

DATA SHEET

MGCplus

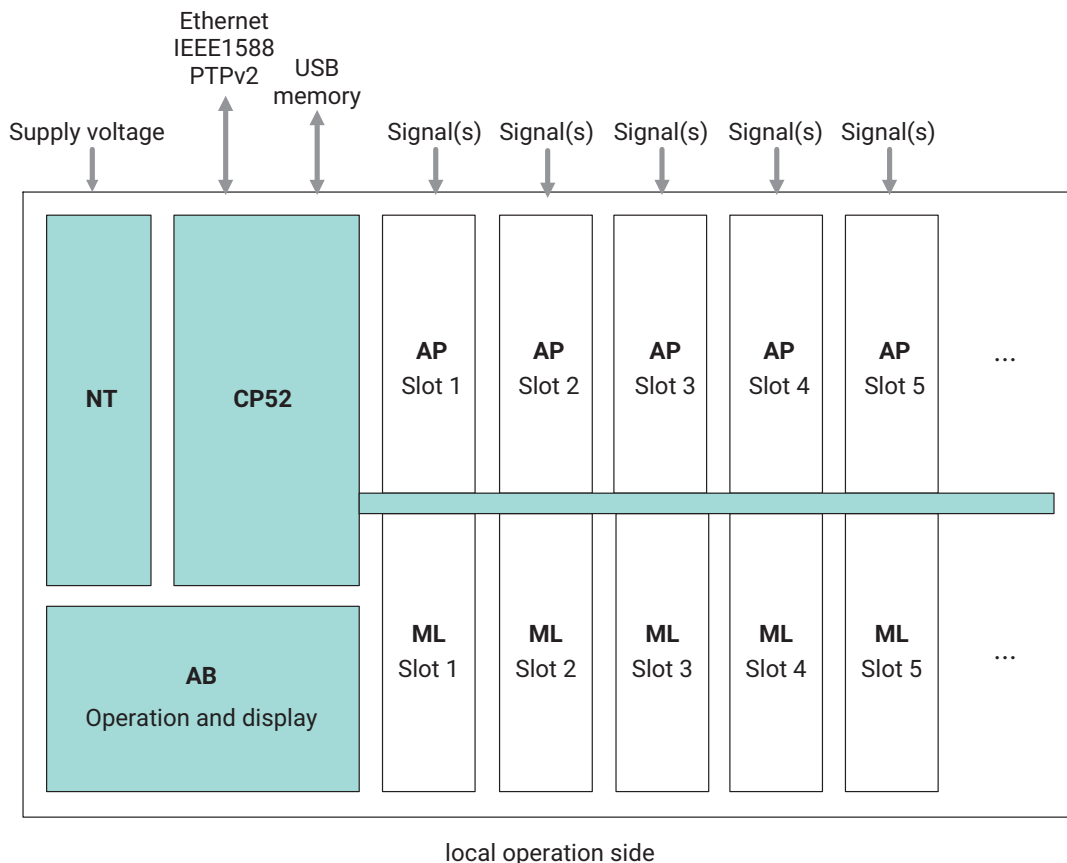
Measuring amplifier system

SPECIAL FEATURES

- Up to 128 channels per MGCplus enclosure (256 or 512 with CANHEAD or CAN)
- Sampling rates up to 19.2 kS/s per channel
- Simultaneous and parallel measurement with three independent sampling rates
- Stand-alone data logging with USB mass storage device
- Accuracy class to 0.0025
- Carrier frequency measuring amplifier for ambient conditions susceptible to error



SCHEMATIC ILLUSTRATION

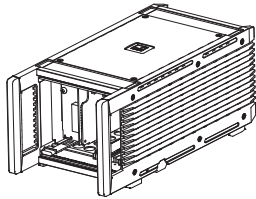


MGCPLUS SYSTEM DEVICES

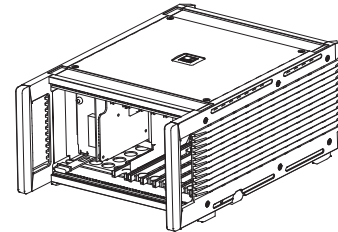
General technical specifications		
Nominal (rated) temperature range	°C	-20 ... +60
Storage temperature range	°C	-25 ... +70
Relative humidity	%	5 ... 85 (non-condensing)
Degree of protection		IP20
Power supply unit	Type	NT040
Rate input voltage	V AC	100 ... 240
Input voltage range	V AC	90 ... 264
Max. power consumption	W	170
Inrush current	A	< 16
Input frequency	Hz	40 ... 65

MGCPLUS ENCLOSURE DIMENSIONS (IN MM)

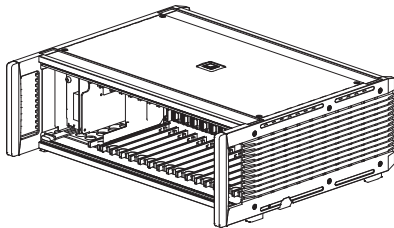
Desktop enclosure TG009E (177x161x386)



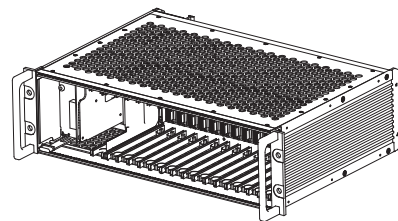
Desktop enclosure TG001E (258x161x386)



Desktop enclosure TG003E (462x161x386)



19" rack frame ER003E (482x133x365)



Desktop enclosure	19" rack	Slots	Supply voltage (V)	Weight, approx. (kg) TG/ER	Weight, approx. (kg) fully equipped
TG001E	-	6	230 (115)~	5.9 ¹⁾	8.3
TG003E	ER003E	16	230 (115)~	8.3 / 5.5 ¹⁾	14.6 / 11.8
TG009E	-	2	230 (115)~	5.0 ¹⁾	5.8

¹⁾ With the NT030 power pack, the enclosures weigh about 150 g less each

Notes

The MGCplus system is tested in accordance with the harmonized European standards 61326-1:2013 and 61010-1:2010. It therefore conforms to the applicable directives 2014/30/EU (Electromagnetic compatibility, EMC) and 2014/35/EU (Low-voltage electrical equipment) in relation to protection against hazards. Mechanical stress is tested in accordance with European standards EN 60068-2-6 for vibration and EN 60068-2-27 for shock. The devices are exposed to an acceleration of 25 m/s² within the frequency range 5 ... 65 Hz in all 3 axes. Duration of this vibration test: 30 minutes per axis. The shock test is implemented at a nominal acceleration of 200 m/s² for a duration of 11 ms, half sine and with shocks in each of the six possible directions. The maximum load per MGCplus slot is 150 mA with 16 slots. Double slot loading is possible if an adjoining slot is left vacant.

TECHNICAL SPECIFICATIONS FOR SINGLE-CHANNEL MEASUREMENT CARDS

General technical specifications for single-channel measurement cards		
Width	mm	20.3 (4 HP) ²⁾
Maximum sampling rate without linearization	Measured values/s	19200
Limit value switch		
Number		4
Reference level		Gross, net, peak values
Reference value (independently adjustable)	%	-100 ... +100 of measuring range
Hysteresis factory setting	%	1 of measuring range
Adjustment accuracy	%	0.0033 of measuring range
Response time	ms	1.0 with Butterworth filter > 5 Hz and Bessel filter > 1.25 Hz
Peak-value memory		
Number		2
Function		Maximum; Minimum
Combination		Peak-to-peak; Arithmetic mean
Update time	µs	30 with Butterworth filter > 250 Hz and Bessel filter > 100 Hz
Clear peak-value memory (switch to instantaneous measured value)		within 1 ms, via control inputs
Retaining the current measured value/peak value		within 1 ms, via control inputs
Time constant for envelope function	s	0.01 ... 10000
Remote controls (HCMOS)		
Inputs (8 lines freely assignable)		
Allowed input voltage	V	-0.5 to +5.5
High level	V	minimum +4.0
Low level	V	maximum +0.7
Schmitt trigger, hysteresis	V	> 1.1
Pull-up resistors (internal)	kΩ	100
Outputs (limit value switches, errors)		
High level at maximum 1 mA	V	> 4.0
Low level at maximum 0.7 mA	V	< 0.7
Internal resistance	kΩ	1
Analog outputs Ua1 and Ua2		
Rated voltage	V	±10 (asymmetrical)
Allowed load resistance	kΩ	> 5
Internal resistance	Ω	< 5
The two output voltages can optionally represent five signal voltages		Measuring amplifier output with zero balance Output offset by tare value Output of peak-value memory 1 (max. or min.) Output of peak-value memory 2 (max. or min.) Output of peak-value memory 3 (combination of 1 and 2)
Max. deviation of analog outputs from digital value	mV	< 3 (for ML10B < 10)
Control output for Ua1 via BNC plug on front panel		
Rated voltage	V	±10 (asymmetrical)
Allowed load resistance	kΩ	> 1000

General technical specifications for single-channel measurement cards		
Internal resistance	kΩ	1
Effect of 10 K change in ambient temperature (additional effect to digital value) on outputs Ua1 and Ua2		
Amplification	%	< 0.08
Zero point	mV	< 3

2) With ML38B: 40.6 mm (8 HP)

