The Art of Measuring.

Knick

Reliable measurement of
DC currents up to the kA range
with a high level of accuracy

Maconic Shunt Resistors

Maconic Shunt Resistors

Usage

In many areas of applications the use of shunt resistors has established itself as a reliable, precise and long-term stable solution for continuous measurement of DC current. The low voltage drop across the shunt resistor is directly proportional to the flowing current. It is sensed by a specially designed shunt isolator, where it is converted to a standard signal and output as a measure of the current for further processing in controllers or displays.

DC currents are measured in a diverse range of applications, including photovoltaics, power supply of public transport systems, control of motors and generators, DC busses of inverters, welding equipment, and generally in systems with high DC currents.

Task

The currents to be measured are associated with system voltages (potentials) which must be safely separated, i.e. galvanically isolated by the shunt isolator. Here, it is important that the voltage measurement is not affected by common mode influences. This can be achieved even for shunt voltages as low as 60 mV by suitably designed shunt isolators. Higher shunt voltages are not necessary with high-quality shunt isolators and because of the physically larger shunt resistors they are generally not desired.

Particularly for high currents, the loss in the shunt resistor must be very low to prevent excessive heating. In any case, the resistance of the shunt should be as constant as possible with changing temperatures. The shunt resistor must be insensitive to corrosion or other environmental effects. Here, special attention must be paid to material and workmanship.

Solution

Maconic shunt resistors are the result of many years of experience in the design and production of such resistors. They are carefully manufactured using high-quality materials. The resistor bars are made of manganin, a special manganese-copper-nickel alloy, so that a very low temperature coefficient is achieved.
Dimensioning and mechanical construction are such that the resistors only moderately heat up until the rated current is reached.

The shunt resistors and associated shunt isolators achieve a very good long-term stability, which guarantees the specified accuracy over the normal periods of application of many years. Current peaks do not cause any offset or drift.
Protection equipment based on current measurement benefits from the reliability and long-term stability of the measurement and achieves a particularly high level of safety performance.

Due to the low shunt voltage of 60 mV, the dimensions of the shunt resistor can be comparatively small – and this is not at the expense of measurement accuracy because the shunt isolators from Knick are optimized for their special task.
Safe measurement of currents associated with high system voltages up to the kV range is also possible. The 3-port-isolated transmitters provide a correspondingly high galvanic isolation and are rated at 3.6 kV working voltage / 15 kV test voltage.

