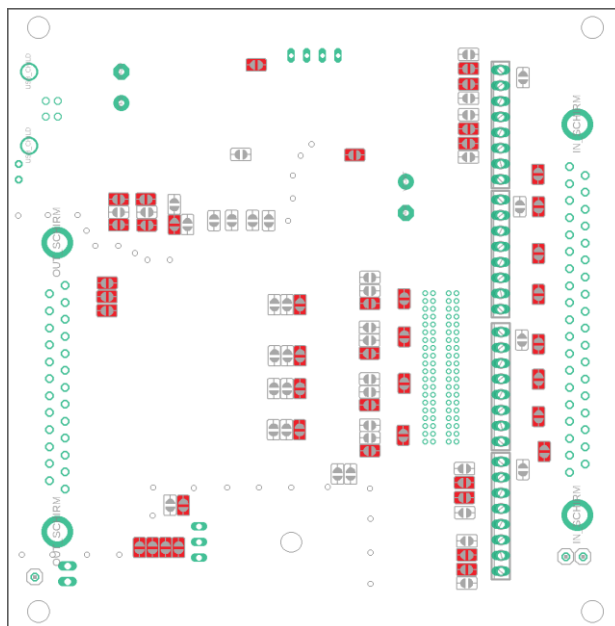


Figure 3: M12 quarter bridge 1kOhm

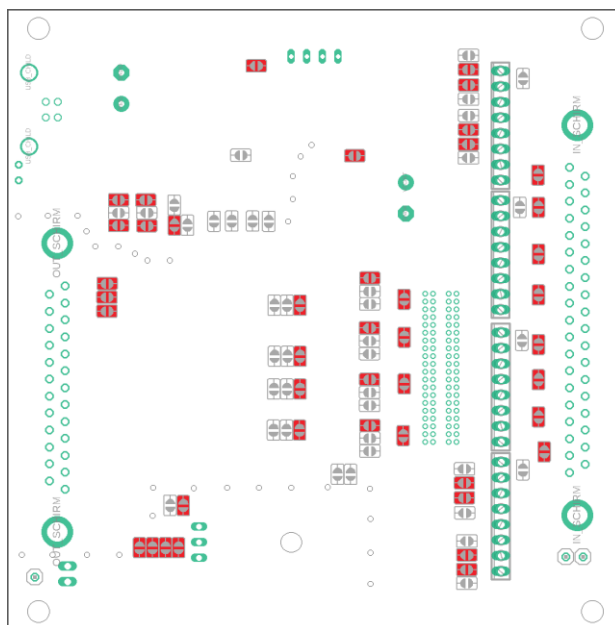


Figure 4: M12 quarter bridge 350Ohm

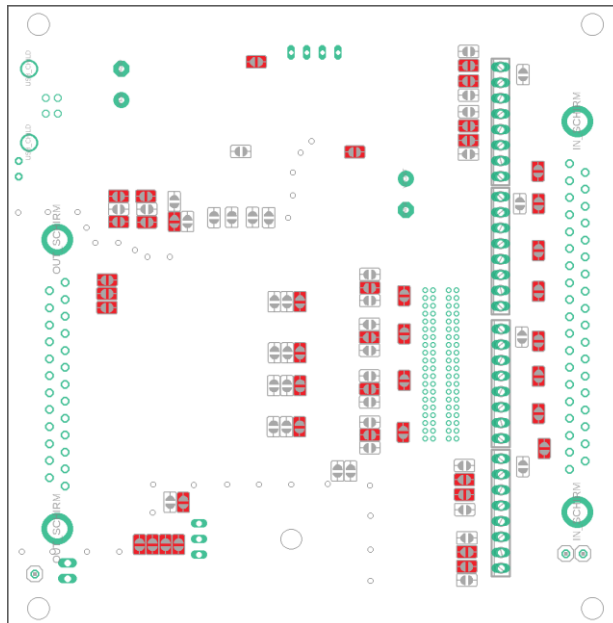


Figure 5: M12 quarter bridge 120Ohm

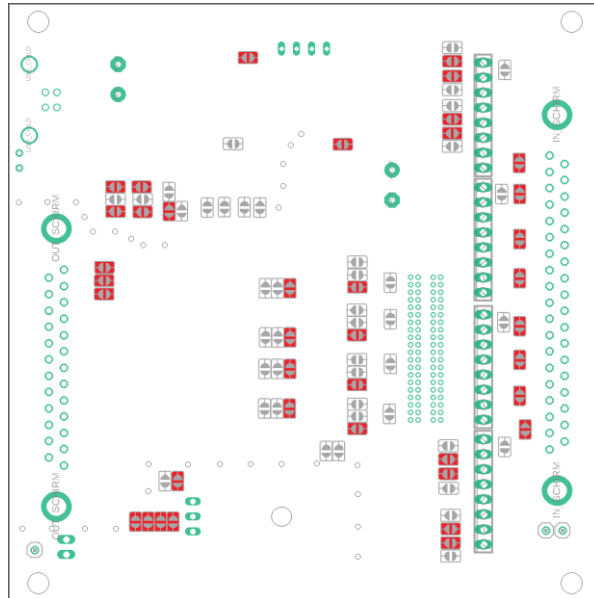
The following table explains the configuration options according to the figures already shown.

| Image, Configuration  | Plug Connector | Full bridge | Half Bridge | Quarter-Bridge 350 Ohm | Quarter-Bridge 120 Ohm | Quarter-Bridge 1000 Ohm |
|-----------------------|----------------|-------------|-------------|------------------------|------------------------|-------------------------|
| M12 Standard variant  | M12            | yes         | no          | no                     | no                     | no                      |
| M12 Half Bridge       | M12            | no *        | yes         | no                     | no                     | no                      |
| Quarter Bridge 350Ohm | M12            | no *        | yes         | yes                    | no                     | no                      |
| Quarter Bridge 120Ohm | M12            | no *        | yes         | no                     | yes                    | no                      |
| Quarter Bridge 1kOhm  | M12            | no *        | yes         | no                     | no                     | yes                     |

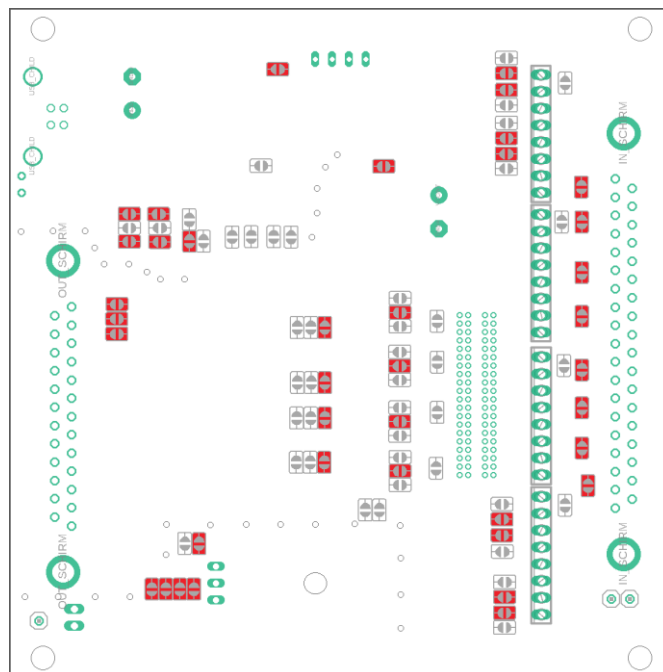
\* Measurement of a full bridge with active half-bridge is possible, but is carried out with a measurement error

### Adapting the bridge extension with Sub-D37 version

The bridge extension can be adapted individually for each channel, for this purpose the device must be opened and, according to the following figures 6 - 8 the desired soldering bridge must be supplemented.



*Figure 6: Sub-D37 standard variant*



*Figure 7: Sub-D37 quarter bridge 120Ohm*

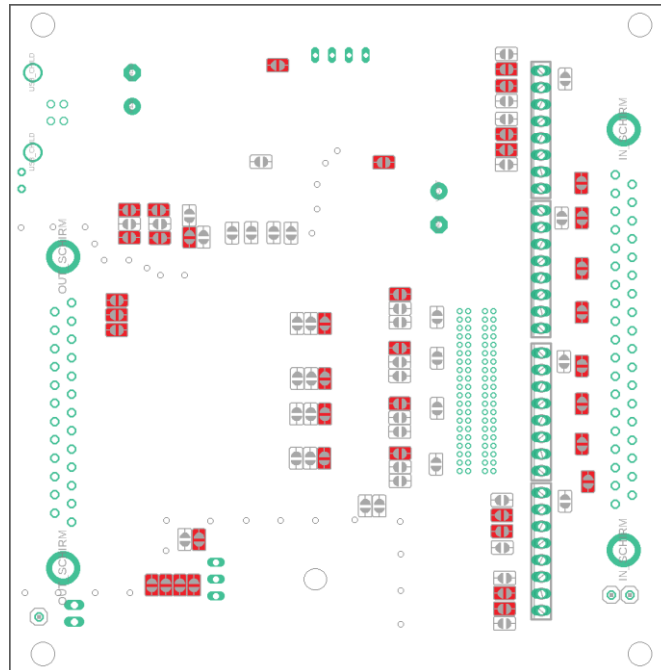


Figure 8: Sub-D37 quarter bridge 350Ohm

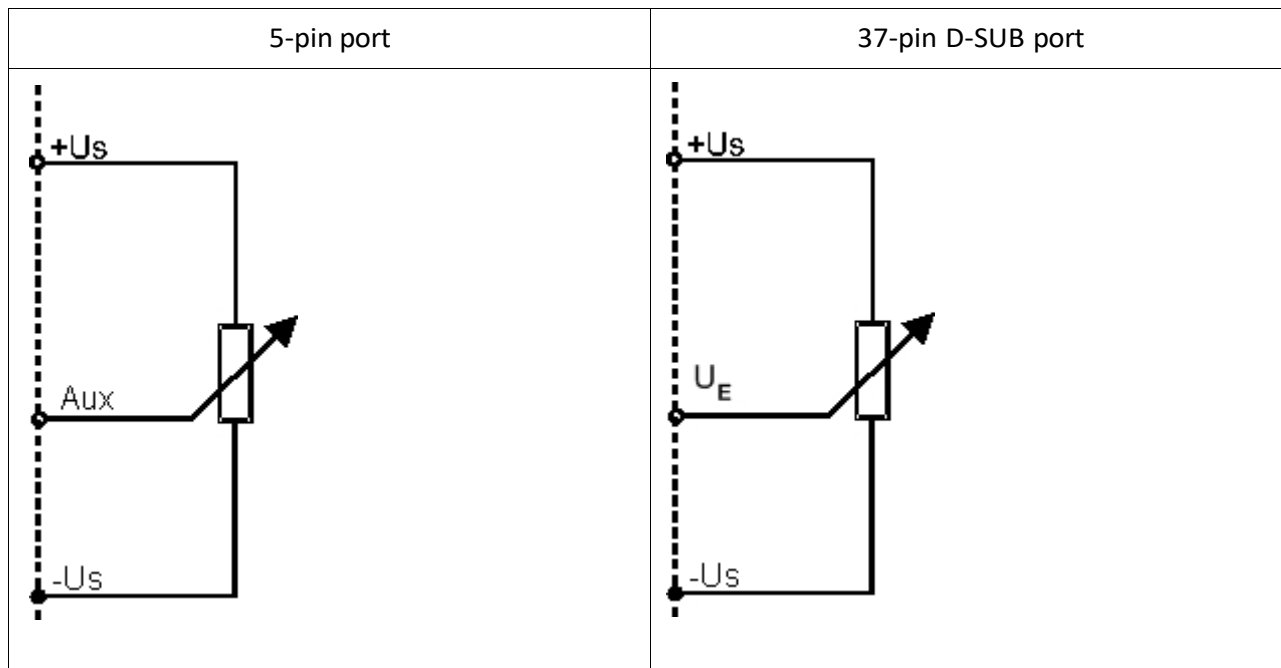
The following table explains the configuration options according to the figures already shown.