Single-channel measurement card ML01B							
Accuracy class		0.03					
Zero error	%	0.1 ³⁾ of full scale value					
Non-linearity	%	< 0.02 of full scale value					
DC voltage amplifier							
Input for voltage measurement		balanced					
Amplifier setting		10 V	75 mV				
Amplifier input signal range	V	-10.2 ... +10.2	-0.0765 ... +0.0765				
Measuring range digitally adjustable	V	±0.4 ... 10.2	±0.002 ... 0.0765				
Zero offset	V	±10	±0.075				
Measurement frequency range	Hz	0 ... 2400 -1 dB ⁴⁾	0 ... 250 -1 dB				
Internal resistance of signal voltage source	kΩ	< 1.3					
Maximum permissible common-mode voltage	V	62					
Input for current measurement							
		unbalanced (to internal normal resistor 50 Ω)					
Input signal range	mA	-20 ... +20					
Measuring range digitally adjustable	mA	±4 ... 20					
Max. measurement frequency range	Hz	0 ... 2400 -1 dB					
Zero drift adjustable (live zero point)	mA	0 ... 20					
Measurement frequency range		Nom. value	f_c -1 dB	-3 dB	Runtime	Rise time	
Low pass with Butterworth characteristic		(Hz)	(Hz)	(Hz)	(ms)	(ms)	
						Overshoot	
						%	
		2400 ⁵⁾	2400	3250	0.28	0.105	5.2
		2000 ⁵⁾	2050	2350	0.40	0.170	12
		1000 ⁶⁾	1050	1190	0.66	0.336	12
		500	500	588	0.90	0.64	11
		250	246	291	1.45	1.3	10
		80	79	99	3.65	3.8	9
		40	37.5	49.5	6.0	7.0	7
		20	19	25.5	11	13.3	6
		10	8.9	12.4	20	26	5
		5	4.5	6.2	42	50	4
Low pass with Bessel characteristic		Nom. value	f_c -1 dB	-3 dB	Runtime	Rise time	Overshoot
		(Hz)	(Hz)	(Hz)	(ms)	(ms)	%
		1100 ⁶⁾	1100	1780	0.45	0.23	1.3
		400	445	805	0.7	0.45	1.3
		200	235	410	1.1	0.86	1.3
		100 ⁷⁾	117	210	1.8	1.7	1.3
		40	38.5	68	4.3	5.1	1
		20	22.0	37.5	7.4	9.4	1
		10	10.5	19.0	12	19.0	0
		5	5.1	9.6	22	35.5	0
		2.5	2.6	4.8	50	70	0
		1.25	1.35	2.4	100	135	0
		0.5	0.7	1.2	200	280	0
		0.2	0.17	0.3	650	1100	0
		0.1	0.08	0.15	1400	2200	0
		0.05	0.043	0.075	3000	4600	0
High pass							
from 0.2 Hz Be; 5 Hz Bu	Hz	0.1					
from 2.5 Hz Be; 5 Hz Bu	Hz	1.0					
from 20 Hz Be; 40 Hz Bu	Hz	10					

Single-channel measurement card ML01B			
Noise with selected low-pass filter 1.25 Hz (Bessel) 100 Hz (Bessel)	$\mu\text{V}/V_{\text{SS}}$	75 mV 3 75	10 V 40 120
Long-term drift over 48 hours Measuring range 75 mV Measuring range 10 V	μV mV	With autocalibration 5 / 10 0.5 / 1	Without autocalibration 5 / 10 0.5 / 1
Effect of 10 K change in ambient temperature on digital signals S1 and S2 Sensitivity Zero point Measuring range 75 mV Measuring range 10 V Measuring range 20 mA	% μV mV μA	With autocalibration < 0.02 < 5 < 0.2 < 4	Without autocalibration < 0.2 < 50 < 6 < 120
Analog outputs Ua1 and Ua2			
Long-term drift (over 48 hours)	mV	< 3	

3) 0.2 % in current measurement

4) At $U_e > 2.5 V_{\text{SS}}$ take account of measurement frequency limitations

5) Applicable to $U_{\text{ESS}} < 2.5 \text{ V}$ with range = 10 V (corresponding to 25 % range level control)

6) Applicable to $U_{\text{ESS}} < 5 \text{ V}$ with range = 10 V (corresponding to 50 % range level control)

7) Factory setting

Single-channel measurement card ML10B							
Accuracy class		0.03					
Non-linearity	%	< 0.03 of full scale value					
Bridge excitation voltage ($\pm 5 \%$)	V	10	5 ⁸⁾	2.5	1		
Transducer SG full and half bridge, potentiometer, piezoresistive transducers	Ω	220 ... 5000	110 ... 5000	60 ... 5000	30 ... 5000		
SG quarter bridge		in conjunction with connection board AP14					
Allowed cable length between transducer and amplifier	m	500 ⁹⁾					
DC voltage amplifier Measuring ranges SG (Low) Potentiometer, piezoresistive transducers (High)	mV/V mV/V	$\pm 0.10 \dots 3.06$ $\pm 10 \dots 306$	$\pm 0.20 \dots 6.12$ $\pm 20 \dots 612$	$\pm 0.40 \dots 12.24$ $\pm 40 \dots 1224$	$\pm 1.0 \dots 30.6$ $\pm 100 \dots 3060$		
Bridge balance range SG (Low) Potentiometer, piezoresistive transducers (High)	mV/V mV/V	± 3.06 ± 306	± 6.12 ± 612	± 12.24 ± 1224	± 30.6 ± 3060		
Measurement frequency range Low pass with Butterworth characteristic		Nom. value (Hz)	$f_c - 1 \text{ dB}$ (Hz)	-3 dB (Hz)	Runtime (ms)	Rise time (ms)	Overshoot %
		10000	8900	9900	0.13	0.05	19 ¹⁰⁾
		3000	2920	3480	0.16	0.116	13
		2000	2160	2500	0.24	0.15	12
		1000	1010	1165	0.66	0.35	12
		500	500	588	0.9	0.64	11
		250	246	291	1.45	1.3	10
		80	79	99	3.65	3.8	9
		40	37.5	49.9	6	7	7
		20	19	25.5	11	13.3	6
		10	8.9	12.4	20	26	5
		5	4.5	6.2	42	50	4

Single-channel measurement card ML10B							
Low pass with Bessel characteristic Only for the analog output (Digital interface 5000 Hz Butterworth)		Nom. value (Hz)	f_c-1 dB (Hz)	-3 dB (Hz)	Runtime (ms)	Rise time (ms)	Overshoot %
		100000	111000	188000	0.0027	0.0025	10.8 (High)
		100000	104000	145000	0.0027	0.0025	10.8 (Low)
		50000	49000	84000	0.0044	0.004	6.6
		1000	900	1800	0.27	0.2	0.6
		400	400	800	0.47	0.44	0.5
		200	230	405	0.82	0.96	0.4
		100 ⁸⁾	117	210	1.58	1.8	0.4
		40	38,5	68	4.21	5.4	0
		20	22	37.5	7.2	9.3	0
		10	10.5	19	13.9	19	0
		5	5.1	9.6	25	37	0
		2.5	2.6	4.8	50	75	0
		1.25	1.35	2.4	100	155	0
		0.5	0.7	1.2	200	300	0
	0.2	0.17	0.3	650	1200	0	
	0.1	0.08	0.15	1400	2300	0	
	0.05	0.043	0.075	3000	4600	0	
High pass							
from 0.2 Hz Be, 5 Hz Bu	Hz				0.1		
from 2.5 Hz Be, 5 Hz Bu	Hz				1.0		
from 20 Hz Be, 40 Hz Bu	Hz				10		
Max. allowed common-mode voltage	V				±6		
Common-mode rejection							
SG	dB				>120 (DC)		
Potentiometer	dB				>95 (DC)		
Noise							
with selected low-pass filter					SG (0.2 ... 6.12 mV/V)	Potentiometer (20 ... 612 mV/V)	
100000 Hz (Bessel)	μV/V _{SS}				4	300	
50000 Hz (Bessel)					3 ¹¹⁾	300	
10000 Hz (Bessel)					3	300	
1000 Hz (Bessel)					1.3	100	
100 Hz (Bessel)					0.35	35	
Long-term drift over 48 hours							
SG (Low)	μV/V				< 0.25	< 5	
Potentiometer (High)	μV/V				< 20	< 400	
Effect of 10 K change in ambient temperature							
on digital signals S1 and S2					With autocalibration	Without autocalibration	
SG (Low) Sensitivity	%				< 0.03	< 0.2	
SG (Low) Zero point	μV/V				< 0.6	< 10	
Potentiometer (High) Sensitivity	%				< 0.03	< 0.2	
Potentiometer (High) Zero point	μV/V				< 30	< 500	
Analog outputs Ua1 and Ua2							
Long-term drift over 48 hours	mV					< 3	

8) Factory setting

9) 100 m maximum distance between connection board and T-ID/TEDS module

10) At max. 25 % level control ($U_{ASS \max}=5 \text{ V}$)

11) With half bridge 20 μV/V. We recommend only measuring up to a cut-off frequency of 10 kHz.