Facts

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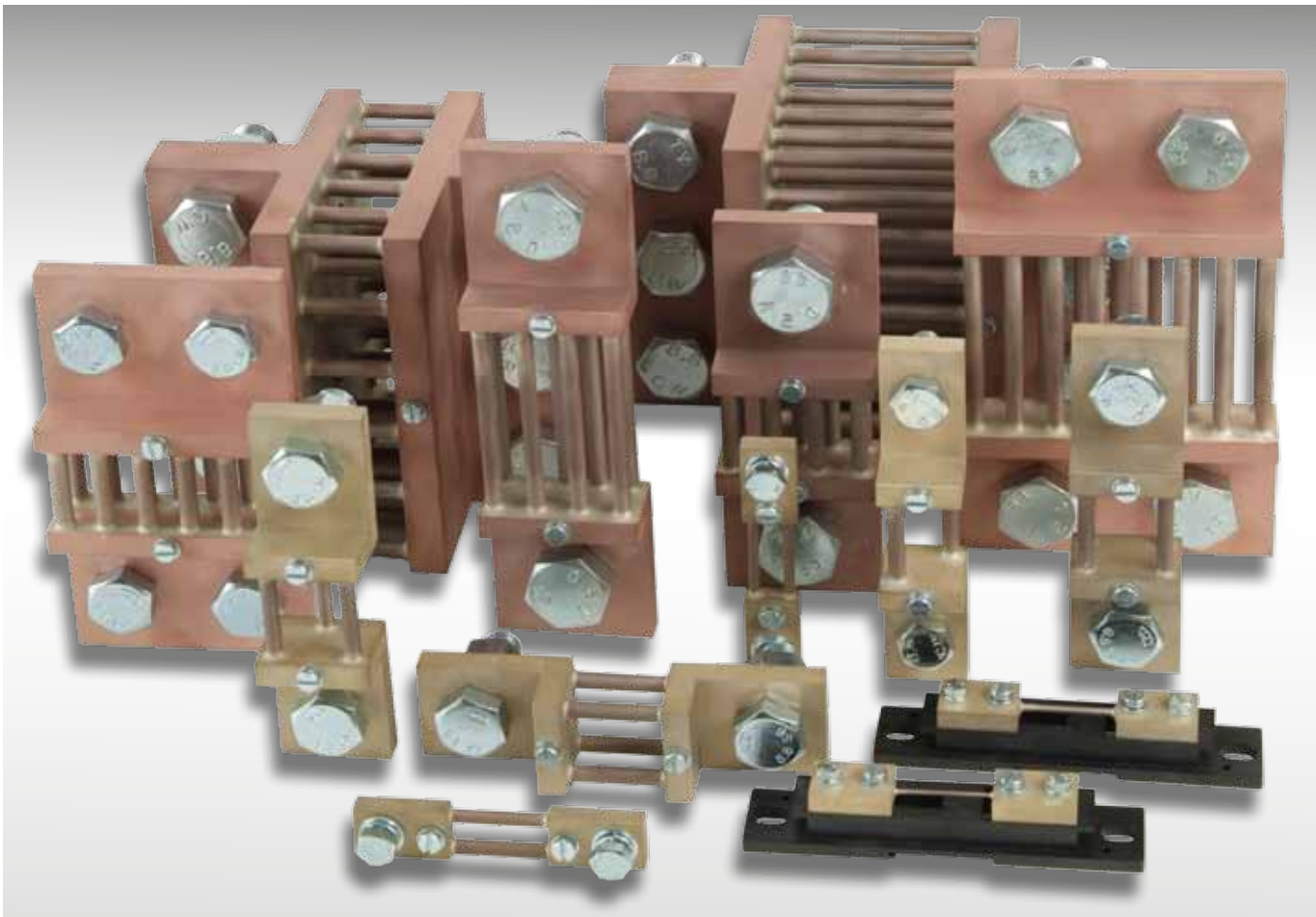
- Precise and long-term stable measurement of DC currents using shunt resistors
- For currents up to 15 kA, up to 8 kA with standard devices
- Low shunt voltage / small dimensions thanks to special shunt isolators
- Shunt accuracy: Class 0.5 optionally Class 0.2
- Shunt isolator/transmitter with 0.1% gain error
- High overload capacity without remaining measurement error
- Measurement principle prevents influences from adjacent lines
- Galvanic isolation between power unit and control unit up to 3.6 kV working voltage / 15 kV test voltage
- Conversion to standard signals ± 20 mA, ± 10 V, 4 … 20 mA
- MTBF of 96 years for the complete current measurement system
- 5-year warranty

Aeas of Applications

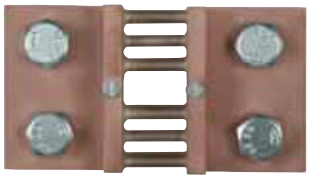
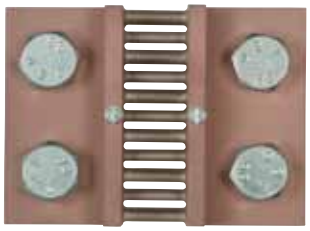
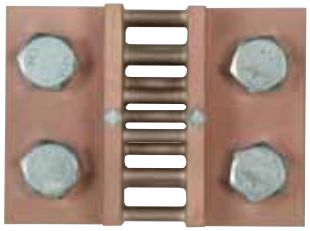
- Photovoltaics
- DC-supplied public transport systems
- Control of motors and generators
- Control of DC bus voltage / frequency inverters
- Welding equipment

