



BP16

Backplane for MAL Amplifiers

Measuring Amplifiers and Sensors. Get Connected.

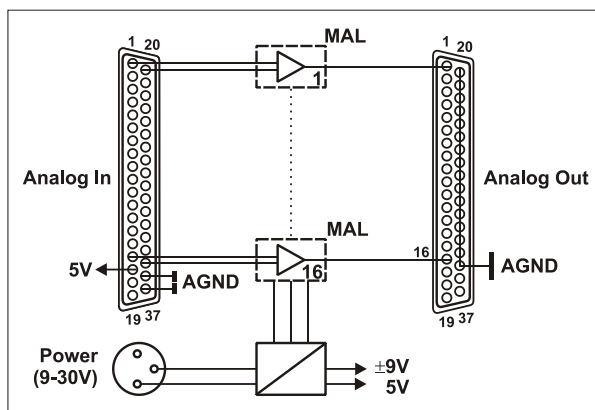
Backplane for miniature amplifiers: Up to 16 measuring amplifiers, converters, or any other function modules can be integrated in the BP16. If installed close to the signal, it provides for high interference resistance. Ideal for remote signal conditioning of passive sensors.

Signal Conditioning in Miniature Format.

In type of construction, the cost-effective MAL modules are designed like a 24-pin DIL IC. Measurement applications can therefore be realized even in problematic locations. With suitable measuring amplifiers, multiple wire technique can be realized, too.

Optimally Supplied.

The BP16 is operated with 9-30V. The integrated amplifiers are supplied by the electrically isolated power supply. In addition, 5V (50mA) with galvanic isolation are provided for sensor supply.



Functional diagram

Signal Connection. D-Sub Standard.

Sensors or other voltage signals can comfortably be connected at a 37-pin D-Sub female.

Connection to the DAQ System.

The amplifier outputs are available at a 37-pin D-Sub female connector. They are connected to the input lines of a data acquisition system. Combining the BP16 with a measuring card or DAQ system from bmcm makes an extreme compact measurement system.

External Device.

The BP16 is accommodated in a stable aluminum housing ideal for mobile use. Notches in the housing frames allow for fixing the BP16 to a DAQ system (e.g. USB-AD14f) providing for a stable measuring unit.

The Smaller Options. You Have the Choice.

For all needing less channels: The backplane for miniature amplifiers is also available as a 2-channel version with carrier for DIN rail mounting (BP2) or integrated in a waterproof IP65 housing (BP2-BOX).

1 Preparations

1.1 Equipment of the BP16

To equip the BP16 with measuring amplifiers, the device must be opened. First remove the red housing frames and open the housing cover by loosening the upper screws at the front and back side.

Up to 16 miniature measuring amplifiers (e.g. MAL series from bmc, see chapter 4.1) can be plugged into any of the 24-pin sockets on the backplane (see chapter 2.5.1). If the marking of the socket is on the left, pin 1 is bottom left (see chapter 0).



Check for correct poling when equipping the backplane.

Change amplifier modules only at no load!

1.2 Installation of the BP16

The BP16 is installed as an independent measuring amplifier system before a PC data acquisition system. If combined with a DAQ system from bmc accommodated in an aluminum case (e.g. LAN-AD16fx, USB-AD14f, USB-AD16f), the housings of both devices can comfortably be fixed together at the red frames of the device making a compact unit. To directly connect the outputs of the BP16 with the inputs of the DAQ system, use the short ribbon cable included with delivery. The device can be supplied (see chapter 2.1) via the DC connector (9-30V DC) and a power supply unit (e.g. ZU-PW10W available as accessory).



2 Connections, Pin Assignments, and Components

The available connections and different components of the BP16 are shown in the following figure of the board (view on top of the board (fitted with components), connectors on both sides). The measuring amplifier slots are consecutively numbered from channel 1 = 1 to channel 16 = 16.