Single-channel measurement card ML30B				
Accuracy class				0.03
Non-linearity	%			< 0.02 of full scale value
Carrier frequency	Hz			600.15 ± 0.06 (synchronized)
Bridge excitation voltage (± 5 %)	V	5 ¹²⁾	2.5	1
Transducer				
SG full bridge	Ω	110 ... 5000	60 ... 5000	30 ... 5000

Single-channel measurement card ML30B							
SG quarter bridge		in conjunction with connection board AP14					
Allowed cable length between transducer and amplifier	m	500					
Carrier frequency amplifier							
Measuring ranges	mV/V	±0.10 ... 3.06	±0.20 ... 6.12	±0.50 ... 15.30			
Bridge balance range	mV/V	±3.06	±6.12	±15.3			
Measurement frequency range		Nom. value	f_c-1 dB	-3 dB	Runtime	Rise time	Overshoot
Low pass with Butterworth characteristic		(Hz)	(Hz)	(Hz)	(ms)	(ms)	%
		200	235	277	2.5	1.4	10
		80	88	103	4.6	3.8	9
		40	43	51	8.2	7.4	7
		20	22	26	14	14	6
		10	10.6	12.7	27	30	5
		5	5.3	6.3	52	56	4
Low pass with Bessel characteristic		Nom. value	f_c-1 dB	-3 dB	Runtime	Rise time	Overshoot
		(Hz)	(Hz)	(Hz)	(ms)	(ms)	%
		100 ¹²⁾	99	180	2.7	2	1
		40	40	72	5.2	4.8	1
		20	20	35.5	9.8	10	1
		10	9.8	18	18	20	0
		5	4.4	8.6	35	40	0
		2.5	2.35	4.4	65	80	0
		1.25	1.2	2.15	125	160	0
		0.5	0.6	1.15	220	300	0
		0.2	0.17	0.31	640	1100	0
		0.1	0.087	0.155	1400	2200	0
		0.05	0.042	0.08	3000	4600	0
High pass							
from 0.2 Hz Be, 5 Hz Bu	Hz	0.1					
from 2.5 Hz Be, 5 Hz Bu	Hz	1.0					
from 20 Hz Be, 40 Hz Bu	Hz	10					
Max. allowed common-mode voltage	V	±6					
Common-mode rejection	dB	> 50 (0 ... 600 Hz)					
Maximum differential voltage DC	V	±0.1					
Noise							
with selected low-pass filter							
200 Hz (Butterworth)		< 0.3					
1.25 Hz (Bessel)	μV/V _{SS}	< 0.03					
Long-term drift over 48 hours	μV/V	< 0.1			2		
Effect of 10 K change in ambient temperature on digital signals S1 and S2		With autocalibration			Without autocalibration		
Sensitivity	%	< 0.01			< 0.2		
Zero point	μV/V	< 0.1			< 2		
Analog outputs Ua1 and Ua2							
Long-term drift over 48 hours	mV	< 3					

¹²⁾ Factory setting

¹³⁾ Measured at U_B = 5 V and input signal 2 mV/V

Single-channel measurement card ML38B		
Accuracy class		0.0025 ¹⁴⁾
Non-linearity	%	< 0.002
Carrier frequency	Hz	225.05±0.02 (synchronized)
Bridge excitation voltage (± 5 %)	V	5 ¹⁵⁾ 2.5
Transducer		
SG full bridge	Ω	30 ... 5000
Allowed cable length between transducer and amplifier	m	500
Carrier frequency amplifier		

Single-channel measurement card ML38B								
Measuring ranges	mV/V	±0.2 ... 5.1		±0.4 ... 10.2				
Bridge balance range	mV/V	±5.1		±10.2				
Measurement frequency range Low pass with Butterworth characteristic		Nom. (rated) value f _c (Hz)	-3 dB (Hz)	-60 dB (Hz)	-120 dB (Hz)	Settling time to 99 % (s)		99.999 % (s)
		1.0	1.1	18.9	50	1	2.3	
		1.5	1.6	21.6	54	0.7	1.6	
		2.5	2.3	24.5	57	0.5	1.14	
		3	3.2	27.4	61	0.37	0.82	
		5	4.6	30.5	65	0.26	0.58	
		6	6.3	33.8	68	0.2	0.42	
		9	8.3	37.3	70	0.16	0.30	
		10	10	41	72	0.13	0.23	
Low pass with Bessel characteristic		Nom. (rated) value f _c (Hz)	-3 dB (Hz)	-60 dB (Hz)	-120 dB (Hz)	Settling time to 99 % (s)		99.999 % (s)
		0.03	0.03	0.125	0.2	32	48	
		0.05	0.05	0.25	0.4	16	24	
		0.1	0.1	0.5	0.8	8	12	
		0.2	0.22	1	1.7	4	6	
		0.5	0.45	2	3.5	2	3	
		0.9	0.9	4	7	1	1.5	
		1.5	1.7	8	14	0.5	0.75	
Transducer adaptation		Linear or polynomial characteristic ¹⁶⁾						
Max. permissible common-mode voltage	V	± 2						
Common-mode rejection	dB	> 100						
Input resistance	MΩ	1000						
Noise with selected low-pass filter								
0.9 Hz (Bessel)		< 0.02						
5 Hz (Butterworth)	μV/V _{SS}	< 0.05						
Long-term drift over 24 hours	ppm	< 20						
Short-term drift over 5 min, from 2 h after switch-on	ppm	< 10						
Effect of 10 K change in ambient temperature on digital signals S1 and S2								
Sensitivity	%	< 0.002						
Zero point	%	< 0.001						
Analog outputs Ua1 and Ua2								
Long-term drift over 48 hours	mV	< 3						

14) With irradiation as per EN 61326, table 1

15) Factory setting

16) When calibrating the measurement chain, the measured values must be recorded in the electrical unit (mV/V) with no display adjustment!

Single-channel measurement card ML55B				
Accuracy class		0.03		
Zero error	%	< 0.1 of full scale value		
Non-linearity	%	< 0.02 of full scale value		
Carrier frequency	Hz	4801.2 ± 0.48 (synchronized)		
Bridge excitation voltage (± 5 %)	V	5 ¹⁷⁾	2.5	1
Transducer ¹⁸⁾				
SG half and full bridge ¹⁹⁾	Ω	110 ... 5000	60 ... 5000	30 ... 5000
Inductive half and full bridge	mH	n/a	2.5 ... 30	1 ... 30
SG quarter bridge ¹⁹⁾		in conjunction with connection board AP14		
Allowed cable length between transducer and amplifier	m	500 ²⁰⁾		
Carrier frequency amplifier				
Measuring ranges				
SG	mV/V	±0.1 ... 3.06	±0.2 ... 6.12	±0.5 ... 15.3
Inductive		±1.5 ... 45.9	±3.0 ... 91.8	±7.5 ... 229.5

Single-channel measurement card ML60B							
Accuracy class		0.01					
Input signals		Input level					
Frequency F1		0.1 .. 30 V _S (with control amplifier) or CMOS level					
Direction of rotation signal F2		0.1 .. 30 V _S (with control amplifier) or CMOS level					
Zero index		CMOS level					
Transducer error (only with AP01i)		CMOS level					
Transducer		T10 series ²¹⁾ , T12/T12HP, T40 series					
HBK torque transducers in conjunction with AP17							
Frequency signal sources with square or sine-wave voltage, Incremental encoder	kHz	0.0001 ... 2000					
Allowed cable length between transducer and amplifier	m	70 ²²⁾					
Input level							
5 V setting	V _s	5 ... 30					
100 mV setting (auto. gain control)	V _s	0.1 ... 30					
Input impedance	kΩ	20					
Detection of direction of rotation		via additional 90° phase-shifted frequency signal					
Measuring ranges							
Frequency measurement	Hz	100 ... 2000 1 000 ... 20 000 10 000 ... 200 000 100 000 ... 2 000 000					
Pulse counting	Pulses	100 ... 1 000 000					
Maximum pulse rate with pulse counting	Pulses/s	1 000 000					
Zero balance range							
Measuring ranges to 2 kHz	Hz	-2000 ... +2000					
Measuring ranges to 20 kHz	Hz	-20 000 ... +20 000					
Measuring ranges to 200 kHz	Hz	-200 000 ... +200 000					
Measuring ranges to 1 MHz	Hz	-2 000 000 ... + 2 000 000					
Measurement frequency range		Nom. value	f_c-1 dB	-3 dB	Runtime	Rise time	Overshoot
Low pass with Butterworth characteristic		(Hz)	(Hz)	(Hz)	(ms)	(ms)	%
		Without filter	2500	3100	0.4	0.12	8
		2000	2000	2400	0.5	0.18	10
		1000	1000	1200	0.8	0.35	8
		500	470	570	0.9	0.70	11
		250	246	291	1.45	1.3	10
		80	79	99	3.65	3.8	9
		40	37.5	49.5	6	7	7
		20	19	25.5	11	13.3	6
		10	8.9	12.4	20	26	5
		5	4.5	6.2	42	50	4
Low pass with Bessel characteristic		Nom. value	f_c-1 dB	-3 dB	Runtime	Rise time	Overshoot
		(Hz)	(Hz)	(Hz)	(ms)	(ms)	%
		900	900	1800	0.6	0.35	0
		400	400	800	0.8	0.52	1.0
		200	235	410	1.1	0.86	1.3
		100 ²³⁾	117	210	1.8	1.7	1.3
		40	38.5	68	4.3	5.1	1
		20	22	37.5	7.4	9.4	1
		10	10.5	19	12	19	0
		5	5.1	9.6	22	35.5	0
		2.5	2.6	4.8	50	70	0
		1.25	1.35	2.4	100	135	0
		0.5	0.7	1.2	200	280	0
		0.2	0.17	0.3	650	1100	0
		0.1	0.08	0.15	1400	2200	0
		0.05	0.043	0.075	3000	4600	0

