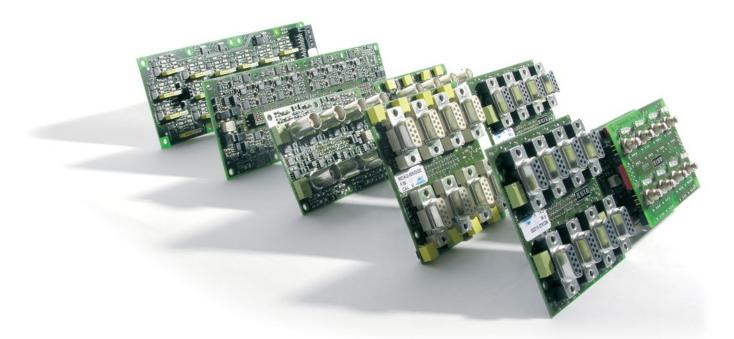


Automotive Energy & Power Analysis Aerospace & Defense Transportation General Test & Measurement



# **Differential Amplifiers**

#### **MDAQ** Series

MDAQ series modules are dynamic differential signal amplifiers with high bandwidth.

All are multi-channel and have an analog voltage output. The configuration is done via RS-485 interface. Models with multipin connectors offer sensor supply for single cable sensor connection.

MDAQ series modules are cost-effective and space saving, thus the ideal solution for applications requiring hundreds of dynamic input channels. The modules fit into many DEWETRON instruments.

#### **Key Features**

- Multi channel
- High bandwidth up to 300 kHz
- ±5 V conditioned signal output
- Differential inputs
- Easy configuration

#### **Configuring MDAQ inputs**

MDAQ modules are configured according a building block system. There is a MDAQ-BASE, the "motherboard" which holds up to two MDAQ-SUB modules. The MDAQ-BASE defines the conditioned signal output of  $\pm 5$  V. A range of MDAQ-SUB modules define the supported input signals. Finally a filter board MDAQ-FILT can be added.



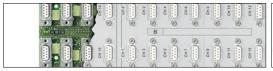
## **MDAQ Series Amplifiers**

- Multi channel
- Small form factor for high channel density
- Cost effective
- High bandwidth up to 300 kHz
- Support of MSI (Modular Smart Interface)



## **Selection Guide**

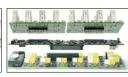
SUB Modules for MDAQ-BASE	-x					
Module	# CH	Input type	Ranges	TEDS	Bandwidth (BW), Highpass filters (HP)	Excitation
MDAQ-SUB-STG-D Connector: DB-9		Strain-gage (Full-, half and quarter- bridge, incl. shunt calibration) for strain gage application	14 ranges from ±0.5 to 1000 mV/V (@ 5 $V_{_{DC}}$ excitation	1	✓ BW: 30 kHz	0 to 12 V <sub>DC</sub>
		Voltage up to ±10 V	15 ranges from ±2.5 mV to ±10 V			
		ICP via MSI-BR-ACC	7 ranges from ±0.25 mV to ±10 V			
IVF <mark>4</mark> F <b>1</b>		Voltage up to 200 V via MSI-BR-V-200	6 ranges from ±10 to ±200 V			
MSI O O O		Thermocouple via MSI-BR-TH-x	full range of TC type			
		Pt100, Pt200, Pt500, Pt1000, Pt2000	-200 °C to 1000 °C	1		
MSI		and resistance via MSI-BR-RTD	and 0 to 6.5 kOhm			
MDAQ-SUB-V-200-D	8	Voltage up to ±200 V	13 ranges from ±0.125 to ±200 V	~	BW: 300 kHz	$\pm 15 V_{DC}$ and
Connector: DB-9		ICP, via MSI-V-ACC	7 ranges from ±0.25 mV to ±10 V	1		0 to 12 V <sub>pc</sub>
		Pt100, Pt200, Pt500, Pt1000, Pt2000	-200 °C to 1000 °C	1		
		and resistance via MSI-V-RTD	and 0 to 6.5 kOhm			
		Note: for safety reasons, max. 120 V <sub>DC</sub> or 50 V <sub>AC</sub> are allow	ed at this connector			
MDAQ-SUB-V-200-BNC	8	Voltage up to ±200 V	13 ranges from ±0.125 to ±200 V	-	BW: 300 kHz	-
Connector: BNC		Note: for safety reasons, max. 120 $V_{pc}$ or 50 $V_{Ac}$ are allow	ed at this connector			
MDAQ-SUB-ACC-BNC	8	ICP <sup>®</sup> or voltage up to ±10 V 8 ranges from ±125 mV to ±10 V		~	BW: 300 kHz	4 / 8 mA
Connector: BNC					HP: 3.4 Hz	
		Single-ended or differential input and one 3.4 Hz highpass filter for noise and shock	0 1			
0701010		MDAQ-SUB-ACC-BNC-S1 0,16 Hz for structural and modal analysis, human body vibration measurement (rest same as MDAQ-SUB-ACC-BNC)			BW: 300 kHz HP: 0.16 Hz	4 / 8 mA
MDAQ-SUB-ACC-A-BNC	8	ICP <sup>®</sup> or voltage up to ±10 V	8 ranges from ±125 mV to ±10 V	1	BW: 300 kHz	4 / 8 mA
Connector: BNC		Single-ended input and two HP filters 0.16 Hz for structural and modal analysis, hu 3.4 Hz for noise and shock response mea			HP: 0.16 Hz, 3.4 Hz	