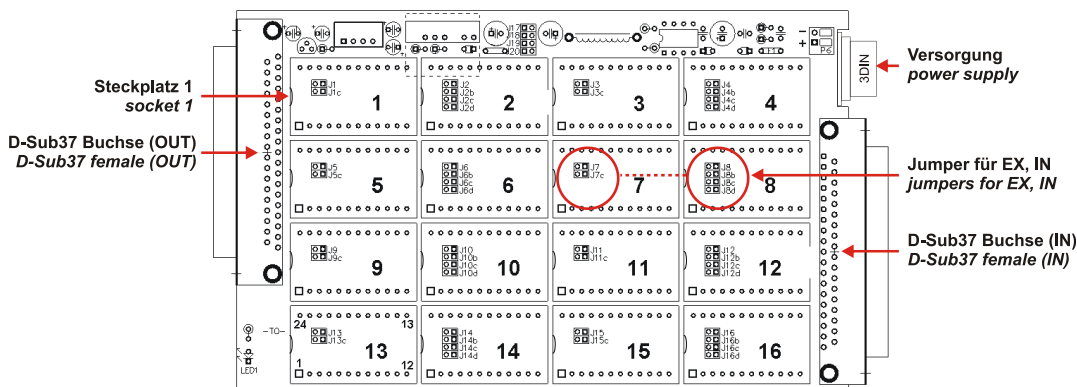
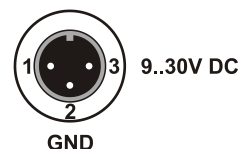


Figure 1

2.1 Power Supply (DC)

The BP16 is operated with 9-30V via the 3-pin DIN plug at the back of the device.

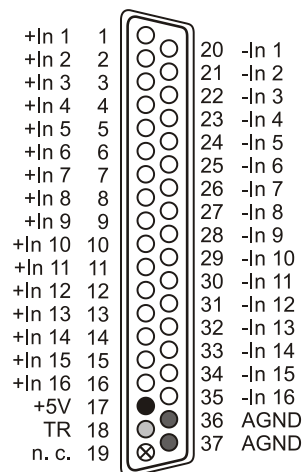


2.2 Analog Inputs

The 16 analog inputs or sensors are connected at the 37-pin D-Sub IN female on the back of the BP16. To realize cold-junction compensation for thermocouple measurement with MAL-THR, a temperature sensor can be connected at pin 18 (e.g. option ZU-TR available as accessory, see chapter 4.2). In addition, 5V sensor supply is provided at pin 17.

The following table and figure on the right show the pin assignment of the 37-pin input connector:

Pin	Function
1(+), 20(-)	Analog In 1
2(+), 21(-)	Analog In 2
...	...
16(+), 35(-)	Analog In 16
17	+5V for sensor supply
18	temperature reference input (for MAL-THR)
19	-
36, 37	analog ground (AGND) for sensor supply



- In = Analogeingang / analog input
- +5V = Hilfsspannung / +5V auxiliary voltage
- AGND = analoge Masse / analog ground
- TR = Temp.referenzeingang / temp. reference input
- ⊗ n. c. = nicht verbunden / not connected

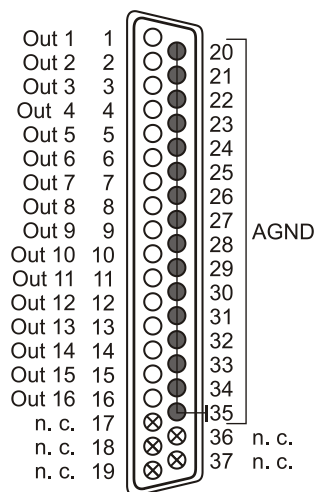
2.3 Analog Outputs

The 16 analog outputs are connected at the 37-pin D-Sub OUT female on the front of the BP16.

They are the outputs of the respective measuring amplifiers or of the bypassed DIL sockets (see chapter 2.5.1), which are connected to the analog inputs of the DAQ system.

The following table and figure on the right show the pin assignment of the 37-pin output connector:

Pin	Function
1..16	Analog Out 1..16
20..35	analog ground (AGND) for outputs
17, 18, 19, 36, 37	-

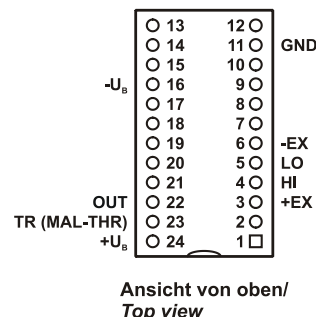


- Out = Analogeingang / analog output
- AGND = analoge Masse / analog ground
- ⊗ n. c. = nicht verbunden / not connected

2.4 Pin Assignment of the Amplifier Slots

Each channel of the backplane can be equipped with miniature amplifiers of the MAL series from bmcm (see chapter 4.1) or compatible measuring amplifiers of other manufacturers. That means that all inputs can be adjusted to the most different signals and sensors.