Single-channel measurement card ML60B		
High pass		
from 0.2 Hz Be; 5 Hz Bu	Hz	0.1
from 2.5 Hz Be; 5 Hz Bu	Hz	1.0
from 20 Hz Be; 40 Hz Bu	Hz	10
Input filter		Glitch filter, selective
Noise (10 kHz input signal) with selected low-pass filter		
Off	Hz	± 3
1 kHz (Butterworth)	Hz	± 1
100 Hz (Bessel)	Hz	± 0.2
Long-term drift over 90 days	%	< 0.005
Effect of 10 K change in ambient temperature on digital signals S1 and S2	%	0.005
Analog outputs Ua1 and Ua2		
Long-term drift over 48 hours	mV	< 3

21) Does not apply to version -KF1

22) Max. 20 m if internal transducer supply is used

23) Factory setting

TECHNICAL SPECIFICATIONS CONNECTION BOARDS FOR SINGLE-CHANNEL AMPLIFIERS

Connection board AP01i		
Transducer connection		D-sub-HD15, 15-pin, DA-15P ²⁴⁾
Connection for output signal		D-sub-HD15, 25-pin, DB-25P ²⁵⁾
Width	mm	20.3 (4 HP)

²⁴⁾ HBK ordering number 3-3312.0182

²⁵⁾ HBK ordering number 2-9278.0293

Connection board AP03i		
Transducer connection		MS cable plug, 7-pin, MS3106A 16S-1P ²⁶⁾
Connection for output signal		D-sub-HD15, 25-pin, DB-25P ²⁷⁾
Width	mm	40.6 (8 HP)

²⁶⁾ HBK ordering number 1-MS3106-PEMV

²⁷⁾ HBK ordering number 2-9278.0293

Connection board AP14		
Accuracy class		
SG full bridge		0.1
SG half bridge		0.5
SG quarter bridge (in 3- or 4-wire configuration)		0.5
Non-linearity	%	0.05
Transducer		
SG full, half and quarter bridge (in 3- or 4-wire configuration)		
Measurement cards that can be connected		ML10B, ML30B, ML55B ²⁸⁾
Transducer connection		D-sub-HD15, 15-pin DA-15P ²⁹⁾
Connection for output signal		D-sub-HD15, 25-pin DB-25P ³⁰⁾
Internal completion resistors	Ω	120, 350, 700
Allowed cable length between transducer and connection board	m	500
Measurement frequency range	kHz	0 ... 50
Effect of 10 K change in ambient temperature		
SG full bridge	Sensitivity	%
	Zero point	%
		0.05
		0.05
SG half and quarter bridge	Sensitivity	%
	Zero point	%
		0.1
		0.5
Width	mm	20.3 (4 HP)

²⁸⁾ When combining the ML55B with AP14, after configuring the measurement chain it is essential to perform a one-off zero balance.

²⁹⁾ HBK ordering number 3-3312.0182

³⁰⁾ HBK ordering number 2-9278.0293

Connection board AP17		
Transducer		
HBK torque transducers		T10 series ³¹⁾ , T12/T12HP, T40 series
Frequency signal sources with square or sine-wave voltage, incremental encoder	kHz	0.0001 ... 1000
Maximum input frequency	kHz	1000
Transducer connection		D-sub-HD15, 15-pin, DA-15P ³²⁾
Connection for output signal		D-sub-HD15, 25-pin, DB-25P ³³⁾

Connection board AP17		
Outputs		
Transducer supply	V (DC)	+16 (max. 500 mA) ³⁴⁾
	V (DC)	-16 (max. 500 mA) ³⁴⁾
	V (DC)	+5 (max. 300 mA) ³⁴⁾
Calibration signal trigger	V (DC)	approx. 5 (max. 100 mA)
Inputs		
Rated input voltage		
	balanced	V _{SS}
unbalanced	V _{SS}	5
Minimum/maximum voltage swing		
	balanced	V _{SS}
unbalanced	V _{0S}	3 / 20
Common-mode range	V	-5 ... +4
Width	mm	20.3 (4 HP)

³¹⁾ Except for the -KF1 version

³²⁾ HBK ordering number 3-3312.0182

³³⁾ HBK ordering number 2-9278.0293

³⁴⁾ The currents indicated are the maximum allowed continuous currents of the AP17. The number of connection boards per enclosure is not restricted, though a maximum of three connection boards can be used to supply the transducer (16 V e.g. for torque measurement flange T10 series, T12/T12HP, T40 series).

If multiple torque flanges are supplied with power, make certain they are powered up one after the other, not simultaneously.

TECHNICAL SPECIFICATIONS FOR MULTI-CHANNEL MEASUREMENT CARDS

Multi-channel measurement card ML455 with connection board AP455i				
Accuracy class			0.05	
Non-linearity	%		< 0.02	
Number of measurement channels			4	
Carrier frequency	Hz		4801.2 ± 0.48 (synchronized)	
Bridge excitation voltage (± 5 %)	V		2.5	
Transducer ³⁵⁾				
SG half or full bridge	Ω		120 ... 1000	
Inductive half or full bridge, LVDT	mH		4 ... 330	
Allowed cable length between transducer and connection board ³⁶⁾	m		100	
Measuring ranges				
SG	mV/V		±4	
Inductive	mV/V		±100	
LVDT	mV/V		±1000	
Noise				
with selected low-pass filter			SG	Inductive LVDT
1000 Hz (Butterworth)	μV/V		< ±3	< ±30 < ±140
80 Hz (Butterworth)	μV/V		< ±0.5	< ±3 < ±28
20 Hz (Butterworth)	μV/V		< ±0.2	< ±1.5 < ±14
5 Hz (Butterworth)	μV/V		< ±0.1	< ±0.5 < ±6
200 Hz (Bessel)	μV/V		< ±3	< ±30 < ±140
40 Hz (Bessel)	μV/V		< ±0.5	< ±3 < ±28
5 Hz (Bessel)	μV/V		< ±0.2	< ±1.5 < ±14
1.25 Hz (Bessel)	μV/V		< ±0.1	< ±0.5 < ±6
Effect of 10 K change in ambient temperature			With autocalibration	Without autocalibration
SG Sensitivity	%		< 0.01	< 0.03
SG Zero point	μV/V		< 0.2	< 0.4
Inductive Sensitivity	%		< 0.01	< 0.03
Inductive Zero point	μV/V		< 5	< 10
LVDT Sensitivity	%		< 0.01	< 0.03
LVDT Zero point	μV/V		< 50	< 100
Transducer connection			D-sub, 15-pin, DA-15P ³⁷⁾	
Width	mm		40.6 (8 HP)	

³⁵⁾ The transducer type can be selected separately for each of the four subchannels

³⁶⁾ Use shielded cable pairs with outside shielding (e.g. HBM no. 4-3301.0071)

³⁷⁾ HBK ordering number 3-3312.0182

Multi-channel measurement card ML801B with connection board AP801/AP801S6 ³⁸⁾		
Accuracy class		0.05
Non-linearity	%	< 0.03
Number of measurement channels		8
Measuring range	V	-10.5 ... +10.5
Zero offset	V	-10.5 ... +10.5
Max. common-mode input voltage (against enclosure/ground)	V	50
Max. differential input voltage	V	50
Allowed cable length between transducer and connection board	m	100

Multi-channel measurement card ML801B with connection board AP801/AP801S6 ³⁸⁾

Maximum sampling rate per channel	Hz	2400 (8 subchannels), 4800 (4 subchannels), 9600 (2 subchannels) ³⁹⁾					
Max. allowed input voltage and common-mode voltage	V	50					
Measurement frequency range ⁴⁰⁾ Low pass with Butterworth characteristic (Butterworth HD)		Nom. value f_c	-1 dB	-3 dB	Internal Sampling rate⁴¹⁾		
		(Hz)	(Hz)	(Hz)	(Hz)		
		1000	1189	1518	9600		
		500	523	691	9600		
		250	253	322	9600		
		200	203	265	9600		
		80	78	103	9600		
		1000	1206	1516	4800		
		500	613	816	4800		
		250	255	327	4800		
		200	203	264	4800		
		80	78	102	4800		
		250	312	413	2400		
		200	226	300	2400		
		80	82	109	2400		
40	41	54	1200				
20	21	27	600				
10	10	13	300				
5	5.3	7	150				
Low pass with Bessel characteristic (Bessel HD)		Nom. value f_c	-1 dB	-3 dB	Internal Sampling rate		
		(Hz)	(Hz)	(Hz)	(Hz)		
		200	259	448	2400		
		100	102	184	2400		
		40	41	75	2400		
		20	20	36	2400		
		10	10	18	2400		
		5	5	9	1200		
		2,5	2,5	4,5	600		
		1	1	1.8	300		
		0.5	0.5	0.9	150		
		0.2	0.21	0.38	75		
		0.1	0.1	0.19	37.5		
		0.05	0.051	0.094	18.7		
		Low pass Butterworth characteristic (Butterworth compatible)		Nom. value f_c	-1 dB	-3 dB	Internal Sampling rate
(Hz)	(Hz)			(Hz)	(Hz)		
1000	1076			1282	4800		
500	596			798	4800		
250	279			345	2400		
200	214			266	2400		
80	78,9			103	2400		
40	38.7			51.8	2400		
20	19.5			27.2	2400		
10	9.36			13.2	2400		
5	4.37			6.4	1200		
Low pass Bessel characteristic (Bessel compatible)				Nom. value f_c	-1 dB	-3 dB	Internal Sampling rate
				(Hz)	(Hz)	(Hz)	(Hz)
				200	322	571	2400
				100	125	216	2400
		40	41	70	2400		
		20	21	37	2400		
		10	11	19	2400		
		5	5.5	9.6	2400		
		2,5	2.7	4.8	1200		
		1	1.36	2.4	600		
		0.5	0.68	1.2	300		
		0.2	0.186	0.186	75		
		0.1	0.093	0.158	37.5		
		0.05	0.047	0.079	18.7		
		Internal resistance of voltage source	k Ω	< 1.0			
Input impedance balanced/unbalanced	k Ω	500/250					
Noise With selected low-pass filter 1 Hz (Bessel)	μ V _{peak-t} o-peak	< 50					