MDAQ modules - available in most of the DEWETRON multichannel systems



DEWE-51-USB2-32 2x MDAQ-SUB-V-200-D, 2x MDAQ-SUB-ACC-A modules and USB-A/D converter



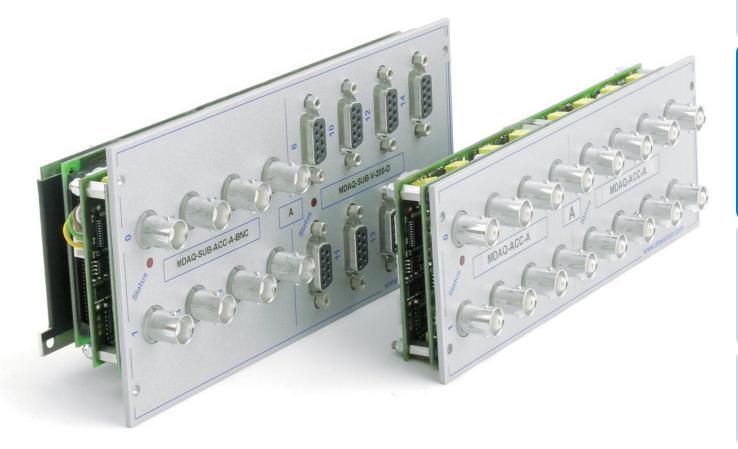
Typical combination with two SUB modules mounted on a BASE module, and FILTER board (optional)



All MDAQ boards are equipped with highest quality components

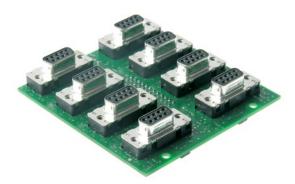
Filter modules for MDAQ				
Module	# CH	Filter characteristics	Cut-off frequencies	Order
MDAQ-AAF4-5-BU	16	Butterworth	100 Hz, 1, 10, 30, 100 kHz, Bypass Note: not possible in all system configurations. Please contact factory for details.	4 <sup>th</sup>
MDAQ-FILT-5-BU	16	Butterworth	30, 100, 300 Hz, 1, 10 kHz, Bypass	2 <sup>nd</sup>
MDAQ-FILT-5-BU-S1	16	Butterworth	100 Hz, 1, 10, 30, 100 kHz, Bypass	2 <sup>nd</sup>
MDAQ-FILT-5-BE	16	Bessel	30, 100, 300 Hz, 1, 10 kHz, Bypass	2 <sup>nd</sup>

MDAQ-BASE boards			
	Sub modules	Bandwidth	Output
MDAQ-BASE-5			
A CONTRACT OF A CONTRACT OF	2	300 kHz	±5 V



#### MDAQ-SUB-STG-D

- 15 input ranges from ±2.5 mV to ±10 V
- 1 mV steps programmable excitation from 0 to 12 V
- Internal bridge completion for ½ and ¼ bridge
- Internal 50 k and 100 k shunt resistor
- TEDS support