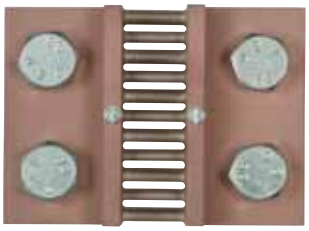
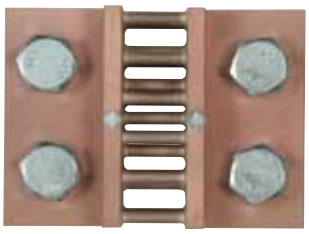


Selection Aid

	Current measurement I < 100 mA	**Current measurement I < 5 A**	**Current measurement I > 5 A**	**Voltage measurement**
Working voltage < 1000 V	VariTrans P 27000 universal transmitter	VariTrans P 29001 Maconic shunt resistor + shunt isolator	VariTrans P 29001 Maconic shunt resistor + shunt isolator	VariTrans P 29000 high-voltage isolation amplifier
Working voltage > 1000 V	VariTrans P 43000 current transmitter	VariTrans P 43000 current transmitter	VariTrans P 41000 Maconic shunt resistor + shunt isolator	VariTrans P 42000 high-voltage isolation amplifier
Working voltage > 2200 V	VariTrans P 43100 current transmitter	VariTrans P 43100 current transmitter	VariTrans P 41100 Maconic shunt resistor + shunt isolator	VariTrans P 42100 high-voltage isolation amplifier

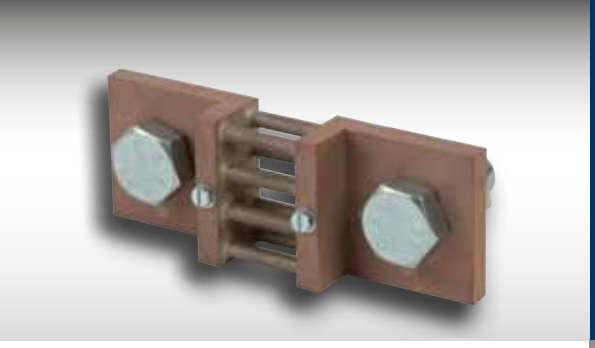
Product Line

Rated current	Rated voltage drop	Accuracy class	Order no.	Picture (example)
10 A	60 mV	0.5	Maconic M10S	
25 A	60 mV	0.5	Maconic M25S	
40 A	60 mV	0.5	Maconic M40S	
100 A	60 mV	0.5	Maconic M100S	
150 A	60 mV	0.5	Maconic M150S	
250 A	60 mV	0.5	Maconic M250S	
300 A	60 mV	0.5	Maconic M300S	
400 A	60 mV	0.5	Maconic M400S	
500 A	60 mV	0.5	Maconic M500S	
600 A	60 mV	0.5	Maconic M600S	
800 A	60 mV	0.5	Maconic M800S	
1000 A	60 mV	0.5	Maconic M1000S	
1200 A	60 mV	0.5	Maconic M1200S	
1500 A	60 mV	0.5	Maconic M1500S	
2000 A	60 mV	0.5	Maconic M2000S	
2500 A	60 mV	0.5	Maconic M2500S	
3000 A	60 mV	0.5	Maconic M3000S	
4000 A	60 mV	0.5	Maconic M4000S	
5000 A	60 mV	0.5	Maconic M5000S	
6000 A	60 mV	0.5	Maconic M6000S	
8000 A	60 mV	0.5	Maconic M8000S	

Rated current	Rated voltage drop	Accuracy class	Order no.	Picture (example)
500 A	60 mV	0.2	Maconic M500HS	
1000 A	60 mV	0.2	Maconic M1000HS	
2000 A	60 mV	0.2	Maconic M2000HS	
2500 A	60 mV	0.2	Maconic M2500HS	
4000 A	60 mV	0.2	Maconic M4000HS	