Multi-channel measurement card ML801B with connection board AP801/AP801S6 ³⁸⁾		
Effect of 10 K change in ambient temperature		
Sensitivity	%	< 0.05
Zero point	%	< 0.05
Long-term drift over 48 hours with/without auto-calibration	mV	0.8 / 1.5
Transducer excitation voltage⁴²⁾ (only AP801S6)	V	8/16 (for all subchannels)
Max. output current per channel	mA	50
Max. output current per connection board	mA	150
Width	mm	20.3 (4TE)

³⁸⁾ Customer-side connector plug: e.g. Phoenix Contact MC1,5/3-ST-3,5; art. no. 1840379 (connector plug for AP801S6: LemoR FGG0B.304 CLAD52)

³⁹⁾ The number of subchannels can be changed via the MGCplus Setup Assistant or the MGCplus Firmware Loader.

⁴⁰⁾ ML801B/AP801 resp. AP801S6: The 1000 Hz Butterworth filter is only supported as from the AP801/AP801S6 hardware version 1.20.

⁴¹⁾ Internally, the signals are converted independently of the preset number of subchannels at 38.4 kHz. The implementation of a digital filter calls for a reduction in the sampling rate (through repeated averaging and sub-sampling). This reduced sampling rate is called the "internal sampling rate".

⁴²⁾ A maximum of 1 A may be drawn from the MGCplus to supply the transducer.

Multi-channel measurement card ML801B with connection board AP809 ⁴³⁾				
Accuracy class				0.05 ⁴⁴⁾
Total error limit at 22 °C ambient temperature	K			±1 ^{46), 47), 48)}
Number of measurement channels				
Transducer				Thermocouples of type K, J, N, T ±75 mV
Max. allowed input voltage and common-mode voltage	V			10
Allowed cable length between transducer and connection board	m			30
Maximum sampling rate per channel	Hz			2400 (8 subchannels), 4800 (4 subchannels), 9600 (2 subchannels) ⁴⁵⁾
Zero error				
Measurement frequency range ⁴⁹⁾				
Low pass with Butterworth characteristic (Butterworth HD)		Nominal	-1 dB	-3 dB
		(Hz)	(Hz)	(Hz)
		1000	1189	1518
		500	523	691
		250	253	322
		200	203	265
		80	78	103
		1000	1206	1516
		500	613	816
		250	255	327
		200	203	264
		80	78	102
		250	312	413
		200	226	300
		80	82	109
		40	41	54
		20	21	27
		10	10	13
		5	5.3	7
				Internal Sampling rate ⁵⁰⁾
				(Hz)
				9600
				9600
				9600
				9600
				9600
				4800
				4800
				4800
				4800
				4800
				4800
				2400
				2400
				2400
				1200
				600
				300
				150

Multi-channel measurement card ML801B with connection board AP809 ⁴³⁾

Low pass with Bessel characteristic (Bessel HD)		Nom. value f_c (Hz) 200 100 40 20 10 5 2,5 1 0.5 0.2 0.1 0.05	-1 dB (Hz) 259 102 41 20 10 5 2,5 1 0.5 0.21 0.1 0.051	-3 dB (Hz) 448 184 75 36 18 9 4,5 1.8 0.9 0.38 0.19 0.094	Internal Sampling rate (Hz) 2400 2400 2400 2400 2400 1200 600 300 150 75 37.5 18.7
Low pass Butterworth characteristic (Butterworth compatible)		Nom. value f_c (Hz) 1000 500 250 200 80 40 20 10 5	-1 dB (Hz) 1076 596 279 214 78,9 38.7 19.5 9.36 4.37	-3 dB (Hz) 1282 798 345 266 103 51.8 27.2 13.2 6.4	Internal Sampling rate (Hz) 4800 4800 2400 2400 2400 2400 2400 2400 1200
Low pass Bessel characteristic (Bessel compatible)		Nom. value f_c (Hz) 200 100 40 20 10 5 2,5 1 0.5 0.2 0.1 0.05	-1 dB (Hz) 322 125 41 21 11 5.5 2.7 1.36 0.68 0.186 0.093 0.047	-3 dB (Hz) 571 216 70 37 19 9.6 4.8 2.4 1.2 0.186 0.158 0.079	Internal Sampling rate (Hz) 2400 2400 2400 2400 2400 2400 1200 600 300 75 37.5 18.7
Input for voltage measurement					
Measuring range	mV	-80 ... +80			
Zero offset	mV	-80 ... +80			
Internal resistance of voltage source	k Ω	< 1.0			
Input impedance balanced/unbalanced	k Ω	2000 / 1000			
Noise With selected low-pass filter 1 Hz (Bessel)	$\mu\text{V}_{\text{peak-t o-peak}}$	< 0.5			
Effect of 10 K change in ambient temperature					
Sensitivity	%	< 0.05			
Zero point	%	< 0.05			
Long-term drift over 48 hours with/without auto-calibration	mV	0.01 / 0.02			
Non-linearity	%	< 0.03			
Input for thermocouples					
Linearization error	$^{\circ}\text{C}$	< 0.06			
Linearization range					
NiCr-Ni (K)	$^{\circ}\text{C}$	-158 ... +1414			
Fe-CuNi (J)	$^{\circ}\text{C}$	-167 ... +1192			
NiCrSi-NiSi (N)	$^{\circ}\text{C}$	-186 ... +1300			
Cu-CuNi (T)	$^{\circ}\text{C}$	-210 ... +393			
Temperature range of cold junction	$^{\circ}\text{C}$	-20 ... +60			

Multi-channel measurement card ML801B with connection board AP809 ⁴³⁾		
Effect of 10 K change in ambient temperature (T _{ref} = 22 °C)	K	±1
Long-term drift over 48 hours with/without auto-calibration	K	0.2 / 0.4
Noise		
With selected low-pass filter 1 Hz (Bessel)		
Type K, J, N, T	K	< 0.1
Width	mm	20.3 (4TE)

⁴³⁾ No line break detection

⁴⁴⁾ Accuracy class and absolute zero error for voltage measurement only

⁴⁵⁾ The number of subchannels can be changed via the MGCplus Setup Assistant or the MGCplus Firmware Loader.

⁴⁶⁾ From AP809: Hardware revision 3.00

⁴⁷⁾ The total error limit for thermocouple type N is ±2 K

⁴⁸⁾ In industrial electromagnetic environments under the influence of continuous disturbance variables, the total error limit is ±1.5 K.

⁴⁹⁾ ML801B/AP801 resp. AP801S6: The 1000 Hz Butterworth filter is only supported as from the AP801/AP801S6 hardware version 1.20.

⁵⁰⁾ Internally, the signals are converted independently of the preset number of subchannels at 38.4 kHz. The implementation of a digital filter calls for a reduction in the sampling rate (through repeated averaging and sub-sampling). This reduced sampling rate is called the "internal sampling rate".

⁵¹⁾ A maximum of 1 A may be drawn from the MGCplus to supply the transducer.

Multi-channel measurement card ML801B with connection board AP835 ⁵²⁾				
Accuracy class		0.05		
Number of measurement channels		8		
Transducer		Pt100 4-wire-connection 0 ... 500 Ω resistance		
Allowed cable length between transducer and connection board	m	300 ⁵³⁾ , ⁵⁴⁾		
Maximum sampling rate per channel	Hz	2400 (8 subchannels), 4800 (4 subchannels), 9600 (2 subchannels) ⁵⁵⁾		
Zero error	%	0.05		
Measurement frequency range ⁵⁶⁾ Low pass with Butterworth characteristic (Butterworth HD)		Nom. value f_c (Hz)	-1 dB (Hz)	-3 dB (Hz)
				Internal Sampling rate ⁵⁷⁾ (Hz)
		1000	1189	1518
		500	523	691
		250	253	322
		200	203	265
		80	78	103
		1000	1206	1516
		500	613	816
		250	255	327
		200	203	264
		80	78	102
		250	312	413
		200	226	300
		80	82	109
		40	41	54
		20	21	27
		10	10	13
		5	5.3	7
Low pass with Bessel characteristic (Bessel HD)		Nom. value f_c (Hz)	-1 dB (Hz)	-3 dB (Hz)
				Internal Sampling rate (Hz)
		200	259	448
		100	102	184
		40	41	75
		20	20	36
		10	10	18
		5	5	9
		2,5	2,5	4,5
		1	1	1,8
		0,5	0,5	0,9
		0,2	0,21	0,38
		0,1	0,1	0,19
		0,05	0,051	0,094