3- or 5-wire ½ bridge with internal completion (software programmable)   3- wire Quarter bridge with internal 120 Ohm and 350 Ohm completion (software programmable)   Shunt Resistor Internal 100 k and 50 k Resistor (software programmable)   Completion and Shunt resistor accuracy 0.05% 5ppm/"K   Bridge resistance 120 Ohm to 10 k Ohm   Automatic bridge balance '' absolute Voltage mV/V @ 5 Vecc µm/m @ 5Vecc k=2 Quarter bridge   2.5 mV to 20 mV ±10 mV ±2 mV/V ±40000 µm/m   250 mV to 10 V ±0 mV × ±20 mV/V ±40000 µm/m   250 mV to 10 V ±0.5 V ±100 mV/V ±20,000,000 µm/m   260 mV to 10 V ±0.5 V ±100 mV/V ±20,000,000 µm/m   8andwidth (-3 dB) 30 kHz in combination with MDAQ-FILT-xx tron   Filters (lowpass) in combination with MDAQ-FILT-xx tron tron   7yp. SNR @ 30 kHz [1 kHz] 64 dB [82 dB] @ 1 mV/V tron tron tron   and 5 V <sub>pce</sub> excitation 125 dB [120 dB] @ DC tron tron tron   and 5 V <sub>pce</sub> excitation 142 dB [86 dB] @ 1 mV/V tron tron tron tron tron tron tro tro tro <td< th=""><th>MDAQ-SUB-STG-D combined with MDA</th><th>Q-BASE-5</th><th></th><th></th><th></th></td<>	MDAQ-SUB-STG-D combined with MDA	Q-BASE-5			
@ 5 V <sub>ac</sub> excitation   ±0.5, 1, 2, 4, 5, 10, 20, 40, 50, 100, 200, 250, 500, 1000 m/V/     Input Ingetance   >100 MOhm     Input Ingetance   >100 MOhm     Dyp. Input offset drift   0.5, 1V * 14z     DC Accuracy   High Gain     22.5 mV/5 m/V/10 m/V/10 m/V/125 W/2 m/V   ±0.03% of reading   ±0.12% of range     20.5 mV/5 m/V/10 m/V/125 W/2 m/V   ±0.03% of reading   ±0.12% of range   ±0.15% of reading   ±0.12% of range     20.5 mV 200 m/V   ±0.03% of reading   ±0.03% of reading   ±0.05% of range   ±0.15% of reading   ±0.03% of reading   ±0.03% of reading   ±0.05% of range   ±0.15% of reading   ±0.03% of reading   ±0.05% of range     2100 m/V   ±0.03% of reading   ±0.03% of reading   ±0.05% of range   ±0.15% of reading   ±0.03% of reading   ±1.07 W/2   ±0.03% of reading   ±0.05% of range     25:0 V   ±0.03% of reading   ±0.05% of range   ±0.15% of reading   ±0.03% of range     25:0 V/   ±0.05% ±0.7 m/2   ±0.05% of range   ±0.05% of range   ±0.05% of range     25:0 V/   ±0.05 % ±0.7 m/2   ±0.05 % ±0.7 m/2   ±0.05 % of reading   ±0.05% of reading </td <td>Gain</td> <td>0.5 to 2000</td> <td></td> <td></td> <td></td>	Gain	0.5 to 2000			
input noise   > 100 MOhm     Input noise   3.5 nV* NHz     Typ, input offset dift   0.5 µV/K (for ranges < 200 mV)	Input ranges	±2.5, 5, 10, 20, 25, 50, <sup>2</sup>	100, 200, 250, 500, 1000, 1	1250, 2500, 5000, 10 0	000 mV
Input noise   3.5 mV * vHz     Typ. input offset drift   0.5 µV/K (for ranges < 200 mV)	@ 5 $V_{DC}$ excitation	±0.5, 1, 2, 4, 5, 10, 20, 4	40, 50, 100, 200, 250, 500,	1000 mV/V	
Typ. Input offset drift   0.5 µV/K (for ranges < 200 mV)   Without software correction table     2.5 mV/S mV/L10 mV/L252 mV   40.03% of reading   ±15 µV [±3 µV/V@ Vsuc] ±0.15% of reading   ±15 µV [±3 µV/V@ SVuc] ±0.15% of reading   ±15 µV [±3 µV/V@ SVuc] ±0.15% of reading   ±0.05% of range   ±0.15% of reading   ±1.07 µV [±80µV/W @VGVer]     55:10 V   ±0.05% of range   ±0.03% of range   ±0.15% of reading   ±0.05% of range   ±0.05% of rande   ±0.05% of rande   ±0.05% of	Input impedance	>100 MOhm			
DC Accuracy   High Gain   Without software correction table     22.5 mV/S mV/V;10 mV/V;25 mV/   40.03% of reading   ±15 µV [±3 µV/V @5 Vest] ±0.15% of reading   ±10 µV @5 Vest] ±0.15% of reading   ±0.03% of reading   ±0.05% of reading	Input noise	3.5 nV * √Hz			