See the relevant data sheet about how to use the individual measuring amplifier. The figure on the right shows view on top of the module backplane (marking of the socket on the left).



Pin	Name	Function
1, 2	n. c.	-
3	+EX	pos. sensor supply
4	LO	neg. signal input
5	HI	pos. signal input
6	-EX	neg. sensor supply
7, 8, 9, 10	n. c.	-
11	GND	power supply ground
12	n. c.	-

Pin	Name	Function
13, 14, 15	n. c.	-
16	-U _B	neg. supply (-9V)
17, 18, 19, 20, 21	n. c.	-
22	OUT	amplifier output $\pm 5V$
23	TR	temp. reference (only MAL-THR)
24	+U _B	pos. supply (+9V)

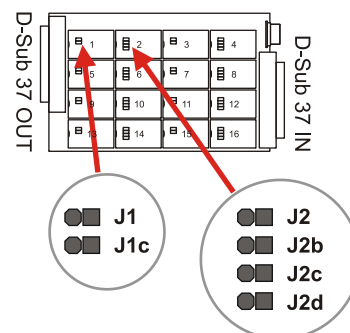
2.5 Using the Jumpers

Each of the 16 amplifier slots is provided with two (uneven slot) or four jumpers (even slot).

The jumpers are numbered corresponding to the number of their DIL slot (see chapter 2.5.1 and 2.5.2). Jumpers of one slot have different functions and are distinguished from each other by an additional letter (e.g. slot 2: J2, J2b, J2c, J2d).

The following table gives a short overview of the jumper function (default setting marked in red):

Platinenoberseite /
top side of the board



• Uneven slot:

Jumper	Function
J1	bypass +IN of slot 1
-	-
J1c	bypass -IN of slot 1
-	-
...	...

• Even slot:

Jumper	Function
J2	bypass +IN of slot 2
J2b	lead through +EX of slot 1 to 37-pin D-Sub IN connector
J2c	bypass -IN of slot 2
J2d	lead through -EX of slot 1 to 37-pin D-Sub IN connector
...	...

Do not use a measuring amplifier at a slot with a closed jumper.

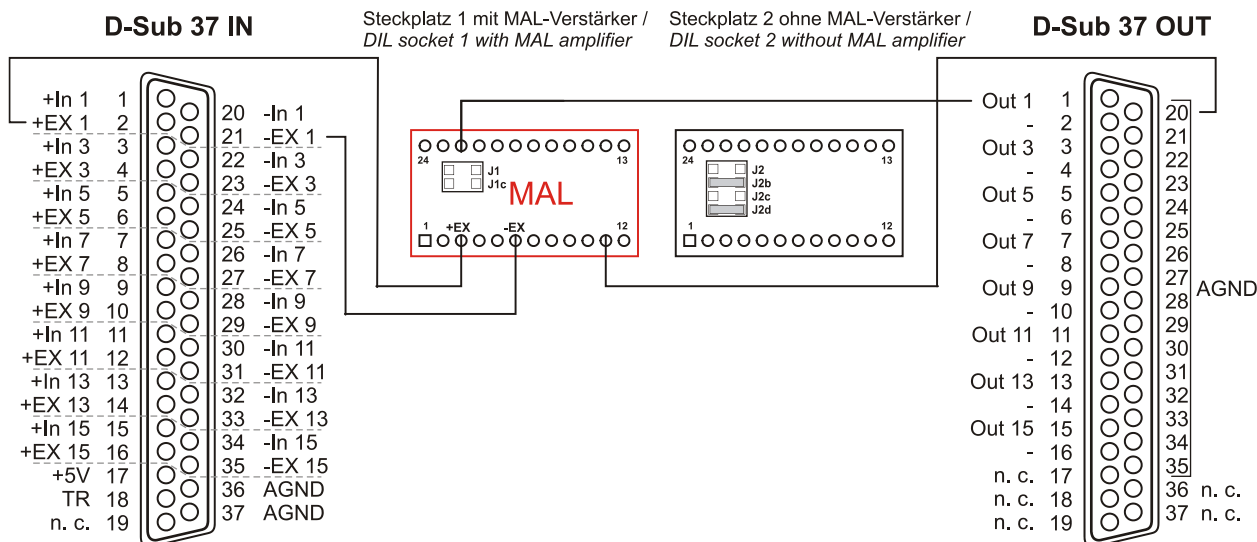
The pin connectors are very damageable. In case of contact problems replace them if necessary.