Multi-channel measurement card ML801B with connection board AP835 ⁵²⁾						
Low pass with Butterworth characteristic (Butterworth compatible)		Nom. value f_c (Hz)	-1 dB (Hz)	-3 dB (Hz)	Internal Sampling rate (Hz)	
		1000	1076	1282	4800	
		500	596	798	4800	
		250	279	345	2400	
		200	214	266	2400	
		80	78,9	103	2400	
		40	38.7	51.8	2400	
		20	19.5	27.2	2400	
		10	9.36	13.2	2400	
		5	4.37	6.4	1200	
Low pass with Bessel characteristic (Bessel compatible)		Nom. value f_c (Hz)	-1 dB (Hz)	-3 dB (Hz)	Internal Sampling rate (Hz)	
		200	322	571	2400	
		100	125	216	2400	
		40	41	70	2400	
		20	21	37	2400	
		10	11	19	2400	
		5	5.5	9.6	2400	
		2,5	2.7	4.8	1200	
		1	1.36	2.4	600	
		0.5	0.68	1.2	300	
		0.2	0.186	0.186	75	
		0.1	0.093	0.158	37.5	
		0.05	0.047	0.079	18.7	
	Input for Pt100					
	Measuring range	Ω	500			
Linearization error	$^{\circ}\text{C}$	< 0.02				
Linearization range	$^{\circ}\text{C}$	-200 ... +848				
Noise With selected low-pass filter 1 Hz (Bessel)	$\text{m}\Omega_{\text{peak-to-peak}}$	2				
Effect of 10 K change in ambient temperature						
Sensitivity	%	< 0.05				
Zero point	%	< 0.05				
Measuring current	mA	0.5				
Non-linearity	K	± 0.1				
Long-term drift over 48 hours with autocalibration	$\text{m}\Omega$	< 30				
Input for the resistance measurement						
Measuring range	Ω	500				
Noise with 1.25 Hz filter	$\text{m}\Omega_{\text{SS}}$	2				
Effect of 10 K change in ambient temperature						
Sensitivity	%	< 0.05				
Zero point	%	< 0.05				
Measuring current	mA	0.5				
Non-linearity	%	< 0.03				
Long-term drift over 48 hours with autocalibration	$\text{m}\Omega$	< 30				
Width	mm	20.3 (4 HP)				

⁵²⁾ Customer-side connector plug: HBK ordering number 3-3312.0258

⁵³⁾ A maximum of 1 A may be drawn from the MGCplus to supply the transducer.

⁵⁴⁾ 100 m max. distance between connection board and T-ID/TEDS module

⁵⁵⁾ The number of subchannels can be changed via the MGCplus Setup Assistant or the MGCplus Firmware Loader.

⁵⁶⁾ ML801B/AP801 resp. AP801S6: The 1000 Hz Butterworth filter is only supported as from the AP801/AP801S6 hardware version 1.20.

⁵⁷⁾ Internally, the signals are converted independently of the preset number of subchannels at 38.4 kHz. The implementation of a digital filter calls for a reduction in the sampling rate (through repeated averaging and sub-sampling). This reduced sampling rate is called the "internal sampling rate".

Multi-channel measurement card ML801B with connection board AP402i ⁵⁸⁾					
Accuracy class		0.1			
Non-linearity	%	0.03			
Measuring ranges					
Voltage	V	1, 10, 60			
Current	mA	20			
Electrical isolation of measurement inputs	V DC	500			
Max. common-mode input voltage (against enclosure/ground)	V	100			
Max. differential input voltage	V	70			
Input impedance					
Measuring ranges 1 V, 10 V	MΩ	10			
Measuring range 60 V	MΩ	0.6			
Measuring range 20 mA	Ω	45			
Common-mode rejection					
at 50 Hz, 20 V _{SS}	dB	> 75			
at DC 10 V	dB	> 100			
Measurement frequency range	Hz	1000 (-1 dB)			
Noise		1 V	10 V	60 V	20 mA over 45 Ω
with selected low-pass filter					
500 Hz (Butterworth)	μV/V _{SS}	< 300	< 3000	< 18000	< 500
5 Hz (Bessel)	μV/V _{SS}	< 40	< 400	< 2400	< 100
Effect of 10 K change in ambient temperature		With autocalibration		Without autocalibration	
Measuring range 1 V	Sensitivity	%	< 0.05	< 0.1	
	Zero point	mV	< 0.2	< 0.75	
Measuring range 10 V	Sensitivity	%	< 0.02	< 0.1	
	Zero point	mV	< 2	< 7.5	
Measuring range 60 V	Sensitivity	%	< 0.05	< 0.01	
	Zero point	mV	< 12	< 45	
Measuring range 20 mA	Sensitivity	%	< 0.05	< 0.1	
	Zero point	mA	< 0.004	< 0.015	
On the zero point (relative to the full scale value)					
Autocal on	%	max. 0.02			
Autocal off	%	max. 0.075			
On sensitivity					
Autocal on	%	max. 0.05 (measuring range 10 V: max. 0.02)			
Autocal off	%	max. 0.1			
Transducer excitation ⁵⁹⁾		Adjustable via jumper panel: open, +5, +8 or +16 (for all subchannels)			
	V DC				
Max. output current					
Electrical isolation	-	no			
Transducer identification		TEDS-capable (only external TEDS modules)			
Max. distance of TEDS module from AP402i	m	100			
Electrical isolation		no			
Transducer connection		6-pin jack, compatible with Lemo® series S, size 0 Matching plugs: e.g. FGG.1B.306.CLA.441.D42 ⁶⁰⁾ FGG.1B.306.CLA.441.D62			
Width	mm	20.3 (4 HP)			

⁵⁸⁾ With one ML801B two AP402i can be operated.

⁵⁹⁾ A maximum of 1 A may be drawn from the MGCplus to supply the transducer.

⁶⁰⁾ HBK ordering number 3-3312.0126

Multi-channel measurement card ML801B with connection board AP418i					
Accuracy class		1			
Non-linearity	%	0.05			
Transducers that can be connected ⁶¹⁾		4 current-fed piezo transducers (IEPE)			
Transducer excitation	mA	4			
Input voltage range	V	2 ... 20			
Measuring ranges	V	±0.05; ±0.5; ±5			
Measurement frequency range	Hz	1000 (-1 dB)			
Lower cut-off frequency (-3 dB)	Hz	0.72			
Noise with selected low-pass filter	μV/V _{SS}	± 0.05 V	± 0.5 V	± 5 V	
		500 Hz (Butterworth)	< 60	< 350	< 3500
		5 Hz (Bessel)	< 25	< 25	< 100
Effect of 10 K change in ambient temperature					
Zero Point	mV	< 0.05	< 0.15	< 1.5	
Transducer identification		T-ID and TEDS capable			
Transducer connection		BNC socket			
Width	mm	20.3 (4 HP)			

⁶¹⁾ If the transducer cable is laid outside enclosed rooms, or with cable lengths of more than 30 meters between the connection board AP418i and transducer, the sensor cables must be executed with an additional, separately grounded, shield in order to ensure protection against overvoltage. This can be done for example by laying the cable in a metallic pipe or using double-shielded cable, in which case the outer shield must be connected to ground potential or protective conductor potential where it is close to the connection board (for example where it enters the switch cabinet). HBK recommends Triaxial cable for this.

Multi-channel measurement card ML801B with connection board AP810i						
Accuracy class		0.1				
Non-linearity	%	0.05				
Bridge excitation voltage (± 5 %)	V	10	5	2.5	0.5	
Transducer		8 SG half bridges in 5-wire configuration 8 SG full bridges in 6-wire configuration				
Allowed cable length between transducer and connection board	m	200 ^{62), 63)}				
Transducer impedance						
SG full and half bridge	Ω	330 ... 4000	160 ... 4000	120 ... 4000	120 ... 4000	
Measuring ranges	mV/V	± 4	± 8	± 16	± 80	
Measurement frequency range	Hz	1000 (-1 dB)				
Control signal (shunt)	mV/V	approx. 1 (with 350 Ω SG full bridge) approx. 0.5 (with 350 Ω SG half bridge)				
Noise for 350 Ω full bridge with selected low-pass filter	μV/V _{SS}					
		500 Hz (Butterworth)	< 0.9	< 1.75	< 3.5	-
		80 Hz (Butterworth)	< 0.075	< 0.15	< 0.3	< 1.5
		5 Hz (Butterworth)	< 0.0125	< 0.025	< 0.05	< 0.2
		200 Hz (Bessel)	< 0.9	< 1.75	< 3.5	-
		40 Hz (Bessel)	< 0.075	< 0.15	< 0.3	< 1.5
1.25 Hz (Bessel)	< 0.0125	< 0.025	< 0.05	< 0.2		
Effect of 10 K change in ambient temperature						
Sensitivity	%	0.1				
Zero point	%	0.05				

Multi-channel measurement card ML801B with connection board AP810i					
Transducer connection		D-sub, 25-pin, DB-25P ⁶⁴⁾			
Width	mm	20.3 (4 HP)			