12.5 mV/1.10 mV/V;10 mV/V;10 mV/V;25 mV +10 3/% of reading +11 y/V (B) V/V (B) V/V;   20 mV +10 3/% of reading ±0 12% of range ±0.15% of reading ±0.15% of reading ±0.05% of range   21 00 mV to 200 nV ±0.03% of reading ±0.03% of read	Typ. input offset drift	0.5 µV/K (for ranges < 2	200 mV)		
20 mV ±0.03% of reading ±0.12% of range ±0.15% of reading ±0.06% of range   ±100 mV to ±200 mV ±0.03% of rading ±0.03% of rading ±0.05% of reading ±100 µV (£50µV) (§5 Vac) ±0.15% of reading ±100 µV (§5 Vac) ±1.5% of reading ±100 µV (§5 Vac) ±1.5% of reading ±100 µV (§5 Vac) ±1.5% of reading ±0.03% of range ±0.15% of reading ±0.03% of range ±0.15% of reading ±0.03% of range ±0.15% of reading ±0.03% of range ±0.05% of reading ±0.05%	DC Accuracy High Gain		Without software correction table		
11.25 V; ±2.5 V   ±0.03% of reading   ±1 mV   ±0.15% of reading   ±1 mV     25:10 V   ±0.03% of reading   ±0.15% of reading   ±0.03% of range     Gain drift   ±5:10 V   ±0.03% of range   ±0.03% of range   ±0.03% of range     Excitation voltage   0 to 12 V programable in 1 mV steps. (5 V default )   Excitation accuracy   ±0.05 % ±0.7 mV     Excitation accuracy   ±0.05 % ±0.7 mV   Excitation accuracy   ±0.05 % ±0.7 mV     Excitation protection   Continuous short to ground   Excitation current limit   50 mA/Channel     Bridge Types   4 - or 6-wire full bridge -3 - or 5-wire 1% bridge with internal 120 Ohm and 350 Ohm completion (software programmable) -3 wire Quarter bridge with internal 120 Ohm and 350 Ohm completion (software programmable)     Shurt Resistor   Internal 100 k and 50 k Resistor (software programmable)     Completion and Shunt resistor accuracy   0.05% 5pm/*K     Eridge resistance   120 Ohm to 10 k Ohm     Automatic bridge balance ''   absolute Voltage   mV/V @ 5 Vacc   µm/m @ 5Vacc   #2 Quarter bridge     2.5 mV to 200 mV   ±10 mV   ±2 mV/V   ±40000 µm/m   ±2 do 00/0 µm/m   ±2 do 00/0 µm/m   ±2 do 00/0 µm/m   ±2 do	20 mV 50 mV	±0.03% of reading ±0.03% of reading	±0.12% of range ±0.06% of range	±0.15% of reading ±0.15% of reading	±0.12% of range ±0.06% of range
Excitation voltage   0 to 12 V programable in 1 mV steps. (5 V default )     Excitation accuracy   ±0.05 % to.7 mV     Excitation drift   ±10 ppm/K ±50 µV/K     Excitation protection   Continuous short to ground     Excitation current limit   50 mA/Channel     Bridge Types   4 or 6-wire full bridge 3- or 6-wire ½ bridge with internal completion (software programmable) 3- wire Quarter bridge with internal 120 Ohm and 350 Ohm completion (software programmable)     Shunt Resistor   Internal 100 k and 50 k Resistor (software programable)     Completion and Shunt resistor accuracy   0.05% 5ppm/"K     Bridge resistance   120 Ohm to 10 k Ohm     Automatic bridge balance <sup>11</sup> absolute Voltage   mV/V @ 5 V <sub>Exc</sub> (s=2 Quarter bridge with internal 120 N with 22 mV/V ±4000 µm/m     2.5 mV to 20 mV   ±10 mV   ±2 mV/V ±4000 µm/m     2.5 mV to 20 mV   ±10 mV   ±20 mV/V ±200.000 µm/m     2.5 mV to 20 mV   ±10 mV   ±20 mV/V ±200.000 µm/m     2.5 mV to 20 mV   ±0.5 V ±1000 mV/V   ±200.000 µm/m     2.5 mV to 20 mV   ±10 mV   ±200.000 µm/m     2.5 mV to 20 mV   ±10 mV   ±200.000 µm/m     2.5 mV to 20 mV   ±10 mV   ±200.000 µm/m	±1.25 V; ±2.5 V	±0.03% of reading	±1mV	±0.15% of reading	±1 mV