Always only close either jumpers Jx, Jxc or Jxb, Jxd. Never close all 4 jumpers at the same time!

2.5.1 Bypassing a Free Slot

If slot x (x=1..16) is not equipped with a measuring amplifier, as the input is open or only voltages are to be measured, this socket has to be bypassed by closing jumpers Jx and Jxc. In this case, this input cannot be operated differentially. Ex works all sockets are bypassed (see chapter 2.5).

2.5.2 Making Excitation Pins Available



If using long cables, 4-wire technique, or for precise measurements, we recommend to lead the excitation connections of the measuring amplifiers through to the 37-pin D-Sub IN female to avoid interferences.

At the D-Sub 37 IN connector, the excitation of a channel (uneven slot) can be reached at the pins that used to be the connections for the following even analog input (see chapter 2.2, e.g. +EX1 to pin 2, before: +IN2; -EX1 to pin 21, before: -IN2) which is not available anymore in this case.

Leading the excitation through is achieved by closing jumpers Jxb and Jxd located at the DIL slots with even numbering (see chapter 2.5). Mixed use of 2- and 4-wire technique is also possible (see chapter 3.3).

The following table shows the pin assignment of the D-Sub 37 IN female connector if all excitation connections are used:

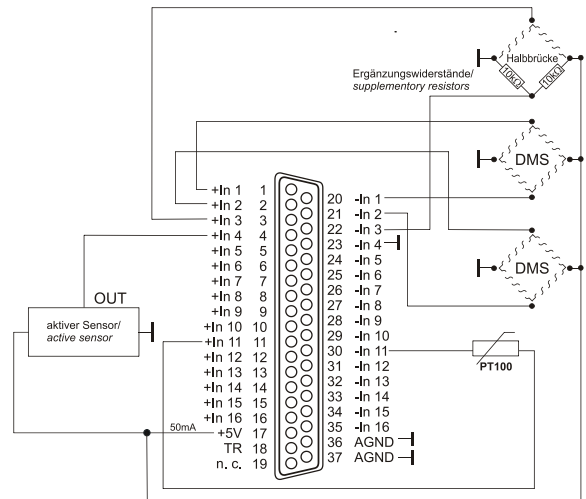
Pin	Function
1(+), 20(-)	Analog In 1
2(+), 21(-)	excitation voltage for Analog In 1
3(+), 22(-)	Analog In 3
4(+), 23(-)	excitation voltage for Analog In 3
5(+), 24(-)	Analog In 5
6(+), 25(-)	excitation voltage for Analog In 5
...	...
15(+), 34(-)	Analog In 15
16(+), 35(-)	excitation voltage for Analog In 15
17	+ 5V for sensor supply
18	temperature reference input (for MAL-THR)
19	-

If the excitation of a channel is led through to the D-Sub 37 IN connector, the following analog input will not be available!

3 Connection Examples

3.1 2-Wire Technique with Joint Supply

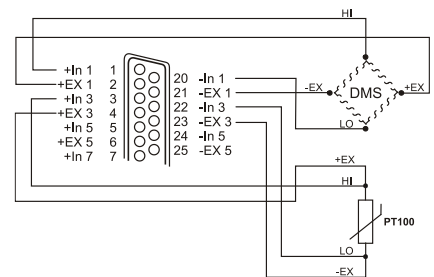
The sensor supplies of the measuring amplifiers are not led through to the 37-pin D-Sub IN connector of the BP16 (see chapter 2.5.2, exception: resistance measurement as 2-wire measurement). The 5V pin (pin 17) generated by the BP16 and electrically isolated from the measuring amplifiers can be used for sensor supply.



3.2 4-Wire Technique

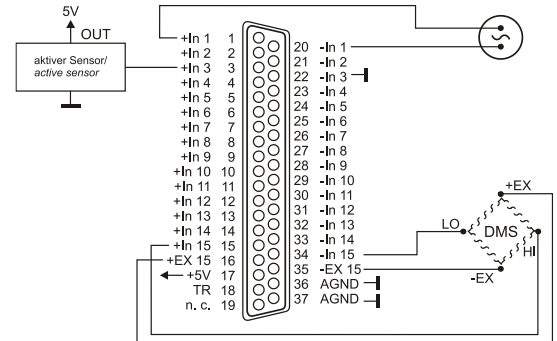
If connecting in 4-wire technique, the sensor supply of the relevant measuring amplifier is used. The advantage is that voltage drops caused by long cables have no influence on the measuring result. In this case, however, only 8 channels can be used. The sensor supply is taken from the amplifier supply. Please note, that the total of all sensor currents must not exceed 100mA.