| Image, Configuration          | Plug connector | Full bridge | Half Bridge | Quarter-Bridge 350 Ohm | Quarter-Bridge 120 Ohm | Quarter-Bridge 1000 Ohm | Voltage input |
|-------------------------------|----------------|-------------|-------------|------------------------|------------------------|-------------------------|---------------|
| Sub-D37 Standard variant      | Sub-D37        | yes         | yes         | no                     | no                     | yes                     | yes           |
| Sub-D37 Quarter bridge 350Ohm | Sub-D37        | yes         | yes         | yes                    | no                     | no                      | yes           |
| Quarter bridge 120Ohm         | Sub-D37        | yes         | yes         | yes                    | yes                    | no                      | yes           |

## Wiring diagram for position sensors

The measuring amplifier BSC4D must be configured by the manufacturer separately when using it with potentiometric position sensors (linear potentiometers or draw wire displacement sensors) for the M12 version.

The position sensor's wiper is connected to the measuring amplifier's "Aux" input (M12) or "U<sub>E</sub>" (37-pin D-Sub). The position sensor supplies via the sensor supply +U<sub>s</sub> and -U<sub>s</sub>.



The potentiometric position sensor is supplied with 2.5 V. The "Aux" input or U<sub>E</sub> records voltages of 0...5 V.

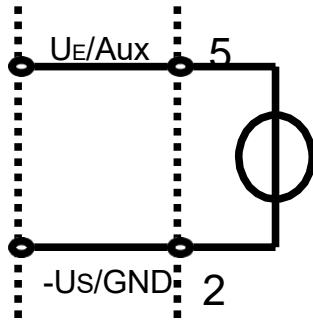
## Connection assignment

| Label               | 5-pin port | 37-pin D-SUB port    |      |      |      |      |
|---------------------|------------|----------------------|------|------|------|------|
|                     |            |                      | CH 1 | CH 2 | CH 3 | CH 4 |
| positive supply +Us | 1          | positive supply +Us  | 20   | 2    | 11   | 29   |
| negative supply -Us | 2          | negative supply -Us  | 27   | 9    | 18   | 36   |
| “Aux” input         | 5          | U <sub>E</sub> input | 28   | 10   | 19   | 37   |

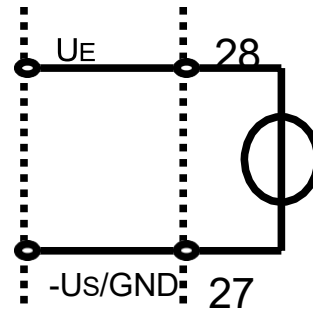
Connection diagram for voltage input 0...5V (0...10V)

The signal to be measured is connected to the input "Aux" (M12) or "U<sub>E</sub>" (37-pin D-Sub) of the measuring amplifier. The signal mass is connected to -US/GND.

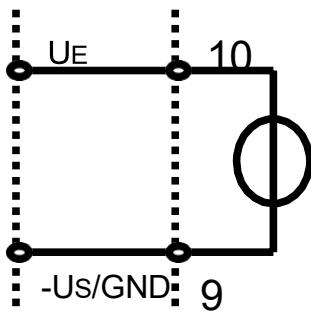
The input Aux or U<sub>E</sub> detects voltages of 0...5V (0...10V).



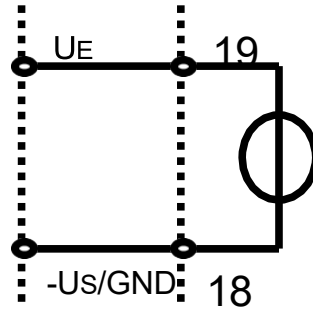
*Drawing 1: 5-pin socket*



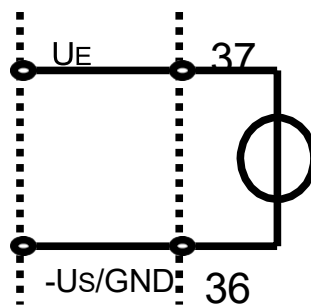
*Drawing 2: 37-pin Sub-D socket, CH 1*



*Drawing 4: 37-pin Sub-D socket, CH 2*



*Drawing 3: 37-pin Sub-D socket, CH 3*



*Drawing 5: 37-pin Sub-D socket, CH 4*

## Connection of the Way Con – draw wire sensor SX

| 4-pin port<br>Waycon draw wire sensor<br>SX | 5-pin port        |      | Label               |      | Color code M12<br>sensor-actuator<br>cable |
|---------------------------------------------|-------------------|------|---------------------|------|--------------------------------------------|
| 1 (+supply)                                 | 1                 |      | positive supply +Us |      | brown                                      |
| 3 (GND)                                     | 2                 |      | negative supply -Us |      | blue                                       |
| 2 (wiper)                                   | 5                 |      | “Aux” input         |      | white                                      |
| 4-pin port<br>Waycon draw wire sensor<br>SX | 37-pin D-SUB port |      |                     |      |                                            |
|                                             | CH 1              | CH 2 | CH 3                | CH 4 |                                            |
| 1 (+supply)                                 | 20                | 2    | 11                  | 29   | pos. supply +Us                            |
| 3 (GND)                                     | 27                | 9    | 18                  | 36   | neg. supply -Us                            |
| 2 (wiper)                                   | 28                | 10   | 19                  | 37   | U <sub>E</sub> input                       |

## Connection assignment SUB-D25 port

| BSC4D assignment            | 25-pin D-sub port (PIN-No.) |           |           |           |
|-----------------------------|-----------------------------|-----------|-----------|-----------|
| IO 5 V fixed voltage output | 1                           |           |           |           |
| IO GND                      | 2                           |           |           |           |
| IO 1                        | 3                           |           |           |           |
| IO 2                        | 4                           |           |           |           |
| IO 3                        | 5                           |           |           |           |
| IO 4                        | 6                           |           |           |           |
| IO 5                        | 7                           |           |           |           |
| IO 6                        | 8                           |           |           |           |
| IO 7                        | 9                           |           |           |           |
| IO 8                        | 10                          |           |           |           |
| TX                          | 11                          |           |           |           |
| RX                          | 12                          |           |           |           |
| GND                         | 13                          |           |           |           |
|                             | Channel 1                   | Channel 2 | Channel 3 | Channel 4 |
| GND                         | 14                          | 17        | 20        | 23        |
| 0...5V Input                | 15                          | 18        | 21        | 24        |
| AUX Input                   | 16                          | 19        | 22        | 25        |

## Strain Gage measuring amplifier BSC4D-BT



Figure 5: BSC4D-BT M12



- Bluetooth interface
- 4-channels
- Inputs for Strain gage / 0–10 V / PT1000
- Measurement ranges 2 mV/V / 10 mV/V
- Strain gage quarter / half / full bridges
- 8 digital inputs / outputs
- Data rate 0 Hz–500 Hz

### Description

The measuring amplifier BSC4D-BT is suited to wireless measurement data acquisition with wire strain gage sensors. The BSC4D-BT is suitable for connecting Strain gage full bridges and half bridges. For quarter bridges (120 Ohm, 350 Ohm, and 1000 Ohm), there is a connection option in three-wire technology.

Data is transmitted by radio via the Bluetooth Standard 2.0+EDR with serial port profile (SPP). The range is 20 m in buildings or up to 100 m when in direct line of sight.

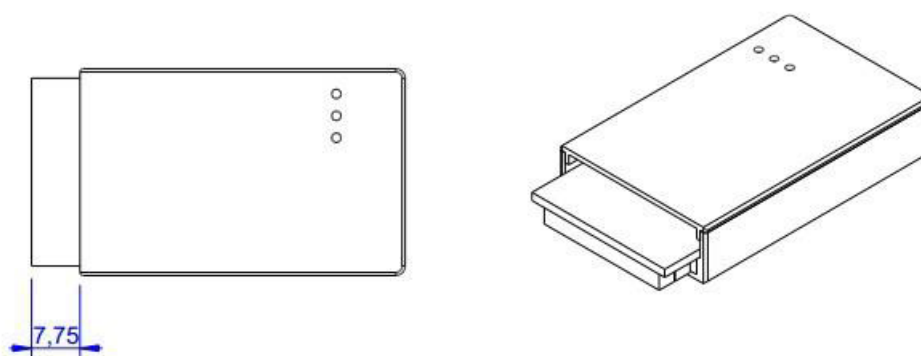
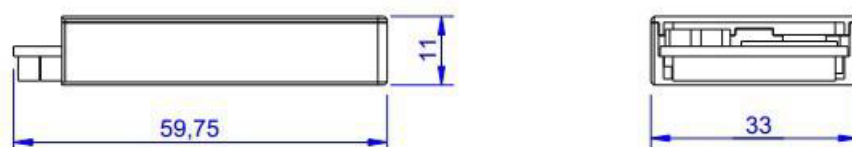
Commercial Bluetooth dongles with Widcom or Toshiba drivers which support the “serial- port- protocol” are suitable as receivers.