Excitation accuracy ±0.05 % ±0.7 mV   Excitation drift ±10 ppm/K ±50 µV/K   Excitation protection Continuous short to ground   Excitation urment limit 50 mA/Channel   Bridge Types 4 - or 6-wire full bridge   3 - or 5-wire 7/bridge with internal completion (software programmable)   3-wire Quarter bridge with internal 120 Ohm and 350 Ohm completion (software programmable)   Shunt Resistor Internal 100 k and 50 k Resistor (software programable)   Completion and Shunt resistor accuracy 0.05% 5pm/°K   Bridge resistance 120 Ohm to 10 k Ohm   Automatic bridge balance '1 absolute Voltage mV/V @ 5 Visc k=2 Quarter bridge   2.5 mV to 200 mV ±10 mV ±20 mV/V ±40000 µm/m   25 to V to 200 mV ±10 mV ±20 mV/V ±40000 µm/m   25 to V to 200 mV ±100 mV ± 22 mV/V ±40000 µm/m   25 to V to 200 mV ±10 mV ±20 mV/V ±40000 µm/m   25 to V to 200 mV ±10 mV ±20 mV/V ±40000 µm/m   25 mV to 20 mV ±10 mV/V ±20 mV/V ±20 mV/V   Bandwidth (-3 dB) 30 KHz 110 mV/V ±20 mV/V   Typ. SNR @ 30 kHz [1 k	Gain drift @ 5 V <sub>DC</sub> excitation	10 ppm/K of range ±0.0	2 µV/V/K		
Excitation drift ±10 ppm/K ±50 µV/K   Excitation protection Continuous short to ground   Excitation current limit 50 mA/Channel   Bridge Types 4- or 6-wire full bridge   3- or 5-wire ½ bridge with internal completion (software programmable) 3- wire Quarter bridge with internal 120 Ohm and 350 Ohm completion (software programmable)   Shunt Resistor Internal 100 k and 50 k Resistor (software programable)   Completion and Shunt resistor accuracy 0.5% Sppm/*K   Define balance ') 2.5 mV to 20 mV   2.5 mV to 20 mV 2.5 mV to 20 mV   2.5 mV to 20 mV 2.5 mV to 20 mV   2.5 mV to 20 mV 2.5 mV to 20 mV   2.5 mV to 20 mV 2.5 mV to 20 mV   2.5 mV to 20 mV 2.5 mV to 20 mV   2.5 mV to 20 mV 2.5 mV to 20 mV   2.5 mV to 20 mV 2.5 mV to 20 mV   2.5 mV to 20 mV 2.5 mV   30 kHz 110 mV   Bandwidth (-3 dB) 30 kHz   Filte	Excitation voltage	0 to 12 V programable in	n 1 mV steps. (5 V defaul	t )	
Excitation protection   Continuous short to ground     Excitation current limit   50 mA/Channel     Bridge Types   4- or 6-wire full bridge 3- or 5-wire 2/ bridge with internal completion (software programmable) 3- wire Quarter bridge with internal 120 Ohm and 350 Ohm completion (software programmable)     Shunt Resistor   Internal 100 k and 50 k Resistor (software programmable)     Completion and Shunt resistor accuracy   0.05% 5ppm?/K     Bridge resistance   120 Ohm to 10 k Ohm     Automatic bridge balance <sup>11</sup> absolute Voltage   mV/V § Venc   µm/m § SVenc k=2 Quarter bridge ±10 mV   ±20 mV/V     2.5 mV to 200 mV   25 mV to 200 mV   ±10 mV   ±20 mV/V   ±40000 µm/m     2.5 mV to 200 mV   25 mV to 10 V   ±20 mV/V   ±40000 µm/m     2.5 mV to 200 mV   25 mV to 10 V   ±20 mV/V   ±40000 µm/m     2.5 mV to 200 mV   250 mV to 10 V   ±20 mV/V   ±40000 µm/m     Bandwidth (-3 dB)   30 kHz   10 nV × ±200,000 µm/m   ±2,000,000 µm/m     and 5 V <sub>oc</sub> excitation   82 dB [96 dB] @ 50 mV/V   ±2,000,000 µm/m   12,000,000 µm/m     Typ. SNR @ 0.1 mV/V [1 mV/V]   125 dB [120 dB] @ DC   10 dB [105 dB] @ 1 mV/V   10 dB [105 dB] @	Excitation accuracy	±0.05 % ±0.7 mV			