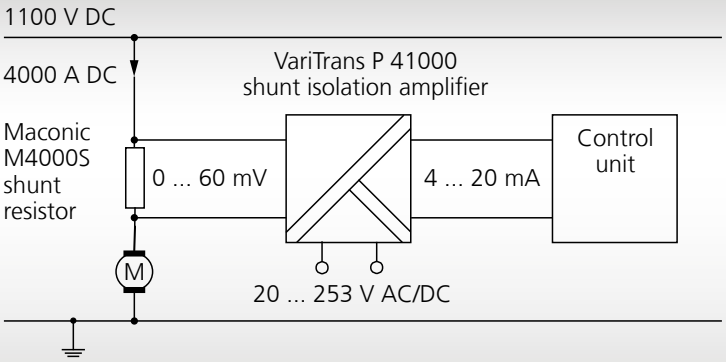
Other current or voltage values, e.g. 50 mV versions, are available upon request

Cap for type A shunt resistors up to 150 A, 60 mV (use with insulating base only)	ZU 0901	
Insulating base for type A shunt resistors, 30 to 150 A, 60 mV (up to 25 A included in package contents of shunt resistor)	ZU 0910	

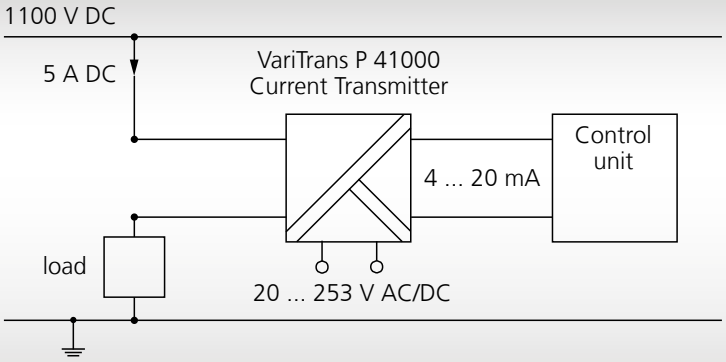


Typical Applications

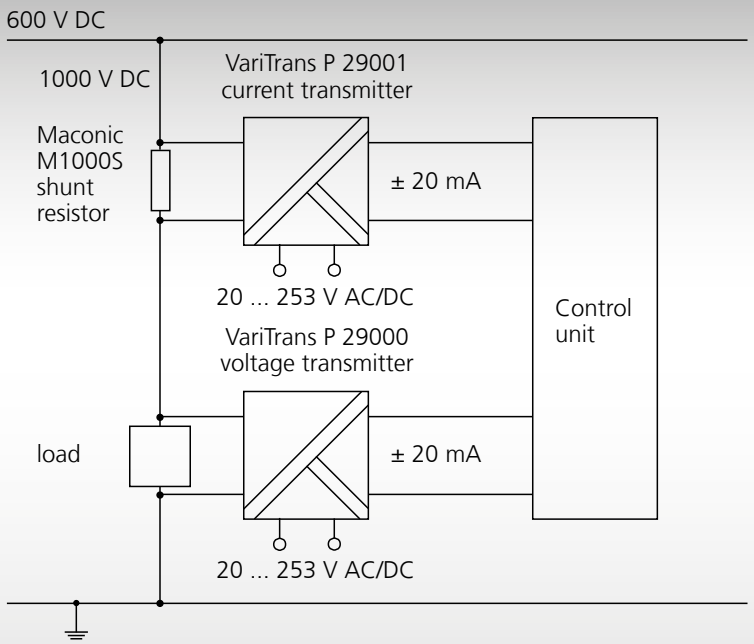
Current measurement using shunt resistor