Data rates are possible from 0 Hz to 500 Hz. They are supplied via e.g. a lithium-polymer battery. By opening the interface for the application software, the module is switched on. Current consumption is less than 150 mA. When not in use, current consumption is under 10 mA. A battery can be charged at 5V supply voltage via an integrated charge regulator. Threshold values or digital outputs can be programmed with the 8 digital outputs

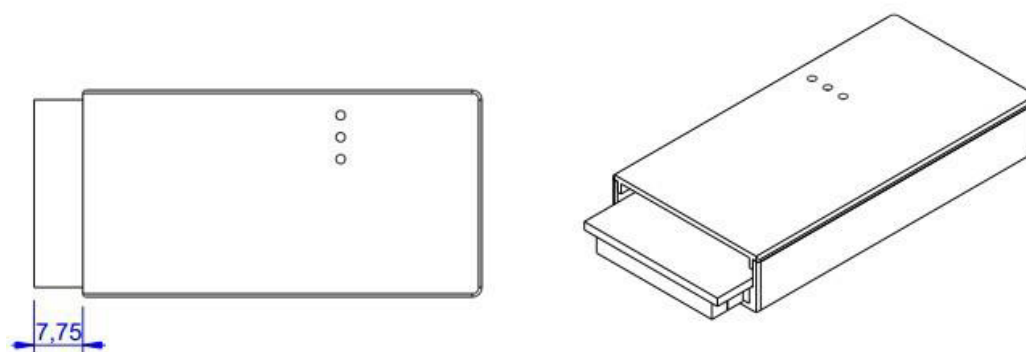
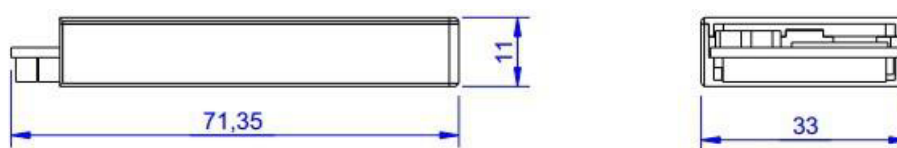
Standard PIN: 0000

## Dimensions

### BSC4D-BT SD



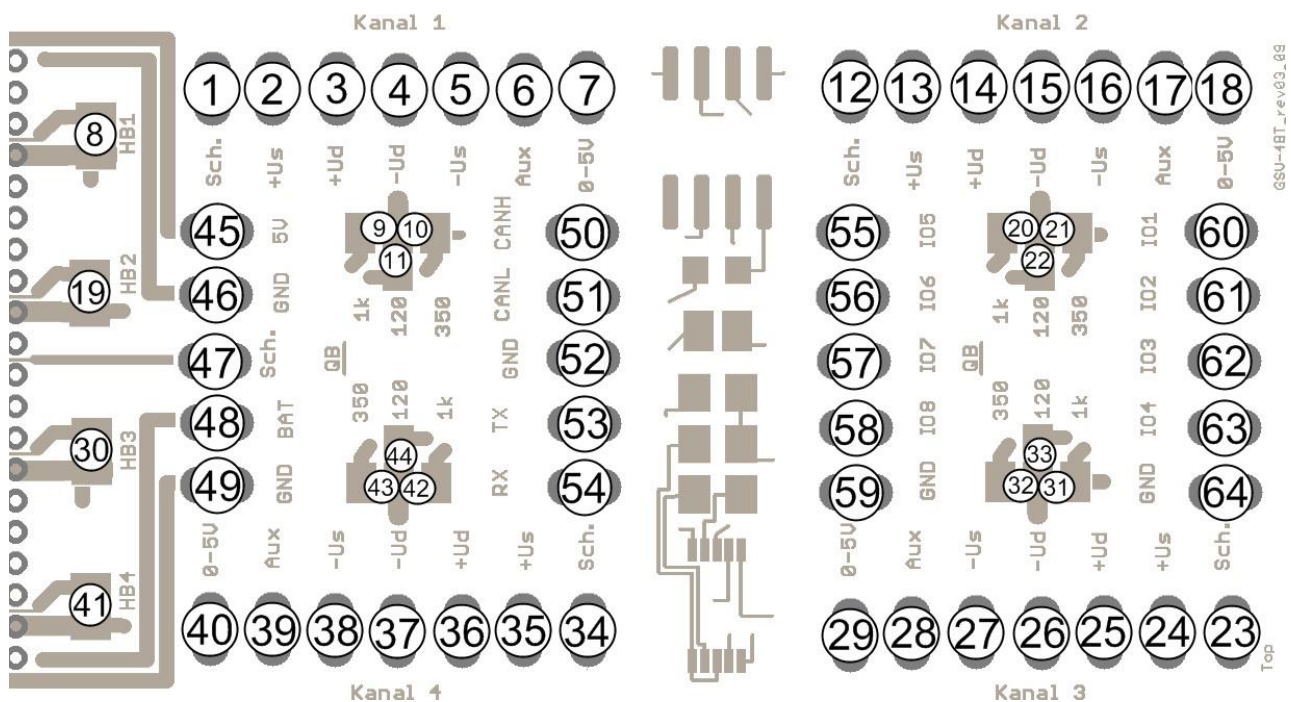
### BSC4D-BT LD



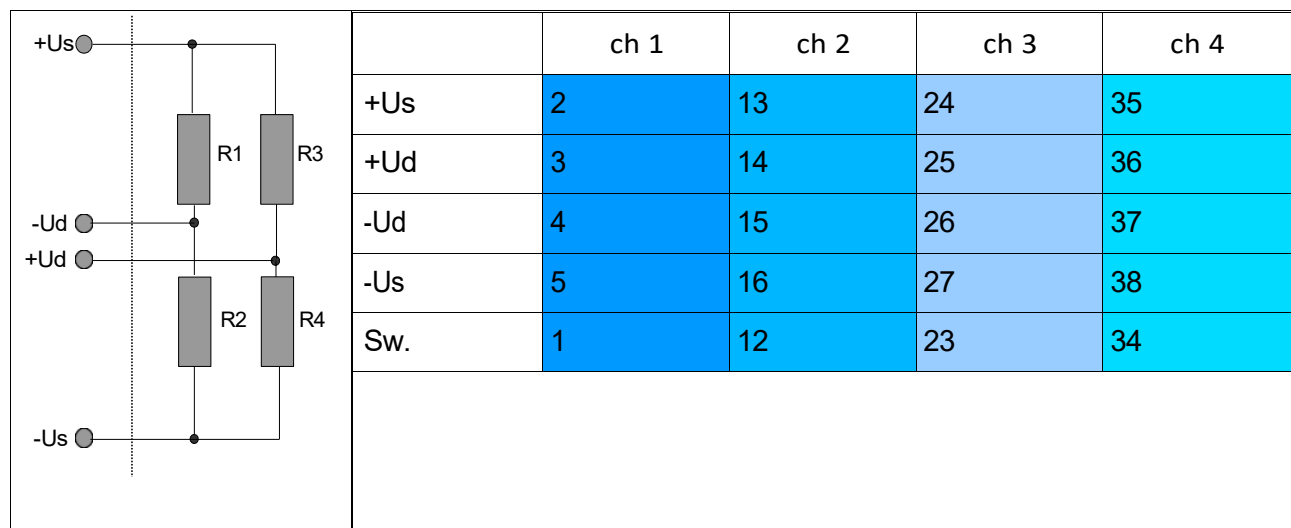
## Technical data

|                                                      |                            |              |
|------------------------------------------------------|----------------------------|--------------|
| Accuracy class                                       | 0.05                       | %            |
| Inputs                                               |                            |              |
| Resolution                                           | 16                         | Bit          |
| Strain gage inputs                                   |                            |              |
| Full bridge                                          | 89-5000                    | Ohm          |
| Half bridge                                          | 89-5000                    | Ohm          |
| Quarter bridge                                       | 120, 350, 1000             | Ohm          |
| Common mode rejection<br>at 60 Hz common-mode signal | 95–110                     | dB           |
| Measurement frequencies                              |                            |              |
| Data frequency                                       | 0–500                      | Hz           |
| Sampling frequency                                   | 1.92                       | MHz          |
| Cut-off frequency                                    |                            |              |
| analog                                               | 450                        | Hz           |
| digital                                              | Notch filter, configurable |              |
| Outputs                                              |                            |              |
| Bridge supply voltage                                | 2.5                        | Volt         |
| Current load capacity                                | 30                         | mA           |
| Switching outputs/inputs I/O 1-8                     | TTL level                  |              |
| Level                                                | 5 (active High)            | V            |
| Current load capacity:                               | 5                          | mA           |
| Interface                                            | Bluetooth Standard 2.0+EDR |              |
| Supply voltage                                       |                            |              |
| Nominal range                                        | 3.3...4.2                  | V DC         |
| Current consumption @ 4.2 V DC                       | < 150                      | mA           |
| Charge regulator                                     | 5.0 ± 0.5                  | V DC         |
| Current consumption @ 5.2 V DC                       | < 450                      | mA           |
| Temperature range                                    |                            |              |
| Nominal temperature range                            | -10...+65                  | -10...+65    |
| Storage temperature range                            | -40...+85                  | -40...+85    |
| Zero point drift                                     | < 0.05                     | %/10°C       |
| Sensitivity drift                                    | < 0.01                     | %/10°C       |
| Dimensions                                           |                            |              |
| L x W x H                                            | 60 x 33 x 10               | mm x mm x mm |
| Protection type                                      |                            |              |
|                                                      | IP64                       |              |

## Wiring diagram



## Strain gage full bridge



## Strain gage half bridge

|     | ch 1 | ch 2 | ch 3 | ch 4 |
|-----|------|------|------|------|
| +Us | 2    | 13   | 24   | 35   |
| +Ud | 3    | 14   | 25   | 36   |
| -Us | 5    | 16   | 27   | 38   |
| HBx | 8    | 19   | 30   | 41   |
| Sw. | 1    | 12   | 23   | 34   |

The active Straingage R3 and R4 are connected to the terminals +Us, +Ud and -Us.

HBx: The solder bridges "8", "19", "30" or "41" must be closed so that the internal extension resistors R1 and R2 are activated.

## Strain gage quarter bridge

|         | ch 1 | ch 2 | ch 3 | ch 4 |
|---------|------|------|------|------|
| +Ud     | 3    | 14   | 25   | 36   |
| -Us     | 5    | 16   | 27   | 38   |
| HBx     | 8    | 19   | 30   | 41   |
| AUX     | 6    | 17   | 28   | 39   |
| QB 120  | 11   | 22   | 33   | 44   |
| QB 350  | 10   | 21   | 32   | 43   |
| QB 1000 | 9    | 20   | 31   | 42   |
| Sw.     | 1    | 12   | 23   | 34   |

The active Strain gage R4 is connected to the terminals +Ud, AUX and -Us in 3-wire technology.

HBx: The solder bridges "8", "19", "30" or "41" must be closed so that the internal extension resistors R1 and R2 are activated.

A solder bridge should be set depending on the Strain gage resistance (120/350/1000 Ohm), e.g. 120 Ohm at channel 1: Solder bridge 11 (vertical); 350 Ohm at channel 2: Solder bridge 21 (horizontal).