Excitation current limit 50 mA/Channel   Bridge Types 4- or 6-wire full bridge 3- or 5-wire's bridge with internal completion (software programmable) 3- wire Quarter bridge with internal 120 Ohm and 350 Ohm completion (software programmable)   Shunt Resistor Internal 100 k and 50 k Resistor (software programable)   Completion and Shunt resistor accuracy 0.05% 5ppm/°K   Bridge resistance 120 Ohm to 10 k Ohm   Automatic bridge balance ') absolute Voltage mV/V @ 5 Vesc µm/m @ 5Vesc k=2 Quarter bridge   2.5 mV to 200 mV ±10 mV ±2 mV/V ±4000 µm/m   2.5 mV to 200 mV ±0.5 V ±100 mV/V ±200,000 µm/m   2.5 mV to 200 mV ±0.5 V ±100 mV/V ±200,000 µm/m   2.5 mV to 200 mV ±0.5 V ±100 mV/V ±200,000 µm/m   2.5 mV to 200 mV ±0.5 V ±100 mV/V ±2,000,000 µm/m   2.5 to 10 2 b to 10 ±5 V ±100 mV/V ±2,000,000 µm/m   2.5 mV to 200 mV ±10 mV ±20 mV/V ±2,000,000 µm/m ±2,000,000 µm/m   2.5 to 10 10 cmbination with MDAQ-FILT-xx Trype, SNR @ 30 kHz 140 B [82 dB] @ 50 m/V 140 B [10 dB] @ 20 C 115 dB [110 dB] @ 400 Hz 115 dB [110 dB] @ 400 Hz 1	Excitation drift	±10 ppm/K ±50 μV/K			
Bridge Types 4. or 6-wire full bridge   3. or 5-wire ½ bridge with internal completion (software programmable)   3-wire Quarter bridge with internal 120 Ohm and 350 Ohm completion (software programmable)   Shunt Resistor Internal 100 k and 50 k Resistor (software programable)   Completion and Shunt resistor accuracy 0.05% 5ppm/°K   Bridge resistance 120 Ohm to 10 k Ohm   Automatic bridge balance '' absolute Voltage mV/V @ 5 Voxc µm/m @ 5Voxc k=2 Quarter bridge   2,5 mV to 200 mV 2,5 mV to 200 mV ±100 mV ±20 MV/V ±40000 µm/m   25 mV to 10 V ±0.0 W ±20 MV/V ±40000 µm/m   25 mV to 200 mV ±100 mV ±200 MV/V ±2,000,000 µm/m   25 mV to 10 V ±0.5 V ±100 mV/V ±2,000,000 µm/m   Bridge so mV/V 2 V to 10 V ±5 V ±100 mV/V ±2,000,000 µm/m   Bridge GB @ 10 KIz 10 cB [102 GB] @ 1 mV/V ±2,000,000 µm/m 10 KIZ   and 5 V <sub>oc</sub> excitation 82 dB [96 dB] @ 50 mV/V 12,000,000 µm/m 110 dB [102 dB] @ 100 HZ 110 dB [103 dB] @ 400 HZ </td <td>Excitation protection</td> <td>Continuous short to gro</td> <td>und</td> <td></td> <td></td>	Excitation protection	Continuous short to gro	und		
3- or 5-wire ½ bridge with internal completion (software programmable)   3- wire Quarter bridge with internal 120 Ohm and 350 Ohm completion (software programmable)   Shunt Resistor Internal 100 k and 50 k Resistor (software programmable)   Completion and Shunt resistor accuracy 0.05% 5ppm/"K   Bridge resistance 120 Ohm to 10 k Ohm   Automatic bridge balance '' absolute Voltage mV/V @ 5 Vecc µm/m @ 5Vecc k=2 Quarter bridge   2.5 mV to 20 mV ±10 mV ±2 mV/V ±40000 µm/m   250 mV to 10 V ±0 mV × ±20 mV/V ±40000 µm/m   250 mV to 10 V ±0.5 V ±100 mV/V ±20,000,000 µm/m   260 mV to 10 V ±0.5 V ±100 mV/V ±20,000,000 µm/m   8andwidth (-3 dB) 30 kHz in combination with MDAQ-FILT-xx tron   Filters (lowpass) in combination with MDAQ-FILT-xx tron tron   7yp. SNR @ 30 kHz [1 kHz] 64 dB [82 dB] @ 1 mV/V tron tron tron   and 5 V <sub>pce</sub> excitation 125 dB [120 dB] @ DC tron tron tron   and 5 V <sub>pce</sub> excitation 142 dB [86 dB] @ 1 mV/V tron tron tron tron tron tron tro tro tro <td< td=""><td>Excitation current limit</td><td>50 mA/Channel</td><td></td><td></td><td></td></td<>	Excitation current limit	50 mA/Channel			