Cable shields can be connected at AGND (analog ground) at one end only.



3.3 Combined 2- and 4-Wire Technique

It is also possible to connect the channels mixed: in 2-wire as well as in 4-wire technique. The 4-wire technique (here at channel 15), for example, can be used only for channels requiring higher accuracy. Depending on the respective application, you will profit from the optimum use of the BP16 in this way.

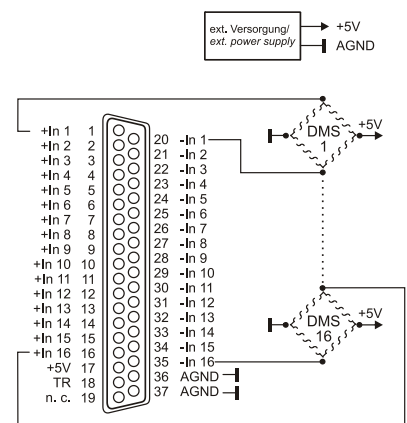


3.4 Supply of 16 Strain Gauge 350Ohm Sensors

Up to 6 strain gauge sensors with 350Ω can be powered by with the amplifier supply (max. 100mA) if connected in 4-wire technique (see chapter 3.2).

If more strain gauge sensors or 120Ω sensors are used, the sensor supply must be realized with an external, stabilized 5V power supply.

The figure on the right shows a connection example with 16 strain gauge sensors.

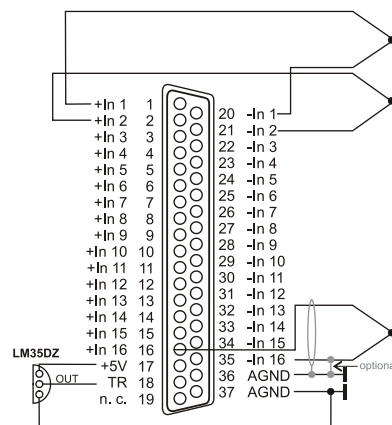


3.5 Thermocouple Measurement with Type K

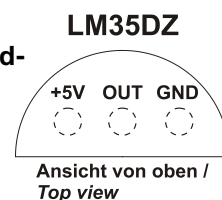
The MAL-THR module is prepared for thermocouple measurement with compensation. Therefore a sensor for temperature reference must be installed at the cold-junction. A semi-conductor sensor LM35DZ is used with an absolute accuracy of $\pm 1^\circ\text{C}$.

The sensor is supplied with 5V by the BP16 and produces a reference voltage for all measuring channels proportional to the cold-junction.

The thermocouples can be extended with a copper wire. In this case, however, the temperature reference sensor must be moved to the cold-junction, too.



The option ZU-TR from bmcm (see chapter 4.2) is a comfortable solution for cold-junction compensation. The D-Sub 37 male connector with integrated LM35DZ only has to be plugged on the D-Sub-37 IN female of the BP16.



4 Available Accessories

4.1 MAL Amplifiers and Connection Technology (BP Line)

A great variety of miniature measuring amplifiers with or without galvanic isolation is available. The backplanes of the BP line from bmcm different in size and design allow the comfortable connection to the data acquisition system and for the amplifier supply. The MAL measuring converters can be plugged on the backplanes in any combination.

The following MAL modules and BP backplanes from bmcm are available:



Product	Description
MAL-ISO1/5/10/50	Galvanically isolating miniature amplifier for voltage ($\pm 1\text{V}/\pm 5\text{V}/\pm 10\text{V}/\pm 50\text{V}$)
MAL-ISO20mA	Galvanically isolating miniature amplifier for current ($\pm 20\text{mA}$)
MAL-FU	Frequency-voltage converter in miniature format
MAL-I20mA	Miniature amplifier for current ($\pm 20\text{mA}$), 5V sensor supply
MAL-PT100	Miniature amplifier for temperature (PT100, $0..300^\circ\text{C}$)
MAL-R1K	Miniature amplifier for resistance ($0..1\text{k}\Omega$)
MAL-SG2/5	Miniature amplifier for strain gauge ($\pm 2\text{mV/V}$ or $\pm 5\text{mV/V}$)
MAL-THR	Miniature amplifier for temperature (thermocouple, type K, $0..1250^\circ\text{C}$)
MAL-U1/5/10	Miniature amplifier for voltage ($\pm 1\text{V}/\pm 5\text{V}/\pm 10\text{V}$), 5V sensor supply
BP16	16 slots, external device in aluminum housing, 5V sensor supply, connections: 2x Sub-D37
BP2	2 slots, for DIN rail mounting, 5V sensor supply, connections: screw terminals
BP2-BOX	2 slots, external device in IP65 box, 5V sensor supply, connections: screw terminals