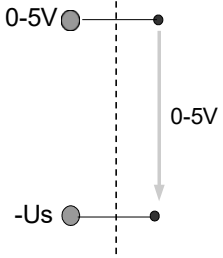
## PT-1000

|                                                                                                                                                                                                                        |         |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|------|------|------|------|
|                                                                                                                                                                                                                        |         | ch 1 | ch 2 | ch 3 | ch 4 |
|                                                                                                                                                                                                                        | AUX     | 6    | 17   | 28   | 39   |
|                                                                                                                                                                                                                        |         | 7    | 18   | 29   | 40   |
|                                                                                                                                                                                                                        | -Us     | 5    | 16   | 27   | 38   |
|                                                                                                                                                                                                                        | QB 1000 | 9    | 20   | 31   | 42   |
|                                                                                                                                                                                                                        | HBx     | 8    | 19   | 30   | 41   |
|                                                                                                                                                                                                                        | Sw.     | 1    | 12   | 23   | 34   |
| <p>HBx: The solder bridges “8”, “19”, “30” or “41” must be closed so that the internal extension resistors R1 and R2 are activated.</p> <p>The solder bridges “9”, “20”, “31” or “42” (horizontal) must be closed.</p> |         |      |      |      |      |

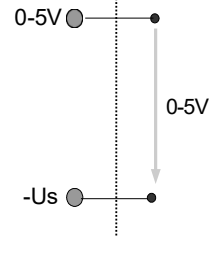
## Thermocouple cable type K

|  |                                                                                                                                                                         |      |      |      |      |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
|  |                                                                                                                                                                         | ch 1 | ch 2 | ch 3 | ch 4 |
|  | +Ud                                                                                                                                                                     | 3    | 14   | 25   | 36   |
|  | -Ud                                                                                                                                                                     | 4    | 15   | 26   | 37   |
|  | -Us                                                                                                                                                                     | 5    | -    | -    | -    |
|  | QB 1000                                                                                                                                                                 | 9    | -    | -    | -    |
|  |                                                                                                                                                                         | 7    | -    | -    | -    |
|  | HBx                                                                                                                                                                     | 8    | 19   | 30   | 41   |
|  | Sw.                                                                                                                                                                     | 1    | 12   | 23   | 34   |
|  | AUX                                                                                                                                                                     | 6    | 17   | 28   | 39   |
|  | <p>A reference sensor PT1000 must be connected to channel 1, Ue “0-5 V” terminal, AUX and -Us.</p> <p>The thermocouple cable is connected to terminals +Ud and -Ud.</p> |      |      |      |      |

### Voltage input 0-5 V

|  |           | ch 1 | ch 2 | ch 3 | ch 4 |
|-----------------------------------------------------------------------------------|-----------|------|------|------|------|
|                                                                                   | Ue „0-5V“ | 7    | 18   | 29   | 40   |
|                                                                                   | -Us       | 5    | 16   | 27   | 38   |
|                                                                                   | Sw.       | 1    | 12   | 23   | 34   |

### Voltage input 0-10 V

|  |           | ch 1 | ch 2 | ch 3 | ch 4 |
|------------------------------------------------------------------------------------|-----------|------|------|------|------|
|                                                                                    | Ue „0-5V“ | 7    | 18   | 29   | 40   |
|                                                                                    | -Us       | 5    | 16   | 27   | 38   |
|                                                                                    | Sw.       | 1    | 12   | 23   | 34   |

## Technical data BSC4D-BT M12

|                                                      |                            |              |
|------------------------------------------------------|----------------------------|--------------|
| Accuracy class                                       | 0.05                       | %            |
| Inputs                                               |                            |              |
| Resolution                                           | 16                         | Bit          |
| Strain gage inputs                                   |                            |              |
| Full bridge                                          | 89-5000                    | Ohm          |
| Half bridge                                          | 89-5000                    | Ohm          |
| Quarter bridge                                       | 120, 350, 1000             | Ohm          |
| Common mode rejection<br>at 60 Hz common-mode signal | 95–110                     | dB           |
| Measurement frequencies                              |                            |              |
| Data frequency                                       | 0–500                      | Hz           |
| Sampling frequency                                   | 1.92                       | MHz          |
| Cut-off frequency                                    |                            |              |
| analog                                               | 450                        | Hz           |
| digital                                              | Notch filter, configurable |              |
| Outputs                                              |                            |              |
| Bridge supply voltage                                | 2.5                        | Volt         |
| Current load capacity                                | 30                         | mA           |
| Switching outputs/inputs I/O 1-8                     | TTL level                  |              |
| Level                                                | 5 (active High)            | V            |
| Current load capacity:                               | 5                          | mA           |
| Interface                                            | Bluetooth Standard 2.0+EDR |              |
| Supply voltage                                       |                            |              |
| Nominal range                                        | 3.3...4.2                  | V DC         |
| Current consumption @ 4.2 V DC                       | < 150                      | mA           |
| Charge regulator                                     | 9,0 ... 36,0               | V DC         |
| Current consumption @ 5.2 V DC                       | < 100                      | mA           |
| Temperature range                                    |                            |              |
| Nominal temperature range                            | -10...+65                  | -10...+65    |
| Storage temperature range                            | -40...+85                  | -40...+85    |
| Zero point drift                                     | < 0.05                     | %/10°C       |
| Sensitivity drift                                    | < 0.01                     | %/10°C       |
| Dimensions                                           |                            |              |
| L x B x H for BSC4D-BT M12                           | 120 x 80 x 55              | mm x mm x mm |
| Protection type                                      |                            |              |

|                  |      |  |
|------------------|------|--|
| for BSC4D-BT M12 | IP65 |  |
|------------------|------|--|

## Switch configuration BSC4D-BT M12

| Input                                      | 1<br>brown | 2<br>red | 3<br>orange | 4<br>yellow | 5<br>green | 6<br>blue | 7<br>purple | 8<br>grey |
|--------------------------------------------|------------|----------|-------------|-------------|------------|-----------|-------------|-----------|
| Strain gage                                | OFF        | OFF      | OFF         | OFF         | OFF        | ON        | ON          | OFF       |
| PT1000                                     | ON         | OFF      | OFF         | OFF         | OFF        | OFF       | OFF         | ON        |
| Voltage                                    | OFF        | OFF      | OFF         | ON          | OFF        | OFF       | OFF         | OFF       |
| Thermo cable<br>+<br>on channel 1 - PT1000 | OFF        | OFF      | OFF         | OFF         | ON         | ON        | ON          | OFF       |
|                                            | ON         | OFF      | OFF         | ON          | OFF        | OFF       | OFF         | OFF       |
| Half bridge                                | OFF        | OFF      | OFF         | OFF         | ON         | OFF       | ON          | OFF       |
| Quarter bridge 1000 Ohm                    | ON         | OFF      | OFF         | OFF         | ON         | OFF       | ON          | OFF       |
| Quarter bridge 120 Ohm                     | OFF        | ON       | OFF         | OFF         | ON         | OFF       | ON          | OFF       |
| Quarter bridge 350 Ohm                     | OFF        | OFF      | ON          | OFF         | ON         | OFF       | ON          | OFF       |
| Displacement sensor                        | OFF        | OFF      | OFF         | ON          | OFF        | OFF       | OFF         | OFF       |

## Pin configuration for external supply voltage M8, 4-pin

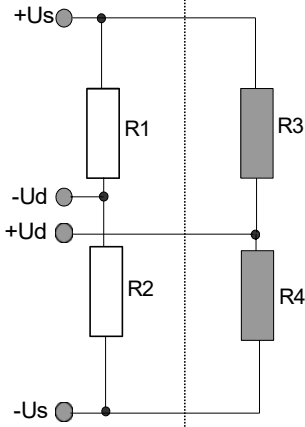
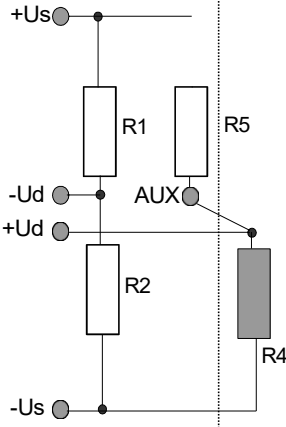
The external supply voltage can be connected via 4-pin round plug connector M8.

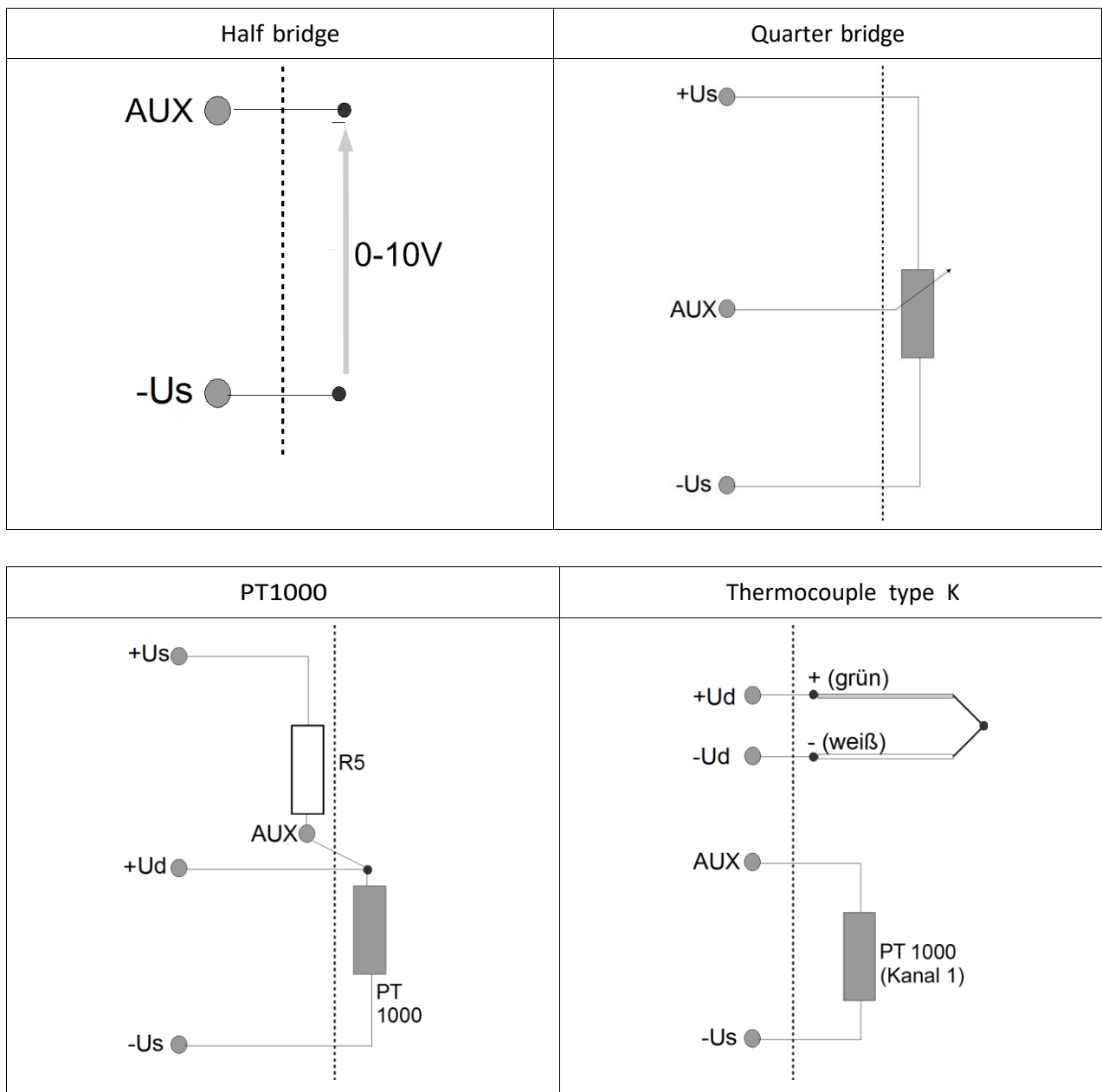
| Pin | Function                   | Sensor-Aktor Cable M8 |
|-----|----------------------------|-----------------------|
| 1   | Supply voltage 9...28 V DC | brown                 |
| 2   | Battery 4,2V               | white                 |
| 3   | GND Supply voltage         | blue                  |
| 4   | Battery GND                | black                 |