Direct current measurement

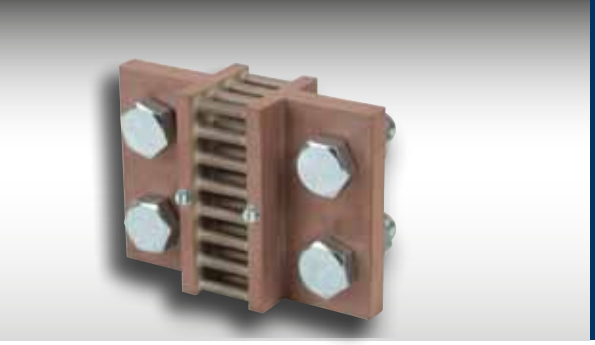


Current measurement and voltage measurement



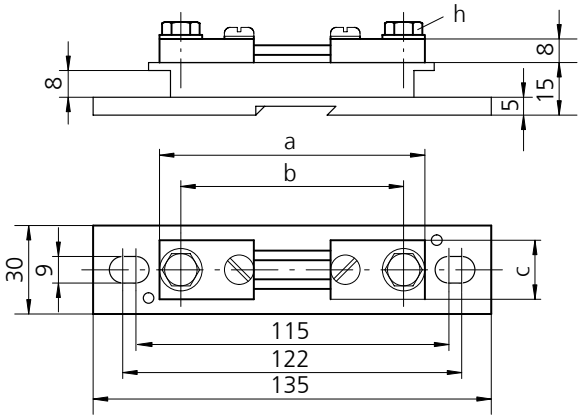
Specifications

Accuracy under rated conditions	Class 0.5 or Class 0.2		
Overload capacity	Permanent	120% full scale	
	Max 5 s	Rated < 2000 A	500% full scale
		Rated > 2000 A	200% full scale
Rated conditions	23 °C ± 1 K		
Ambient conditions	Climate suitability	Climatic class 3 according to VDE/VDI 3540	
	Ambient temperature	Operation	-10 ... +55 °C
		Transport and storage	-25 ... +65 °C
	Relative humidity	Annual average < 75%, no condensation	
Mounting	Type A with insulating base	Up to 150 A	Snap-on mounting for 35-mm top-hat rail according to EN 60715 or wall mounting, screws max. M8
	Type B	Up to 3000 A	L profiles
	Type C	Up to 8000 A	T profiles
Material	Resistor bars	Manganin	
	Connecting pieces	Type A	Brass
		Type B	Brass/copper
		Type C	Copper
	Base material	Type A	Lexan, black, self-extinguishing to UL 94 V–0
Connections	Current	For threaded screws, see table	
	Voltage	M5 x 8	
Ingress protection	IP 00		
Dimensions	See dimension drawings and product line		
Weight	See dimension drawings and product line		