⁶²⁾ Use a connection cable with wire cross-section $\geq 0.25 \text{ mm}^2$

⁶³⁾ 100 m max. distance between connection board and T-ID/TEDS module

⁶⁴⁾ HBK ordering number 2-9278.0293

Multi-channel measurement card ML801B with connection board AP814Bi					
Accuracy class		0.1 ⁶⁵⁾			
Non-linearity	%	0.05			
Bridge excitation voltage ($\pm 5 \%$)	V	5	2.5	1	0.5
Transducer		8 SG quarter bridges in 3-wire configuration			
Allowed cable length between transducer and connection board	m	200 ^{66), 67)}			
Internal completion resistors	Ω	120, 350, 700, 1000 ⁶⁸⁾			
Measuring ranges	mV/V	± 8	± 16	± 40	± 80
Measurement frequency range	Hz	500 (-1 dB)			
Control signal (shunt)	mV/V	approx. 1 (at 350 Ω)			
Noise at quarter bridge 350 Ω with selected low-pass filter	$\mu\text{V}/V_{\text{SS}}$				
500 Hz (Butterworth)		< 1.25	< 3.25	< 6.5	-
80 Hz (Butterworth)		< 0.15	< 0.325	< 0.75	< 1.75
5 Hz (Butterworth)		< 0.025	< 0.05	< 0.125	< 0.225
200 Hz (Bessel)		< 1.25	< 3.25	< 6.5	-
40 Hz (Bessel)		< 0.15	< 0.325	< 0.75	< 1.75
1.25 Hz (Bessel)	< 0.025	< 0.05	< 0.125	< 0.225	
Effect of 10 K change in ambient temperature					
Sensitivity	%	0.1			
Zero point	%	0.1			
Transducer connection		D-sub, 25-pin, DB-25P ⁶⁹⁾			
Width	mm	20.3 (4 HP)			

⁶⁵⁾ The effect of faults due to unbalanced cable resistances is not included in the accuracy class.

⁶⁶⁾ Use a connection cable with wire cross-section $\geq 0.25 \text{ mm}^2$

⁶⁷⁾ 100 m max. distance between connection board and T-ID/TEDS module

⁶⁸⁾ Option

⁶⁹⁾ HBK ordering number 2-9278.0293

Multi-channel measurement card ML801B with connection board AP815i					
Accuracy class		0.1 ^{70), 71), 72)}			
Non-linearity	%	0.05			
Bridge excitation voltage ($\pm 5 \%$)	V	5	2.5	1	0.5
Transducer		8 SG quarter bridges in 4-wire configuration 8 SG half bridges in 5-/6-wire configuration 8 SG full bridges in 6-wire configuration			
Allowed cable length between transducer and connection board	m	200 ⁷³⁾			
Internal completion resistors	Ω	120, 350, 700, 1000 ⁷⁴⁾			
Transducer impedance	Ω				
SG half and full bridge		330 ... 4000	160 ... 4000	120 ... 4000	120 ... 4000
Measuring ranges	mV/V	± 8	± 16	± 40	± 80
Measurement frequency range	Hz	1000 (-1 dB)			
Control signal (shunt)	mV/V	1.0078 $\pm 0.1 \%$ (at 350 Ω)			

Multi-channel measurement card ML801B with connection board AP815i					
Noise for 350 Ω full bridge with selected low-pass filter					
500 Hz (Butterworth)	μV/V _{SS}	< 4	< 8	< 20	40
80 Hz (Butterworth)		< 0.6	< 1.2	< 3	< 6
5 Hz (Butterworth)		< 0.1	< 0.2	< 0.5	< 1
200 Hz (Bessel)		< 4	< 8	< 20	40
40 Hz (Bessel)		< 0.6	< 1.2	< 3	< 6
1.25 Hz (Bessel)		< 0.1	< 0.2	< 0.5	< 1
Effect of 10 K change in ambient temperature					
Sensitivity	%	0.1			
Zero point	%	0.1 ⁷¹⁾			
Transducer connection		D-sub, 25-pin, DB-25P ⁷⁵⁾			
Width	mm	20.3 (4 HP)			

⁷⁰⁾ 0.2 with irradiation as per EN 61000-4-3:1996 + A1:1998

⁷¹⁾ 0.2 with 5 V bridge excitation voltage

⁷²⁾ If zero balancing is not possible, the following accuracy classes apply: 0.2 with $R_{\text{transducer}} > 2 \text{ k}\Omega$ and 0.3 with $R_{\text{transducer}} > 3 \text{ k}\Omega$.

⁷³⁾ 100 m max. distance between connection board and T-ID/TEDS module

⁷⁴⁾ Option

⁷⁵⁾ HBK ordering number 2-9278.0293

Multi-channel measurement card ML801B with connection board AP36i		
Accuracy class		0.1
Non-linearity	%	0.05
Bridge excitation voltage ($\pm 5 \%$)	V	5
Transducer		8 potentiometers in a five-wire configuration or 8 voltage sources with an active supply
Allowed cable length between transducer and connection board	m	200 ^{76), 77)}
Transducer impedance	Ω	190 ... 5000
Measuring ranges		
Potentiometric transducers	mV/V	± 500
Active transducers ⁷⁸⁾	V	± 10
Measurement frequency range	Hz	500 (-1 dB)
Noise with selected low-pass filter		
500 Hz (Butterworth)	mV/V _{SS}	< 0.5
80 Hz (Butterworth)		< 0.05
5 Hz (Butterworth)		< 0.01
200 Hz (Bessel)		< 0.5
40 Hz (Bessel)		< 0.05
1.25 Hz (Bessel)		< 0.01
Effect of 10 K change in ambient temperature		
Sensitivity	%	0.1
Zero point	%	0.05
Transducer connection		D-sub, 25-pin, DB-25P ⁷⁹⁾
Width	mm	20.3 (4 HP)

⁷⁶⁾ Use a connection cable with wire cross-section $\geq 0.25 \text{ mm}^2$!

⁷⁷⁾ 100 m max. distance between connection board and T-ID/TEDS module

⁷⁸⁾ Bridge excitation voltage adjustable via display and control panel or software to 5 V; 10 V.

⁷⁹⁾ HBK ordering number 2-9278.0293

SPECIFICATIONS FOR SPECIAL PLUG-IN MODULES

Communication card ML71B with connection board AP71 (CAN-Bus)							
CAN interface							
Number of CAN interfaces		2					
Protocol		CAN 2.0B					
Baud rate	baud	10 k	20 k	50 k	125 k	250 k	500 k 667 k 1 M
Line length	m	1000	1000	1000	500	250	100 50 25
Hardware bus link per CAN interface individually reversible		Standard High SPEED ISO 11898-24V Fault Tolerant Low Speed					
Connection technique		2 x D-sub, 9-pin, DE-9, individually electrically isolated from supply and measurement ground					
Measured value recording							
Number of recordable signals/signals to be transmitted		max. 128 per module ⁸⁰⁾ Signals per second					
		25	50	100	400	1200	
Maximum number of signals (16-bit signals each with 4 signals per message)		128	72	36	8 ⁸¹⁾	1 ... 8 ⁸²⁾	
Data base with parameter setting information via the CAN signals		2 (1 data base per CAN interface)					
Data base size	Byte	2 x 100 k					
Data base storage		Non-volatile, in flash memory in ML71B					
Analog output							
The analog output can optionally represent one of the max. 128 input signals							
Rated voltage	V	± 10 asymmetrical					
Allowed load resistance	kΩ	> 5					
Internal resistance	Ω	< 5					
Non-linearity	%	0.05					
Effect of 10 K change in ambient temperature							
Sensitivity	%	< 0.08					
Zero point	mV	3					
Mechanical							
Width	mm	20.3 (4 HP)					

⁸⁰⁾ Maximum 256 channels per CP42, maximum 512 channels per CP52

⁸¹⁾ In operation with more than 8 subchannels

⁸²⁾ In 8-channel operation

Communication card ML74B with connection board AP74 (CANHEAD)							
Interface							
Protocol		CAN 2.0B					
Baud rate	kBaud	250 or 500					
Maximum bus length		See CANHEAD data sheet					
Connection technique		5-pin M12 male connector for data and supply (as per the DEVICENET specification)					
Measured value recording							
Maximum number of CANHEAD modules per module		12					
Number of subchannels per module		10 ... 120 ⁸³⁾					
Maximum sampling rate per CANHEAD line ⁸⁴⁾	S/s	3000 or 6000					

Communication card ML74B with connection board AP74 (CANHEAD)		
CANHEAD supply		
Cut-off current	A	2
Cut-off upon current to earth	A	0.1
Width	mm	20.3 (4 HP)

⁸³⁾ The maximum number of channels per CP42 and CP52 is 256, with up to 512 channels possible if a CP52 is combined with an NT040 power supply

⁸⁴⁾ Depending on baud rate, see operating manual and technical data sheet CANHEAD

Communication card ML77B with connection board AP77 (Profibus-DP)		
Profibus DP interface		
Protocol		Profibus-DP slave as per DIN 19245-3
Baud rate	baud	9.6 k ... 12 M
Profibus ident number		04A9 (hexadecimal)
Electrical isolation	V	500
Connection technique		D-sub, 9-pin, DE-9
Transmission of measured values		
Supported formats		4 byte integer 2 byte integer 4 byte float (IEEE) 4 byte float (Siemens) 4 byte raw values 2 byte raw values
Data rate on Profibus		
Float; 24 signals	Hz	2400
Float; 48 signals	Hz	1200
Integer 32 bit; 32 signals	Hz	2400
Integer 16 bit; 48 signals	Hz	2400
Integer 16 bit; 88 signals	Hz	1200
Integer 16 bit; 120 signals	Hz	800
Measured value update rate with 15 channels and 1 signal per channel	1/s	1200
Mechanical		
Width	mm	20.3 (4 HP)