## Pin configuration BSC4D-BT M12

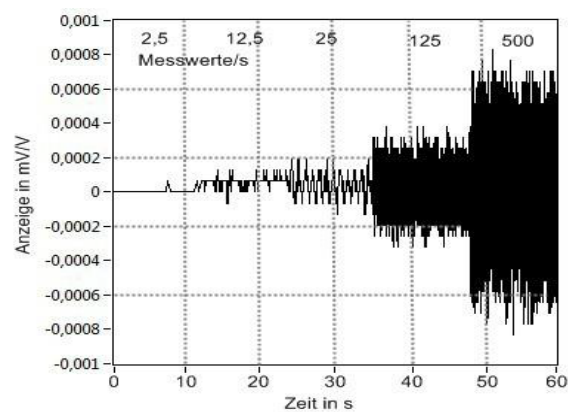
| Port side                                                                         | 5-pol. | Description                                 | Color |
|-----------------------------------------------------------------------------------|--------|---------------------------------------------|-------|
|  | 2      | -U <sub>S</sub> negative bridge supply      | white |
|                                                                                   | 1      | +U <sub>S</sub> positive bridge supply      | brown |
|                                                                                   | 3      | +U <sub>D</sub> positive differential input | blue  |
|                                                                                   | 4      | -U <sub>D</sub> negative differential input | black |
|                                                                                   | 5      | AUX in input without cable                  | grey  |

## Connection plan for BSC4D-BT M12

| Half bridge                                                                         | Quarter bridge                                                                       |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|  |  |
| Voltage input                                                                       | Potentiometric input                                                                 |



## Measurement resolution



The achievable relation signal / noise depends on the ambient conditions (cable length, shield) and on the settled data rate. The graphic illustrates the resolution with 1m cable, measuring range  $\pm 2\text{mV/V}$  and 350 Ohm Strain gage – Simulator on channel 1.

### Order variants BSC4D-BT

| Type                       | Description                                                                                                                |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------|
| BSC4D-BT                   | Miniature variant, external battery                                                                                        |
| Li-Ion 1S/1P/2.6Ah         | Li-Ion battery, 2,6Ah, for BSC4D-BT                                                                                        |
| Adapter-BSC4D-BT           | Connecting Adapter with solder connection for BSC4D-BT                                                                     |
| Adapter-BSC4D-BT MSTB      | Connecting Adapter with screw terminals RM2,5 for BSC4D-BT                                                                 |
| Bluetooth-USB-Adapter      | Bluetooth receiver with USB Port (to 100m)                                                                                 |
| BSC4D-BT M12               | Variant with housing and plug connector, integrated battery, "Long-Distance" in connection with Bluetooth USB-Dongle UD100 |
| BSC4D-BT LD                | Miniature Variant, external battery, „Long Distance“ to 300m in connection with Bluetooth USB-Dongle UD100                 |
| Bluetooth USB-Dongle UD100 | Bluetooth receiver with USB Port (to 300m, in connection with BSC4D-BT M12 or BSC4D-BT LD                                  |

## Programming / configuration

For programming Windows DLL and LabVIEW Vis can be downloaded from the website. Optionally it is possible to program the measuring amplifier directly via serial interface or USB with ASCII Codes.

## Scaling of measured values

Each channel can be configured individually for a defined measuring range, e.g.

for measuring

- with wire strain gages 2 mV/V,
- with wire strain gages 10 mV/V,
- with active sensors 0-5 V,
- with temperature sensors PT1000,
- with type K thermocouples,
- with active sensors 0–10 V,

The measuring range is set using the command “set\_gain”.

105% of the input signal matches a value range of 0x0000 to 0xFFFF.

## Measuring range 2.0 mV/V

| Measuring range $\pm 2$ mV/V (set_gain 0xB2 <p1> <p2>) with p1=ch, p2=0x01 |                      |                                   |
|----------------------------------------------------------------------------|----------------------|-----------------------------------|
| Input signal in mV/V                                                       | Measuring range in % | 16 Bit output value (hexadecimal) |
| 2.1                                                                        | 105.00%              | FFFFh                             |
| 2.0                                                                        | 100.00%              | F9E7h                             |
| 0.0                                                                        | 0.00%                | 8000h                             |
| -2.0                                                                       | -100.00%             | 0618h                             |
| -2.1                                                                       | -105.00%             | 0000h                             |

Conversion of digital output value to analog input signal:

Output value = Highbyte \* 256 + Lowbyte;

Input signal Ud = (output value - 32768) / 32768 \* 2.10 mV/V;

## Measuring range 10.0 mV/V

| Measuring range $\pm 10$ mV/V (set_gain 0xB2 <p1> <p2>) with p1=ch, p2=0x02 |                      |                                   |
|-----------------------------------------------------------------------------|----------------------|-----------------------------------|
| Input signal in mV/V                                                        | Measuring range in % | 16 Bit output value (hexadecimal) |
| 10.5                                                                        | 105.00%              | FFFFh                             |
| 10.0                                                                        | 100.00%              | F9E7h                             |

Measuring range  $\pm 10$  mV/V (set\_gain 0xB2 <p1> <p2>) with p1=ch, p2=0x02

|       |          |       |
|-------|----------|-------|
| 0.0   | 0.00%    | 8000h |
| -10.0 | -100.00% | 0618h |
| -10.5 | -105.00% | 0000h |

Conversion of digital output value to analog input signal:

Output value = Highbyte \* 256 + Lowbyte;

Input signal  $U_d = (\text{output value} - 32768) / 32768 * 10.5 \text{ mV/V}$ ;

Measuring range 0.0 to 5 V

Measuring range 0-5 V (set\_gain 0xB2 <p1> <p2>) with p1=ch, p2=0x03

| Input signal in V | Measuring range in % | 16 Bit output value (hexadecimal) |
|-------------------|----------------------|-----------------------------------|
| 5.25              | 105.00%              | FFFFh                             |
| 5.0               | 100.00%              | F9E7h                             |
| 0.0               | 0.00%                | 8000h                             |

Conversion of digital output value to analog input signal:

Output value = Highbyte \* 256 + Lowbyte;

Input signal  $U_d = (\text{output value} - 32768) / 32768 * 5.25 \text{ V}$ ;

Measuring range 0.0 to 10 V

Measuring range 0-10 V (set\_gain 0xB2 <p1> <p2>) with p1=ch, p2=0x07

| Input signal in V | Measuring range in % | 16 Bit output value (hexadecimal) |
|-------------------|----------------------|-----------------------------------|
| 10.5              | 105.00%              | FFFFh                             |
| 10                | 100.00%              | F9E7h                             |
| 0.0               | 0.00%                | 8000h                             |

Conversion of digital output value to analog input signal:

Output value = Highbyte \* 256 + Lowbyte;

Input signal  $U_e = (\text{output value} - 32768) / 32768 * 10.5 \text{ V}$ ;

Measuring range PT1000

Measuring range PT1000 (set\_gain 0xB2 <p1> <p2>) with p1=ch, p2=0x04

| Input signal in °C | Measuring range in % | 16 Bit output value (hexadecimal) |
|--------------------|----------------------|-----------------------------------|
| 1050               | 105%                 | FFFFh                             |
| 1000               | 100%                 | F9E7h                             |
| 0.0                | 0.0%                 | 8000h                             |

Measuring range PT1000 (set\_gain 0xB2 <p1> <p2>) with p1=ch, p2=0x04

|     |     |       |
|-----|-----|-------|
| -40 | -4% | 6DB0h |
|-----|-----|-------|

Conversion of digital output value to analog input signal:

Output value = Highbyte \* 256 + Lowbyte;

Input signal Ue = (output value - 32768) / 32768 \* 1050 °C;

## Measuring range K thermocouple cable

Measuring range K-thermocouple cable (set\_gain 0xB2 <p1> <p2>) with p1=ch, p2=0x06

| Input signal in °C | Measuring range in % | 16 Bit output value (hexadecimal) |
|--------------------|----------------------|-----------------------------------|
| 1050               | 105%                 | FFFFh                             |
| 1000               | 100%                 | F9E7h                             |
| 0.0                | 0.0%                 | 8000h                             |
| -40                | -4%                  | 6DB0h                             |

Conversion of digital output value to analog input signal:

Output value = Highbyte \* 256 + Lowbyte;

Input signal Ud = (output value - 32768) / 32768 \* 1050 °C;

## Commands for configuration

The code of the command concerned is sent to the measuring amplifier for configuration. Some commands expect parameters, e.g. the channel number “ch” and potentially other bytes.

**Note:** To set the configuration, the data transfer should be interrupted by sending the command “stop\_transmission”.

After completing the configuration, the data transfer can be restarted again by executing the command “start\_transmission”.