Completion and Shunt resistor accuracy 0.05% 5ppm/°K   Bridge resistance 120 Ohm to 10 k Ohm   Automatic bridge balance '' absolute Voltage mV/ @ 5 V <sub>Exc</sub> µm/m @ 5V <sub>Exc</sub> k=2 Quarter bridge   2.5 mV to 20 mV ±10 mV ±2 mV/V ±40000 µm/m   25 mV to 20 mV ±100 mV ±20 mV/V ±40000 µm/m   25 mV to 20 mV ±100 mV ±20 mV/V ±40000 µm/m   25 mV to 20 mV ±0.5 V ±100 mV/V ±200,000 µm/m   25 mV to 20 to V ±0.5 V ±1000 mV/V ±20,000,000 µm/m   20 S mV to 10 2 V to 10 ±5 V ±1000 mV/V ±20,000,000 µm/m   Briders (lowpass) In combination with MDAQ-FILT-xx Typ. SNR @ 30 kHz [1 kHz] 64 dB [82 dB] @ 1 mV/V   and 5 V <sub>Dc</sub> excitation 82 dB [96 dB] @ 50 mV/V 110 dB [10 dB] @ DC 110 dB [10 dB] @ 0 Hz   and 5 V <sub>Dc</sub> excitation 115 dB [110 dB] @ 0 Hz 110 dB [10 dB] @ 1 kHz 110 dB [105 dB] @ 1 kHz   Max. common mode voltage range ±12 V 110 dB [105 dB] @ 1 kHz 110 dB [105 dB] @ 1 kHz   Max. for mA Continuous short to ground 110 dB [105 dB] @ 1 kHz 110 dB [105 dB] @ 1 kHz   Max. common mode voltage rang	Bridge Types	3- or 5-wire 1/2 bridge wi			software programmable)
Bridge resistance120 Ohm to 10 k OhmAutomatic bridge balance ''absolute VoltagemV/V @ 5 V <sub>Exc</sub> $\mu$ m/m @ 5V <sub>Exc</sub> $k=2$ Quarter bridge $2.5 \text{ mV to 20 mV}$ $\pm 10 \text{ mV}$ $\pm 2 \text{ mV/V}$ $\pm 4000 \text{ µm/m}$ $25 \text{ mV to 20 mV}$ $\pm 10 \text{ mV}$ $\pm 2 \text{ mV/V}$ $\pm 4000 \text{ µm/m}$ $25 \text{ mV to 10 vV}$ $\pm 20 \text{ mV/V}$ $\pm 200,000 \text{ µm/m}$ $250 \text{ mV to 11 V}$ $2 \text{ V to 10 V}$ $\pm 100 \text{ mV/V}$ $250 \text{ mV to 10 V}$ $\pm 2 \text{ mV/V}$ $\pm 200,000 \text{ µm/m}$ Bandwidth (-3 dB)30 kHzFilters (lowpass)In combination with MDAQ-FILT-xxTyp. SNR @ 30 kHz [1 kHz]64 dB [82 dB] @ 1 mV/Vand 5 V <sub>pc</sub> excitation82 dB [96 dB] @ 50 mV/VTyp. CMR @ 0.1 mV/V [1 mV/V]125 dB [120 dB] @ DCand 5 V <sub>pc</sub> excitation115 dB [110 dB] @ 400 Hz110 dB [105 dB] @ 1 kHzMax. common mode voltage range $\pm 12 \text{ V}$ Input overvoltage protection $\pm 25 \text{ V}_{pc}$ Output resistance< 10 Ohm	Shunt Resistor	Internal 100 k and 50 k	Resistor (software program	nable)	
Automatic bridge balance 1)absolute Voltage $mV/V @ 5 V_{Evc}$ $\mum/m @ 5V_{Evc}$ $k=2$ Quarter bridge $2.5 mV to 200 mV\pm 10 mV\pm 2 mV/V\pm 40000 \mum/m25 mV to 200 mV\pm 10 mV\pm 20 mV/V\pm 40000 \mum/m250 mV to 1 V\pm 0.5 V\pm 100 mV/V\pm 20 mV/V250 mV to 1 V\pm 0.5 V\pm 100 mV/V\pm 2000,000 \mum/m250 mV to 10 V\pm 0.5 V\pm 100 mV/V\pm 2,000,000 \mum/mBandwidth (-3 dB)30 kHzFilters (lowpass)In combination with MDAQ-FILT-xxfV_{Dc} excitation82 dB [96 dB] @ 50 mV/Vand 5 V_{Dc} excitation82 dB [96 dB] @ 50 mV/VTyp. SNR @ 30 kHz [1 kHz]64 dB [82 dB] @ DCand 5 V_{Dc} excitation115 dB [110 dB] @ 400 Hzand 5 V_{Dc} excitation115 dB [110 dB] @ 400 Hz110 dB [105 dB] @ 1 kHzMax. common mode voltage range\pm 12 V110 dB [105 dB] @ 1 kHzMax. common mode voltage range\pm 5 V0utput resistance<10 OhmOutput resistance<10 OhmOutput currentMax. 5 mAOutput currentMax. 5 mAOutput resistanceDS2406, DS2430A, DS2432, DS2433Power consumption$20 Ohm 16 Channels typ. 8 W$20 Ohm 16 Channels typ. 15 W@ 10 VDC350 Ohm 16 Channels typ. 15 W$	Completion and Shunt resistor accuracy	0.05% 5ppm/°K			
$ \begin{array}{c cccc} 2.5 \text{ mV to 20 mV} & \pm 10 \text{ mV} & \pm 2 \text{ mV/V} & \pm 4000 \text{ µm/m} \\ \pm 25 \text{ mV to 20 mV} & \pm 100 \text{ mV} & \pm 20 \text{ mV/V} & \pm 40000 \text{ µm/m} \\ \pm 20 \text{ mV/V} & \pm 200,000 \text{ µm/m} \\ \pm 200,000 \text{ µm/m} & \pm 200,000 \text{ µm/m} \\ \pm 200,$	Bridge resistance	120 Ohm to 10 k Ohm			
Bandwidth (-3 dB)30 kHzFilters (lowpass)In combination with MDAQ-FILT-xxTyp. SNR @ 30 kHz [1 kHz]64 dB [82 dB] @ 1 mV/Vand 5 V <sub>pC</sub> excitation82 dB [96 dB] @ 50 mV/VTyp. CMR @ 0.1 mV/V [1 mV/V]125 dB [120 dB] @ DCand 5 V <sub>pC</sub> excitation115 dB [110 dB] @ 400 Hz110 dB [105 dB] @ 1 kHzMax. common mode voltage range±12 VInput overvoltage protection±25 V <sub>pC</sub> Output voltage±5 VOutput voltage±5 VOutput resistance<10 Ohm	2.5 mV to 20 mV 25 mV to 200 mV 250 mV to 1 V	±10 mV   ±2 mV/V   ±4000 μm/m     ±100 mV   ±20 mV/V   ±40000 μm/m     ±105 V   ±100 mV/V   ±200,000 μm/m			00 μm/m 000 μm/m ,000 μm/m