4.2 Temperature Reference ZU-TR

Available as accessory for the backplane BP16 is the option ZU-TR. The LM35DZ soldered to the D-Sub37 connector serves as a reference for cold-junction compensation during thermocouple measurement with the miniature amplifier MAL-THR.

If ZU-TR is attached to the 37-pin D-Sub IN female of the BP16, the temperature reference is provided at each slot. The measuring leads of the thermocouple only have to be soldered to the relating pins at the D-Sub37 male of the ZU-TR.



5 Important Notes for Using the BP16

- The BP16 is only suitable for extra-low voltages – please observe the relevant regulations!
- An electrically isolated power unit (with CE) must be used for power supply.
- All accessible pins are electrostatic sensitive devices. Provide for an earthed conductive work place when installing.
- The jumpers of the BP16 are very damageable and not too suitable for use in motion. In case of contact problems and in steady applications, we recommend soldering the jumpers if necessary.
- For reasons relating to EMC, the BP16 must only be operated in closed housings.
- Sensors or signals are connected at the 37-pin input connector. Use screened cables! For good noise suppression connect the shield of the sensor lines at one end only. Close open inputs if possible. ESD voltages on lines may cause malfunction during operation.
- The ground of the BP16 is electrically connected to the installed PC data acquisition system and also with the PC ground. Usually the ground of the PC is earthed, too. Be sure to avoid ground loops when connecting the sensors since they will cause measuring errors!
- Only use non-solvent detergents for cleaning. The product is designed to be maintenance-free.
- The board must not be used for safety-relevant tasks. With the use of the product, the customer becomes manufacturer by law and is therefore fully responsible for the proper installation and use of the product. In the case of improper use and/or unauthorized interference, our warranty ceases and any warranty claim is excluded.



Do not dispose of the product in the domestic waste or at any waste collection places. It has to be either duly disposed according to the WEEE directive or can be returned to bmcm at your own expense.

6 Technical Data (typical at 20°C, after 5min., 9-30V supply)

Electrical Data

Power supply:	+9..30V _{DC} , min. 0.3W, max. 4W
Sensor supply at pin 17 of D-Sub 37 IN:	+5V _{DC} , accuracy ±0.25%, TK 100ppm, electrically isolated
Current (sensor supply):	max. 50mA (if supplied with 9..30V _{DC})
Amplifier supply:	app. ±9V (max. 100mA), electrically isolated

General Data

Connection analog:	37-pin D-Sub-D female for input and output each at the back and front side of the device
Connection power supply:	3-pin DIN plug at the back of the device
Temperature ranges:	storage and operating temperature -25..70°C
Relative humidity:	0-90% (not condensing)
CE standards:	EN61000-6-1, EN61000-6-3, EN61010-1; for decl. of conformity (PDF) visit www.bmcm.de
ElektroG // ear registration:	RoHS and WEEE compliant // WEEE Reg.-No. DE75472248
Max. permissible potentials:	60V DC acc. to VDE, max. 1kV ESD on open lines
Protection type:	IP30
Dimensions (L x W x H):	167 x 113 x 30 mm ³
Delivery:	device in aluminum housing, 3-pin coupling for power supply, 37-pin analog out cable
Warranty:	2 years from date of purchase at bmcm, claims for damages resulting from improper use excluded

Accessories

Measuring amplifiers:	miniature measuring amplifiers and converters of the MAL / MAL-ISO series
Plugs:	ZU3DIN, ZU37ST
Cable:	ZUKA37SB, ZUKA37SS
Connector panels:	ZU37BB, ZU37CB, ZU37CO
DIN rail sets:	ZU-SCHI
Temperature reference:	ZU-TR with 37-pin D-Sub male
Power supply:	power supply unit ZU-PW40W (24V, 1.67A)
Other:	gender changer ZU37SS; waterproof housings ZU-PBOX-PG, ZU-PBOX-LAN