**Notes:** After each switch-on, the “normal mode” must be set in order to send commands (0x26 01 62 65 72 6C 69 6E).

## List of commands

The table lists the available commands (rev0x0B) and their hexadecimal codes.

| Commands              | Code | p1 | p2 | p3 | p4 | p5 | p6 | p7 | p8 | p9 |
|-----------------------|------|----|----|----|----|----|----|----|----|----|
| set_zero              | 0C   | ch |    |    |    |    |    |    |    |    |
| save_konfiguration    | 09   | B  |    |    |    |    |    |    |    |    |
| restore_konfiguration | 0A   | B  |    |    |    |    |    |    |    |    |

| Commands             | Code | p1 | p2 | p3 | p4 | p5 | p6 | p7 | p8 | p9 |
|----------------------|------|----|----|----|----|----|----|----|----|----|
| set_offset           | 0B   | ch | B  | HB | B  | LB |    |    |    |    |
| get_offset           | 0D   | ch | B  |    |    |    |    |    |    |    |
| set_frequency        | 12   | B  |    |    |    |    |    |    |    |    |
| get_frequency        | 16   |    |    |    |    |    |    |    |    |    |
| get_serial_number    | 1F   |    |    |    |    |    |    |    |    |    |
| set_serial_number    | 1E   | B  | B  | B  | B  | B  | B  | B  | B  |    |
| set_threshold        | 20   | B  | HB | LB |    |    |    |    |    |    |
| get_threshold        | 21   | B  |    |    |    |    |    |    |    |    |
| stop_transmission    | 23   |    |    |    |    |    |    |    |    |    |
| start_transmission   | 24   |    |    |    |    |    |    |    |    |    |
| set_mode             | 26   | B  | B  | B  | B  | B  | B  | B  |    |    |
| get_mode             | 27   |    |    |    |    |    |    |    |    |    |
| set_tx_status        | 28   | B  |    |    |    |    |    |    |    |    |
| get_tx_status        | 29   |    |    |    |    |    |    |    |    |    |
| get_firmware_version | 2B   |    |    |    |    |    |    |    |    |    |
| set_power_on         | 2C   | B  |    |    |    |    |    |    |    |    |
| get_power_on         | 2D   |    |    |    |    |    |    |    |    |    |
| set_threshold_mode   | 2E   | ch | B  |    |    |    |    |    |    |    |
| get_threshold_mode   | 2F   |    |    |    |    |    |    |    |    |    |
| get_value            | 3B   |    |    |    |    |    |    |    |    |    |
| set_cal_factor       | 88   | ch | B  | HB | B  | LB |    |    |    |    |
| get_cal_factor       | 89   | ch | B  |    |    |    |    |    |    |    |
| set_rs232            | B0   | B  |    |    |    |    |    |    |    |    |
| get_rs232            | B1   |    |    |    |    |    |    |    |    |    |
| set_gain             | B2   | ch | B  |    |    |    |    |    |    |    |
| get_gain             | B3   |    |    |    |    |    |    |    |    |    |
| set_unit             | B4   | ch | B  |    |    |    |    |    |    |    |
| get_unit             | B5   | ch |    |    |    |    |    |    |    |    |
| set_digital          | B6   | B  | B  |    |    |    |    |    |    |    |

| Commands           | Code | p1 | p2 | p3 | p4 | p5 | p6 | p7 | p8 | p9 |
|--------------------|------|----|----|----|----|----|----|----|----|----|
| get_digital        | B7   | B  |    |    |    |    |    |    |    |    |
| set_digital_on_off | B8   | B  | B  |    |    |    |    |    |    |    |
| get_digital_port   | B9   |    |    |    |    |    |    |    |    |    |
| set_user_scale     | BA   | ch | HB | B  | B  | LB |    |    |    |    |
| get_user_scale     | BB   | ch | HB | B  | B  | LB |    |    |    |    |
| set_user_sring     | BC   | HB | B  | B  | B  | LB |    |    |    |    |
| get_user_sring     | BD   |    |    |    |    |    |    |    |    |    |
| reserviert         | BE   |    |    |    |    |    |    |    |    |    |
| get_digital_port A | BF   |    |    |    |    |    |    |    |    |    |
| set_can_bitrate    | C0   | B  |    |    |    |    |    |    |    |    |
| get_can_bitrate    | C1   |    |    |    |    |    |    |    |    |    |
| reserviert         | C2   |    |    |    |    |    |    |    |    |    |
| reserviert         | C3   |    |    |    |    |    |    |    |    |    |
| set_can_id         | C5   | B  | HB | B  | B  | LB |    |    |    |    |
| get_can_id         | C6   | B  |    |    |    |    |    |    |    |    |
| reserviert         | C7   | ch |    |    |    |    |    |    |    |    |
| reserviert         | C8   | ch |    |    |    |    |    |    |    |    |
| reserviert         | D0   | B  | B  | B  | B  | B  | B  | B  |    |    |
| reserviert         | D1   | ch |    |    |    |    |    |    |    |    |
| reserviert         | D2   | B  | B  |    |    |    |    |    |    |    |
| reserviert         | D3   |    |    |    |    |    |    |    |    |    |
| reserviert         | D4   |    |    |    |    |    |    |    |    |    |
| reserviert         | D5   | B  | B  |    |    |    |    |    |    |    |
| reserviert         | D6   |    |    |    |    |    |    |    |    |    |

Table 4: Command list for BSC4D (ch = channel number), B = byte, HB = high byte, LB = low byte)  
Commands in grey are reserved for the initial setup or calibration. The commands shaded grey are only available after restarting.

## Description of commands

### set\_gain (B2)

With the command set\_gain, the 4 inputs on the measuring amplifier can be configured individually for various sensor types.

| Parameters in HEX | Description                                      |
|-------------------|--------------------------------------------------|
| 01                | Strain gage input $\pm 2$ mV/V                   |
| 02                | Strain gage input $\pm 10$ mV/V                  |
| 03                | analog input 0-5 V                               |
| 04                | Input for PT1000 -40°C ... 1000 °C               |
| 06                | Input for K-thermocouple cable -40°C ... 1000 °C |
| 07                | analog input 0 – 10 V                            |

### set\_frequency (12)

The data frequency is set with the command set\_frequency. The measurement data is acquired with the data frequency and are ready to be transmitted via the interface (CANBus, RS232, Bluetooth, GPRS, etc.) By setting the data frequency, the digital filter is set automatically, see data frequencies and filter properties.

After executing the command “start\_transmission”, the measurement data is transmitted steadily at the set data frequency. After executing the command “stop\_transmission”, the measuring data is only sent when required. It can be requested with the command “get\_value” or for devices with CAN bus via CAN-Sync\_ID (page 53).

**Note:** Care should be taken to ensure that the request for measured values does not occur more frequently than the set data frequency. Otherwise, a current measured value will not be available every time there is a request. The same measured values are requested repeatedly.

| Parameters in HEX | Data frequency in Hz( nominal) | Data frequency in Hz( effective) |
|-------------------|--------------------------------|----------------------------------|
| A0                | 0,63                           | 0,625                            |
| A1                | 1,25                           | 1,250                            |

| Parameters in HEX | Data frequency in Hz( nominal) | Data frequency in Hz( effective) |
|-------------------|--------------------------------|----------------------------------|
| A2                | 2,5                            | 2,500                            |
| A3                | 3,75                           | 3,750                            |
| A4                | 6,25                           | 6,250                            |
| A5                | 7,5                            | 7,500                            |
| A6                | 12,5                           | 12,400                           |
| A7                | 15                             | 14,7                             |
| A8                | 25                             | 24,4                             |
| A9                | 125                            | 125                              |
| AA                | 250                            | 250                              |
| AB                | 500                            | 500                              |
| AC                | 937,5                          | ...                              |

set\_can\_bitrate (C0) / get\_can\_bitrate (C1)

| Parameters in HEX | Bitrate in kbit/s |
|-------------------|-------------------|
| 10                | 20                |
| 20                | 50                |
| 30                | 80                |
| 40                | 100               |
| 50                | 125               |
| 60                | 250               |
| 70                | 500 (standard)    |
| 80                | 1000              |

| Parameters in HEX | Bitrate in kbit/s |
|-------------------|-------------------|
|                   |                   |

save\_configuration (0A) / restore\_configuration (09)

The entire configuration (data frequency, configuration of inputs, etc.) can be saved and restored as a parameter set. Two memories are available for the configuration.

| Parameters in HEX | Description          |
|-------------------|----------------------|
| 01                | Manufacturer setting |
| 02                | User setting 1       |
| 03                | User setting 2       |

set\_user\_scale (BA) / get\_user\_scale (BB)

A scaling factor in 32 Bit format can be stored for each channel.

This scaling factor is stored in the EEPROM of the measuring amplifier and can be read with get\_user\_scale.

| Parameters in HEX | Memory No. | Label     |
|-------------------|------------|-----------|
| 01                | 1          | Channel 1 |
| 02                | 2          | Channel 2 |
| 03                | 3          | Channel 3 |
| 04                | 4          | Channel 4 |

Number format:

| Sign  | Index           | Significand      |
|-------|-----------------|------------------|
| Bit 0 | Bit 1 ... Bit 8 | Bit 9 ... Bit 31 |

## Protocol for measured values

Measured values are framed by a prefix 0xA5 and a postfix from the sign 0x0D 0x0A (carriage return linefeed).

The entire frame is 11 bytes long.

| Prefix | Channel 1 |    | Channel 2 |    | Channel 3 |    | Channel 4 |    | Postfix |    |
|--------|-----------|----|-----------|----|-----------|----|-----------|----|---------|----|
| A5     | HB        | LB | HB        | LB | HB        | LB | HB        | LB | 0D      | 0A |

Table 5: Protocol for transmitting the measured values via RS232 interface

## Protocol for commands

After switching on, only the commands:

get\_value (0x3B)

set\_mode (0x26 01 62 65 72 6C 69 6E)

get\_mode (0x27)

get\_tx\_status (0x29)

get\_firmware\_version (0x2B)

can be used! To be able to use all of the commands, "set\_mode" has to be sent.

Commands begin with the code followed by parameters.

| Code | Parameter |    |     |    |
|------|-----------|----|-----|----|
| xx   | p1        | p2 | ... | pn |

Examples:

Requesting serial number 1F

Setting channel 1 to zero: 0C 01

## Protocol for responding to commands

Responses are framed by a prefix 0x3B and a postfix from the sign 0x0D 0x0A (carriage return linefeed).

The entire frame has a variable length. The number of frames still to follow is given with "n".

The number of variable bytes is defined in the fourth and fifth Byte with the data word "len".

The entire length of the response is (10 + len) bytes.

The command "get\_value" is an exception. The response to this command takes place with a protocol for measured values.

| Prefix | Code | n | len |    | No. |    |    | len bytes |    |     |    | Postfix |    |
|--------|------|---|-----|----|-----|----|----|-----------|----|-----|----|---------|----|
| 3B     | xx   | B | HB  | LB | aa  | bb | cc | p1        | p2 | ... | pn | 0D      | 0A |

Table 6: Protocol for responding to commands

Example: Releasing commands

Send: 0x26 01 62 65 72 6C 69 6E

Example: Locking commands

Send: 0x26 00 62 65 72 6C 69 6E

Example: Request serial number

Send: 0x23

Send: 0x1F

Receive 0x 3B 1F 0100 08 30 35 30 30 38 34 34 39 30 35 30 0D 0A

Send 0x24

Result: The serial number is "08449050".

Example: Change status(Send measured value OFF/ON)

To permanently save the value send stop or start measured value, the command set\_tx\_status (0x28<p1>) can be used.

| Parameters in HEX | Parameters in Bit | Current                 | After switching on      |
|-------------------|-------------------|-------------------------|-------------------------|
| 00                | 0 0 0 0 0 0 0 0   | Send measured value OFF | Send measured value OFF |
| 01                | 0 0 0 0 0 0 0 1   | Send measured value OFF | Send measured value ON  |
| 02                | 0 0 0 0 0 0 1 0   | Send measured value ON  | Send measured value OFF |
| 03                | 0 0 0 0 0 0 1 1   | Send measured value ON  | Send measured value ON  |

Send: 0x23

Send: 0x29

Receive : 0x 3B 29 0100 01 30 33 33 01 0D 0A

Result: Current-OFF , After switching on-ON

Send: 0x28 02

Send: 0x29

Receive : 0x 3B 29 0100 01 30 33 33 02 0D 0A

Result: Current-ON , After switching on-OFF

## Digital IOs

The entire port is always read (IO8 to IO1).