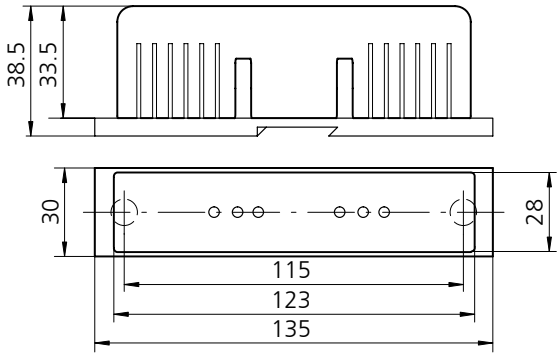


Dimension Drawings

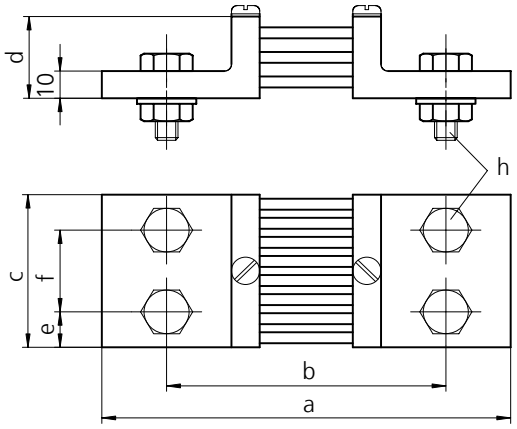
Type A
with insulating base



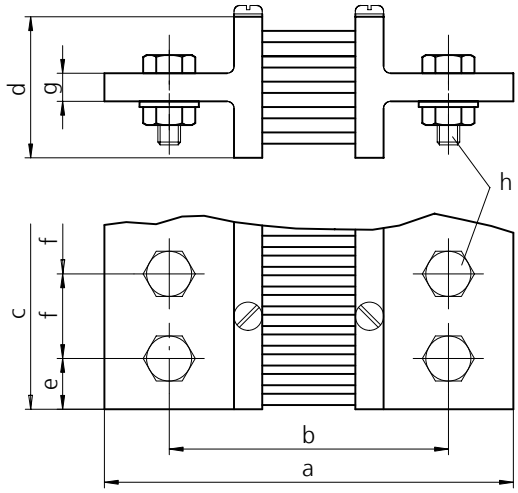
with insulating base and cap



Type B



Type C



All dimensions in mm

Rated current	Rated voltage drop	Type	Weight (kg)	Dimensions (mm)							Current connections on each side		Accuracy class	Order no.
				a	b	c	d	e	f	g		h		
10 A	60 mV	A	0.13	90	78	20					1	M5x12	0.5	Maconic M10S
25 A	60 mV	A	0.13	90	78	20					1	M5x12	0.5	Maconic M25S
40 A	60 mV	A	0.13	100	80	20					1	M8x16	0.5	Maconic M40S
100 A	60 mV	A	0.13	100	80	20					1	M8x16	0.5	Maconic M100S
150 A	60 mV	A	0.13	100	80	20					1	M8x16	0.5	Maconic M150S
250 A	60 mV	B	0.61	145	105	30	30	15			1	M12x40	0.5	Maconic M250S
300 A	60 mV	B	0.61	145	105	40	30	20			1	M16x45	0.5	Maconic M300S
400 A	60 mV	B	0.83	145	105	40	30	20			1	M16x45	0.5	Maconic M400S
500 A	60 mV	B	0.83	145	105	40	30	20			1	M16x45	0.5	Maconic M500S
600 A	60 mV	B	0.85	145	105	40	30	20			1	M16x45	0.5	Maconic M600S
800 A	60 mV	B	0.90	145	105	40	30	20			1	M16x45	0.5	Maconic M800S
1000 A	60 mV	B	1.45	165	115	60	30	30			1	M20x50	0.5	Maconic M1000S
1200 A	60 mV	B	1.45	165	115	90	30	21	48		2	M16x45	0.5	Maconic M1200S
1500 A	60 mV	B	1.96	165	115	90	30	21	48		2	M16x45	0.5	Maconic M1500S
2000 A	60 mV	B	2.30	165	115	90	30	21	48		2	M16x45	0.5	Maconic M2000S
2500 A	60 mV	B	2.90	165	115	120	30	21	48		2	M16x45	0.5	Maconic M2500S
3000 A	60 mV	B	3.00	165	115	120	30	21	48		2	M16x45	0.5	Maconic M3000S
4000 A	60 mV	C	4.25	165	115	120	60	30	60	15	2	M20x50	0.5	Maconic M4000S
5000 A	60 mV	C	4.30	165	115	120	60	30	60	15	2	M20x50	0.5	Maconic M5000S
6000 A	60 mV	C	10.5	175	125	154	130	25	52	25	3	M20x75	0.5	Maconic M6000S
8000 A	60 mV	C	12.0	175	125	154	130	25	52	25	3	M20x75	0.5	Maconic M8000S
500 A	60 mV	B		210	160	60	30	30	–	–	1	M20x50	0.2	Maconic M500HS
1000 A	60 mV	B		210	160	120	30	30	60	–	2	M20x50	0.2	Maconic M1000HS
2000 A	60 mV	C		210	160	120	60	30	60	15	2	M20x60	0.2	Maconic M2000HS
2500 A	60 mV	C		220	170	120	130	30	60	25	2	M20x60	0.2	Maconic M2500HS
4000 A	60 mV	C		220	170	154	130	25	52	25	3	M20x75	0.2	Maconic M4000HS

Other current or voltage values, e.g. 50 mV versions, are available upon request

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Isolation Amplifiers / Transmitters
Indicators
Process Analytics
Portable Meters
Laboratory Meters
Sensors
Fittings

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Subject to change without notice