Multi-channel I/O module ML78B with connection board AP75		
Analog outputs		
Max. number of analog outputs		2 (both outputs filterable, 1 of which additionally accessible on ML78B front panel)
Electrical isolation	V	-
Update rate of analog outputs	Hz	2400
D/A converter resolution	bit	16
Ground systems		1, isolated from dig. ground systems
Rated voltage	V	±10 unbalanced
Allowed load resistance	kΩ	≥ 5
Internal resistance	Ω	< 5
Long-term drift (over 48 hours)	mV	< 3
Effect of 10 K change in ambient temperature		
Output signal	%	< 0.08
Zero point	mV	< 3

Multi-channel I/O module ML78B with connection board AP75		
Digital inputs		
Max. number of digital inputs		8 (16) ⁸⁵⁾
Input voltage range	V	0 ... 30 (nominal 0 ... 24)
Electrical isolation	V	500
Low potential	V	< 5
High potential	V	>10
Ground systems		1, isolated from digital output
Control functions for groups of MGCplus channels		Turn autocalibration on/off; Zero; Tare; Clear/hold peak value; Synchronization of internal curve generator
Digital outputs		
Max. number of digital outputs		8 (16) ⁸⁵⁾
Output voltage range	V	0 ... 30 (nominal 0 ... 24)
Output current	A	0.5
Short-circuit current	A	1.5
Electrical isolation	V	500
Response time (not for "external" mode)	ms	< 4
Ground systems		1, isolated from digital inputs
Bridge excitation voltage	V	18... 30 (nom. 24); external
Possible function assignment of the outputs		<ul style="list-style-type: none"> - Limit values of up to 120 MGCplus channels can be combined - Acknowledgement signal for input - Set by external software command - Overload signaling for groups of measurement channels
Curve generator		
Max. number of waveforms		10
Update rate (programmable per channel)	Hz	1; 2; 5; 10; 20; 50; 100; 200; 600; 1200; 2400
Max. number of curve points		≤ 128000, can be permanently stored in Flash memory
Mechanical		
Connection technique		Pluggable screw terminals
Allowed connection board configurations		1 x AP78 / 1 x AP75 / 1 x AP78 and 1 x AP75 / 2 x AP75 ⁸⁶⁾
Width	mm	20.3 (4 HP)

⁸⁵⁾ When using 2 AP75 connection boards: 16 digital inputs and 16 digital outputs

⁸⁶⁾ Both analog outputs V_{O1} and V_{O2} are available on both connection boards

Multi-channel I/O module ML78B with connection board AP78		
Analog outputs		
Max. number of analog outputs		10 (2 outputs filterable, 1 of which additionally accessible on ML78B front panel)
Electrical isolation	V	200 ⁸⁷⁾
Update rate of analog outputs	Hz	2400
D/A converter resolution	bit	16
Ground systems		2 ⁸⁸⁾
Rated voltage	V	±10 unbalanced
Allowed load resistance	kΩ	≥ 5
Internal resistance	Ω	< 5
Long-term drift (over 48 hours)	mV	< 3

Multi-channel I/O module ML78B with connection board AP78		
Effect of 10 K change in ambient temperature		
Output signal	%	< 0.08
Zero point	mV	< 3
Curve generator		
Max. number of waveforms		10
Update rate (programmable per channel)	Hz	1; 2; 5; 10; 20; 50; 100; 200; 600; 1200; 2400
Max. number of curve points		≤ 128000, can be permanently stored in Flash memory
Mechanical		
Connection technique		D-sub, 25-pin, DB-25P
Allowed connection board configurations		1 x AP78 / 1 x AP75 / 1 x AP78 and 1 x AP75 / 2 x AP75 ⁸⁹⁾
Width	mm	20.3 (4 HP)

⁸⁷⁾ The digitally filterable outputs are not electrically isolated!

⁸⁸⁾ 1 Ground system for 2 digitally filterable analog outputs and 1 ground system for the remaining 8 analog outputs

⁸⁹⁾ Both analog outputs V₀₁ and V₀₂ are available on both connection boards

Display and control panel AB22A	
Display AB22A	Backlit LCD display, resolution 192x64 pixels
Keypad	Alphanumeric keypad, 4 function keys, cursor keys and 5 dialog keys. All keys are membrane keys with real keys behind them.
Password	It is possible to protect specific operator control levels by a password.
Dialog	Menu languages: German/English/French/Spanish
Display formats	1, 3, 6 measured values; ty, xy graph; limit value status; recording status

Communications processor CP52				
Interfaces to PC		Electrical isolation	Connection technique	Bit rate
Ethernet (2 x independent)		500 V	RJ45	100 Mbit
Stand-alone data logging				
USB ⁹⁰⁾ mass storage (FAT32)		No	USB host	480 Mbit (USB 2.0)
Data rate ⁹¹⁾				
Ethernet and USB	kS/s			307.2
I/O contacts				
Electrical isolation	V DC			250 ⁹²⁾
Connection technique 2 x In, 2 x Out, 24 V, GND				Screw terminals (line length < 30 m)
Input voltage level LOW	V			0 ... 5
Input voltage range HIGH	V			10 ... 24
Input current, typ., High level = 24 V	mA			12
Input current, typ., High level = 10 V	mA			3
Output level active High at 0 A				Level supply minus 1.5 V
Output level active High at 0.5 A				Level supply minus 3 V
Supply (external)	V			24 (11 ... 30)
Output current max.	A			0.5
Short-circuit current, typ.	A			0.6
Short-circuit period				unlimited
Width	mm			60.9 (12 HP)

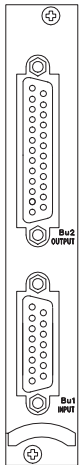
⁹⁰⁾ Cable length ≤ 5 m; extension cable not allowed

⁹¹⁾ 128 channels at 2.4 kS/s, 16 channels at 19.2 kS/s or combined

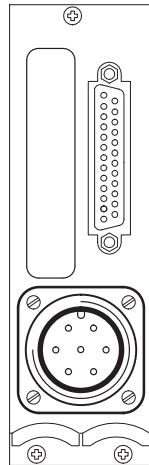
⁹²⁾ From hardware revision 1.01, for hardware revision 1.0: 50 V

CONNECTION BOARDS FOR SINGLE-CHANNEL AMPLIFIERS

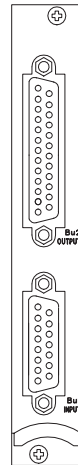
AP01i



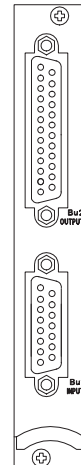
AP03i



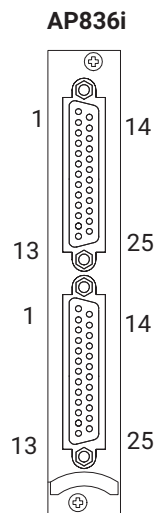
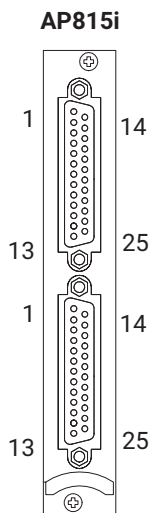
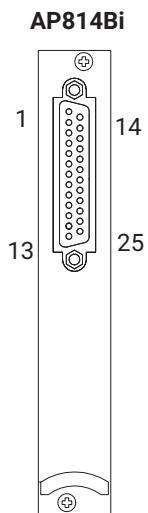
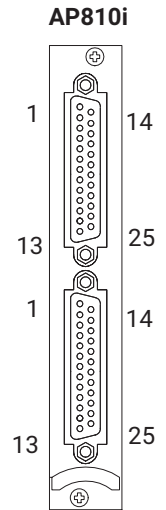
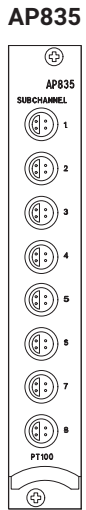
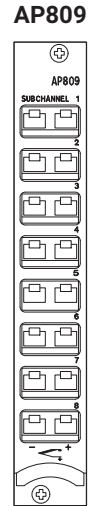
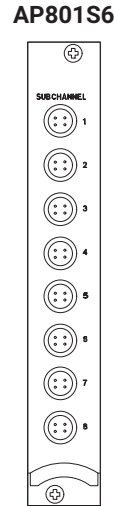
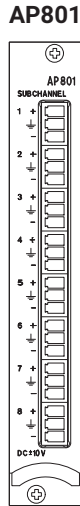
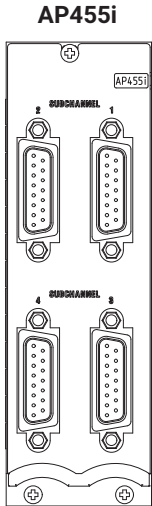
AP14



AP17



CONNECTION BOARDS FOR MULTI-CHANNEL AMPLIFIERS

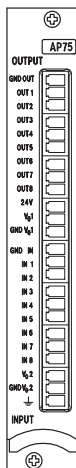


CONNECTION BOARDS FOR SPECIAL PLUG-IN MODULES

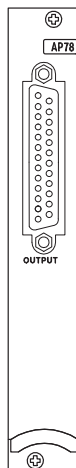
AP74



AP75



AP78



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