BSC4D CAN assignment:

| Digital IO | BSC4D-CAN | BSC4D-BT | Port |
|------------|-----------|----------|------|
| 01         | Digital 1 | IO1      | IO1  |
| 02         | -         | IO2      | IO2  |
| 03         | Digital 2 | IO3      | IO3  |
| 04         |           | IO4      | IO4  |
| 05         | Digital 3 | IO5      | IO5  |

| Digital IO | BSC4D-CAN | BSC4D-BT | Port |
|------------|-----------|----------|------|
| 06         |           | IO6      | IO6  |
| 07         | Digital 4 | IO7      | IO7  |
| 08         | Digital 5 | IO8      | IO8  |

Example: Read port

Send: 0x23

Send: 0xB9

Receive : 0x 3B B9 0100 01 30 33 33 00 0D 0A

Result: all inputs and outputs are "low"

| Parameters in HEX | Parameters in Bit | Port                            |
|-------------------|-------------------|---------------------------------|
| 00                | 0 0 0 0 0 0 0 0   | IO8 IO7 IO6 IO5 IO4 IO3 IO2 IO1 |

The digital port can be configured with set\_digital (0xB6 <p1><p2>) and set\_digital\_on\_off(0xB8 <p1> <p2>). The port is set with <p1> /

set\_digital (0xB6 <p1> <p2>)

| Parameters in HEX <p2> | Description |
|------------------------|-------------|
| 00                     | Eingang     |
| 01                     | Ausgang     |
| 02                     | get_Value   |
|                        |             |
| 0A                     | Tara all    |
| 0B                     | Tara Kanal1 |
| 0C                     | Tara Kanal2 |
| 0D                     | Tara Kanal3 |
| 0E                     | Tara Kanal4 |
|                        |             |
| 0F                     | Slave       |
| 10                     | Master      |
|                        |             |

| Parameters in HEX <p2> | Description   |
|------------------------|---------------|
| 11                     | SW1           |
| 12                     | SW2           |
| 13                     | SW3           |
| 14                     | SW4           |
| 15                     | SW5           |
| 16                     | SW6           |
| 17                     | SW7           |
| 18                     | SW8           |
|                        |               |
| 21                     | SW1 rel.      |
| ...                    | ...           |
| 28                     | SW8 rel.      |
|                        |               |
| 31                     | SW1 1s        |
| ...                    | ...           |
| 38                     | SW8 1s        |
|                        |               |
| 41                     | SW1 rel. 1s   |
| ...                    | ...           |
| 48                     | SW8 rel. 1s   |
|                        |               |
| 51                     | SW1 inv.      |
| ...                    | ...           |
| 58                     | SW8 inv.      |
|                        |               |
| 61                     | SW1 inv. rel. |
| ...                    | ...           |
| 68                     | SW8 inv. rel. |
|                        |               |

| Parameters in HEX <p2> | Description      |
|------------------------|------------------|
| 71                     | SW1 inv. 1s      |
| ...                    | ...              |
| 78                     | SW8 inv. 1s      |
|                        |                  |
| 81                     | SW1 inv. rel. 1s |
| ...                    | ...              |
| 88                     | SW8 inv. rel. 1s |

set\_digital\_on\_off(0xB8 <p1> <p2>)

| Parameters in HEX <p2> | Parameters in Bit | Port           | Description |
|------------------------|-------------------|----------------|-------------|
| 00                     | 0 0 0 0 0 0 0 0   | For IO1 to IO8 | OFF         |
| 01                     | 0 0 0 0 0 0 0 1   | For IO1 to IO8 | ON          |

Example: Change IO1

Send: 0x23

Send: 0xB6 01 0B

Send: 0xB7

Receive : 0x 3B B7 0100 02 30 33 33 01 0B 0D 0A

Result: IO1 is configured as Tara for channel1

Send: 0xB6 01 00

Send: 0xB7

Receive : 0x 3B B7 0100 02 30 33 33 01 00 0D 0A

Send: 0x24

Result: IO1 is configured as an input and can be read with 0xB9

set\_threshold (0x20 <p1> <p2>)

| Parameters in HEX <p1> | Description | Channel assignment | Switching threshold |
|------------------------|-------------|--------------------|---------------------|
| 01                     | SW1         | 1                  | ON                  |

| Parameters in HEX <p1> | Description | Channel assignment | Switching threshold |
|------------------------|-------------|--------------------|---------------------|
| 02                     | SW1         | 1                  | OFF                 |
| 03                     | SW2         | 1                  | ON                  |
| 04                     | SW2         | 1                  | OFF                 |
| 05                     | SW3         | 2                  | ON                  |
| 06                     | SW3         | 2                  | OFF                 |
| 07                     | SW4         | 2                  | ON                  |
| 08                     | SW4         | 2                  | OFF                 |
| 09                     | SW5         | 3                  | ON                  |
| 0A                     | SW5         | 3                  | OFF                 |
| 0B                     | SW6         | 3                  | ON                  |
| 0C                     | SW6         | 3                  | OFF                 |
| 0D                     | SW7         | 4                  | ON                  |
| 0E                     | SW7         | 4                  | OFF                 |
| 0F                     | SW8         | 4                  | ON                  |
| 10                     | SW8         | 4                  | OFF                 |

By setting the on and off switching thresholds differently, a hysteresis can be programmed. The second parameter (<p2>) is the switching threshold in HEX e.g.: 0x89 FF.

**Caution:** in order to compare the threshold value with the measured value directly, it has to be added with 0x80 00.

Example: Configuration of SW1 IO8 ( or digital 5)

Send: 0x 23

Send: 0x B6 08 11

Configure IO8 for SW1

Send: 0x 20 01 01 00

The turn-on threshold of SW1 is set to 0x81 00.

Send: 0x 20 02 FE 00

The turn-off threshold of SW1 is set to 0x7E 00.

If the measured value increases above 0x81 00, IO8 is switched on. If the measured value falls below 0x7E 00, IO8 is switched off.

analog input

Example: Requesting the configuration of analog inputs

Send: 0x23

Send: 0xB3

Receive : 0x 3B B3 0100 04 30 35 30 01 01 02 03 0D 0A

Send 0x24

Result: Channel 1 = 2 mV/V, channel 2 = 2 mV/V, channel 3 = 10 mV/V, channel 4 = 0-5 V;

Example: Setting the configuration of analog inputs

Specification: configuring channel 1 to channel 4 for PT1000

Send: 0x23

Send: 0xB2 01 04

Send: 0xB2 02 04

Send: 0xB2 03 04

Send: 0xB2 04 04

Send 0x24

Example: Setting the data frequency to 12.5 Hz

Specification: The measured value should be sent steadily with a frequency of approx. 12.5/s.

Send: 0x23

Send: 0xA6

Send 0x24

## CAN bus

Devices with CAN bus have the same command structure as devices with serial interfaces or Bluetooth or GPRS. Prefixes and postfixes are omitted if the measured values and responses are sent within a CAN bus frame.

### Protocol for measured values

Measured values via CAN are always transmitted in a CANbus frame. Bytes 1 to 8 include the measurement data of the 4 channels with 16 bit each. First the highbyte (HB) and then the lowbyte (LB) is sent.

| Channel 1 |    | Channel 2 |    | Channel 3 |    | Channel 4 |    |
|-----------|----|-----------|----|-----------|----|-----------|----|
| HB        | LB | HB        | LB | HB        | LB | HB        | LB |

Table 11: CAN frame with measurement data;

### Protocol for commands

Commands begin with the code followed by parameters.

| Code | Parameter |    |     |    |
|------|-----------|----|-----|----|
| xx   | p1        | p2 | ... | pn |

Examples:

Requesting serial number **1F**

Setting channel 1 to zero: **0C 01**

### Protocol for responding to commands

Commands for the measuring amplifier are transmitted in the CAN frame (data range). If the measuring amplifier sends a response, a command response frame is sent.

Head frame:

| Prefix | Code | n | len |    | No. |    |    |
|--------|------|---|-----|----|-----|----|----|
| 3B     | xx   | B | HB  | LB | aa  | bb | cc |

Table 12: Head frame for responding to commands via CAN bus

Frame 1 ... n

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| B | B | B | B | B | B | B | B |
| B | B | B | B | B | B | B | B |

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| B | B | B | B | B | B | B | B |
|---|---|---|---|---|---|---|---|

Table 13: Following frame for responding to commands via CAN bus

Example: Request serial number

Send: 0x23

Send: 0x1F

Receive 0x **3B** **1F** **01** **00 08 30 35 30**

0x **30 38 34 34 39 30 35 30**

Send 0x24

Result: The serial number is "08449050".

Example: Requesting the configuration of analog inputs

Send: 0x23

Send: 0xB3

Receive 0x **3B** **B3** **01** **00 04 30 35 30**

0x **01 01 02 03**

Send 0x24

Result: Channel 1 = 2 mV/V, channel 2 = 2 mV/V, channel 3 = 10 mV/V, channel 4 = 0-5 V;

Example: Setting the configuration of analog inputs

Specification: Configuring channel 1 to channel 4 for 0 - 5V

Send: 0x23

Send: 0xB2 01 03

Send: 0xB2 02 03

Send: 0xB2 03 03

Send: 0xB2 04 03

Send 0x24

Configuring the CAN-ID

set\_id(0xC5 <p1> <p2>)

CAN-ID for receiving measurement data <p1>=0x01

The default value of CAN-ID for receiving measurement data is 0x00 00 06 10 (<p2>).

CAN-ID for receiving responses <p1>=0x02

The default value of CAN-ID for receiving responses is 0x00 00 06 11 (<p2>).

CAN-ID for sending commands <p1>=0x06

The default value of CAN-ID for sending commands is 0x00 00 01 11 (<p2>).

CAN-ID for synchronising the measurement data <p1>=0x05

To request measured values, the same CAN-ID is available for all measuring amplifiers (CAN-Sync-ID). All frames with this CAN-Sync-ID trigger the sending of a measured value. The default value of CAN-Sync-ID for sending is 0x00 00 01 10 (<p2>).

**Note: The CAN-ID is changed immediately (this should be noted particularly for the ID for sending commands and the CAN baud rate.)**

Example: Configuring the CAN-Bitrate

Send: 0x 23  
Send: 0x C0 60

Converting the baud rate to 250 kBit on the CAN bus (or CAN adapter)

Send: 0x C1  
Receive 0x 3B C1 01 00 01 30 35 30  
0x 60  
Send 0x 24

Example: Configuring the CAN-ID

Send: 0x 23  
Send: 0x C6 06  
Receive 0x 3B C6 01 00 05 30 35 30  
0x 06 00 00 01 11

The CAN-ID for receiving commands is set to 0x00 00 01 11.

Send: 0x C5 06 00 00 01 00

Converting the ID to 0x00 00 01 00 for sending commands in the program.

Send: 0x C6 06  
Receive 0x 3B C6 01 00 05 30 35 30  
0x 06 00 00 01 00  
Send 0x 24

The CAN-ID for receiving commands is set to 0x00 00 01 00.

## Data frequency and filter

### analog filter

The integrated analog filter is a first-order low-pass filter with a cut-off frequency of 1 kHz. It is set as an *antialiasing* filter for the A-D converter. This filter is permanently installed and cannot be changed.

### Digital filter

The digital filter is indirectly set with the data frequency. The effective data frequency may differ slightly from the set (nominal) data frequency. The grey shaded settings are recommended as with these settings faults with a mains frequency of 50 Hz are best suppressed by the integrated “notch filter”.

| Data frequency in Hz (nominal) | Data frequency in Hz (effective) | Notch frequency in Hz | -3db cut-off frequency in Hz (digital filter) | Parameters for “set frequency” |
|--------------------------------|----------------------------------|-----------------------|-----------------------------------------------|--------------------------------|
| 500                            | 500                              | 7500                  | 3003                                          | 0xAB                           |
| 250                            | 250                              | 2000                  | 878                                           | 0xAA                           |
| 125                            | 125                              | 1000                  | 441                                           | 0xA9                           |
| 25                             | 24,4                             | 100                   | 44.2                                          | 0xA8                           |
| 15                             | 14,7                             | 60                    | 26.5                                          | 0xA7                           |
| 12,5                           | 12,4                             | 50                    | 22.1                                          | 0xA6                           |
| 7,5                            | 7,5                              | 30                    | 13.3                                          | 0xA5                           |
| 6,25                           | 6,25                             | 25                    | 11.1                                          | 0xA4                           |
| 3,75                           | 3,75                             | 15                    | 6.63                                          | 0xA3                           |
| 2,5                            | 2,5                              | 10                    | 4.42                                          | 0xA2                           |
| 1,25                           | 1,25                             | 5                     | 2.21                                          | 0xA1                           |
| 0,625                          | 0,625                            | 2.5                   | 1.1                                           | 0xA0                           |

Table 10: data frequencies and filter properties

|                    |
|--------------------|
| 50 Hz Notch Filter |
| 60 Hz Notch Filter |

## Annex

### Connection figures for BSC4D-BT SD and BSC4D-BT LD

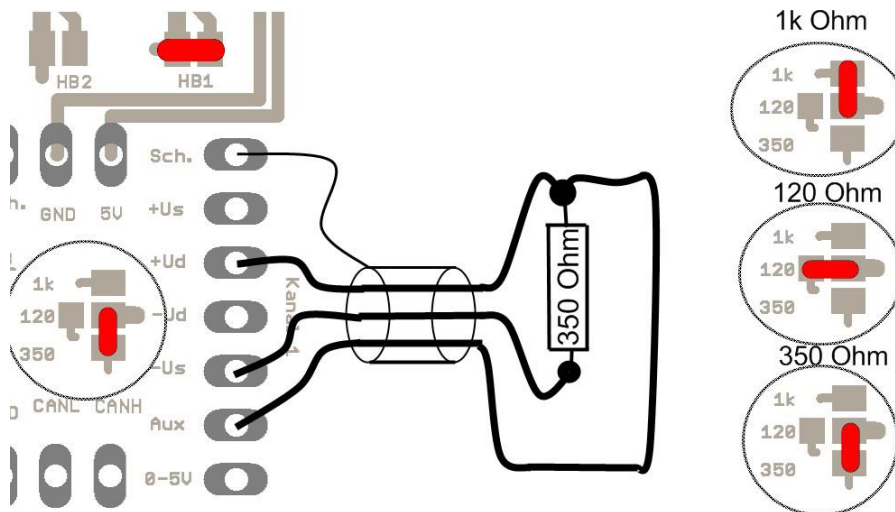


Figure 6: Strain gage-Quarter bridge

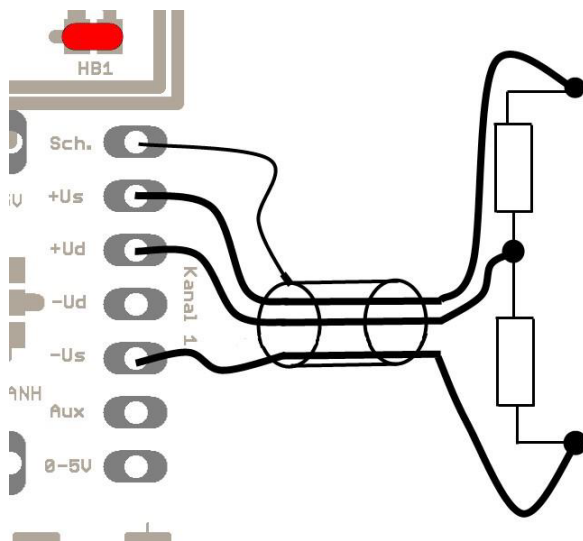


Figure 7: Strain gage-Half bridge

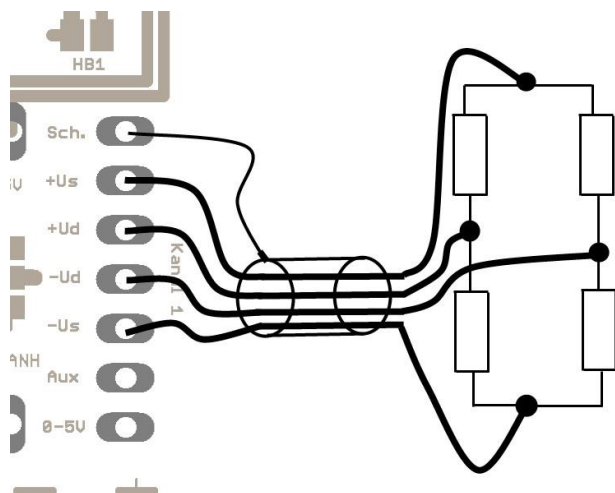


Figure 8: Strain gage-Full bridge

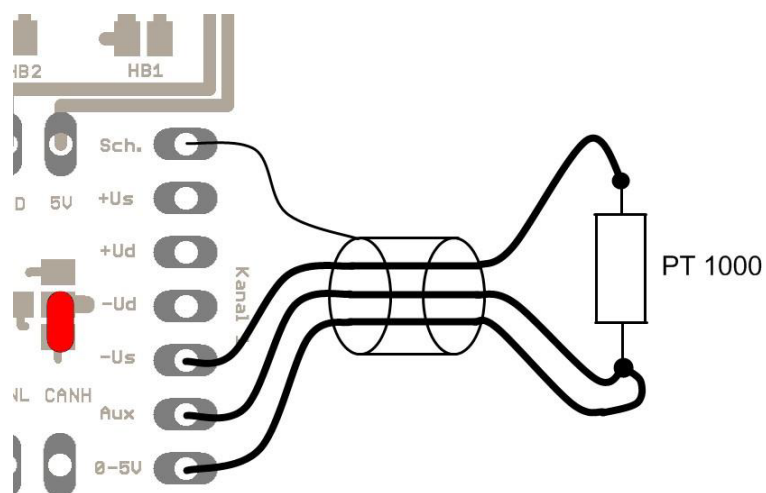


Figure 9: PT1000

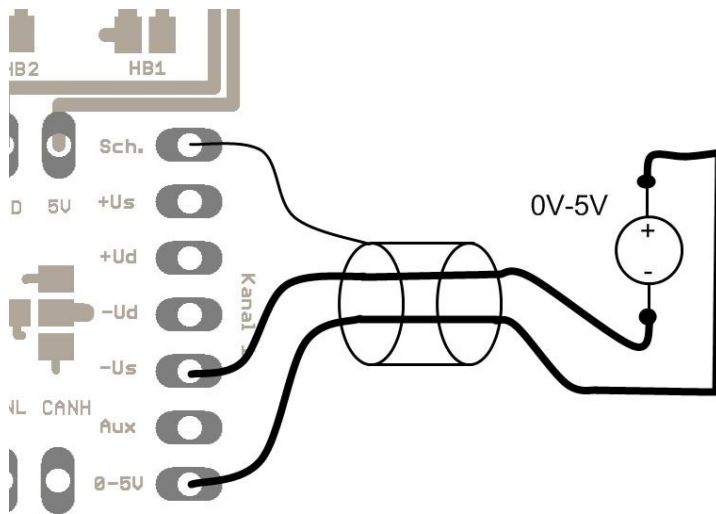


Figure 10: Voltage

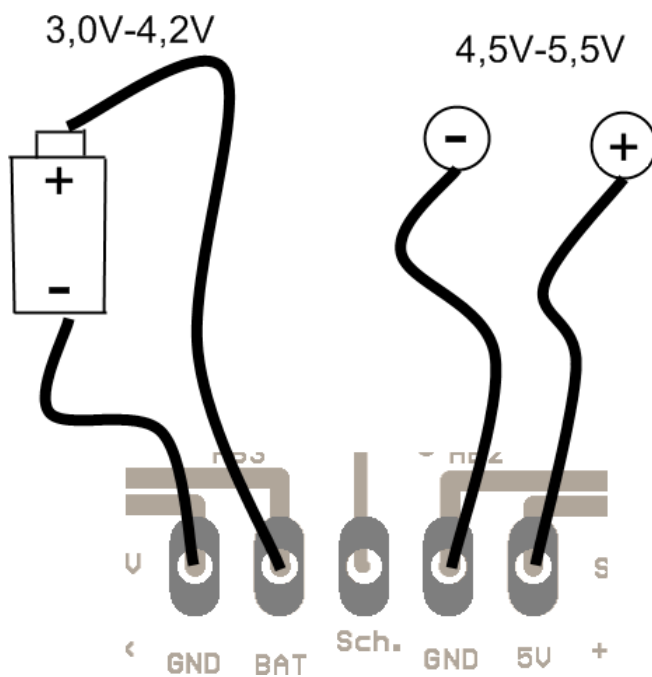


Figure 11: Connection battery, optionally connection load 5V

## Warranty

All instrument products from Interface Inc., ('Interface') are warranted against defective material and workmanship for a period of (1) one year from the date of dispatch. If the 'Interface' product you purchase appears to have a defect in material or workmanship or fails during normal use within the period, please contact your Distributor, who will assist you in resolving the problem. If it is necessary to return the product to 'Interface' please include a note stating name, company, address, phone number and a detailed description of the problem. Also, please indicate if it is a warranty repair. The sender is responsible for shipping charges, freight insurance and proper packaging to prevent breakage in transit. 'Interface' warranty does not apply to defects resulting from action of the buyer such as mishandling, improper interfacing, operation outside of design limits, improper repair or unauthorized modification. No other warranties are expressed or implied. 'Interface' specifically disclaims any implied warranties of merchantability or fitness for a specific purpose. The remedies outlined above are the buyer's only remedies. 'Interface' will not be liable for direct, indirect, special, incidental, or consequential damages whether based on the contract, tort or other legal theory. Any corrective maintenance required after the warranty period should be performed by 'Interface' approved personnel only.