Typ. SNR @ 30 kHz [1 kHz]64 dB [82 dB] @ 1 mV/Vand 5 V <sub>pc</sub> excitation82 dB [96 dB] @ 50 mV/VTyp. CNR @ 0.1 mV/V [1 mV/V]125 dB [120 dB] @ DCand 5 V <sub>pc</sub> excitation115 dB [110 dB] @ 400 Hz110 dB [105 dB] @ 1 kHzMax. common mode voltage range±12 VInput overvoltage protection±25 V <sub>pc</sub> Output voltage±5 VOutput resistance<10 Ohm	Bandwidth (-3 dB)	30 kHz		· · · · ·	· ·
and 5 V <sub>DC</sub> excitation82 dB [96 dB] @ 50 mV/VTyp. CMR @ 0.1 mV/V [1 mV/V]125 dB [120 dB] @ DCand 5 V <sub>DC</sub> excitation115 dB [110 dB] @ 400 Hz110 dB [105 dB] @ 1 kHz110 dB [105 dB] @ 1 kHzMax. common mode voltage range±12 VInput overvoltage protection±25 V <sub>DC</sub> Output voltage±5 VOutput resistance< 10 Ohm	Filters (lowpass)	In combination with MD	AQ-FILT-xx		
and 5 V <sub>DC</sub> excitation82 dB [96 dB] @ 50 mV/VTyp. CMR @ 0.1 mV/V [1 mV/V]125 dB [120 dB] @ DCand 5 V <sub>DC</sub> excitation115 dB [110 dB] @ 400 Hz110 dB [105 dB] @ 1 kHz110 dB [105 dB] @ 1 kHzMax. common mode voltage range±12 VInput overvoltage protection±25 V <sub>DC</sub> Output voltage±5 VOutput resistance< 10 Ohm	Typ. SNR @ 30 kHz [1 kHz]	64 dB [82 dB] @ 1 mV/\	V		
Typ. CMR @ 0.1 mV/V [1 mV/V]125 dB [120 dB] @ DCand 5 V <sub>pc</sub> excitation115 dB [110 dB] @ 400 Hz110 dB [105 dB] @ 1 kHzMax. common mode voltage range±12 VInput overvoltage protection±25 V <sub>pc</sub> Output voltage±5 VOutput resistance<10 Ohm					
Input overvoltage protection±25 V DCOutput voltage±5 VOutput resistance< 10 Ohm		115 dB [110 dB] @ 400			
Output voltage±5 VOutput resistance< 10 Ohm	Max. common mode voltage range				
Output resistance< 10 OhmOutput currentMax. 5 mAOutput protectionContinuous short to groundTEDSHardware support for TEDS (Transducer Electronic Data Sheet)Supported TEDS chipsDS2406, DS2430A, DS2432, DS2433Power consumption350 Ohm 16 Channels typ. 8 W 120 Ohm 16 Channels typ. 15 W@ 10 VDC350 Ohm 16 Channels typ. 15 W	Input overvoltage protection	±25 V <sub>DC</sub>			
Output currentMax. 5 mAOutput protectionContinuous short to groundTEDSHardware support for TEDS (Transducer Electronic Data Sheet)Supported TEDS chipsDS2406, DS2430A, DS2432, DS2433Power consumption350 Ohm 16 Channels typ. 8 W 120 Ohm 16 Channels typ. 15 W 350 Ohm 16 Channels typ. 15 W@ 10 VDC350 Ohm 16 Channels typ. 15 W	Output voltage				
Output protectionContinuous short to groundTEDSHardware support for TEDS (Transducer Electronic Data Sheet)Supported TEDS chipsDS2406, DS2430A, DS2432, DS2433Power consumption350 Ohm 16 Channels typ. 8 W 120 Ohm 16 Channels typ. 15 W@ 10 VDC350 Ohm 16 Channels typ. 15 W	Output resistance				
TEDSHardware support for TEDS (Transducer Electronic Data Sheet)Supported TEDS chipsDS2406, DS2430A, DS2432, DS2433Power consumption@ 5 VDC excitation350 Ohm 16 Channels typ. 8 W 120 Ohm 16 Channels typ. 15 W@ 10 VDC350 Ohm 16 Channels typ. 15 W	•	Max. 5 mA			
Supported TEDS chipsDS2406, DS2430A, DS2432, DS2433Power consumption@ 5 VDC excitation350 Ohm 16 Channels typ. 8 W 120 Ohm 16 Channels typ. 15 W 350 Ohm 16 Channels typ. 15 W@ 10 VDC350 Ohm 16 Channels typ. 15 W	Output protection				
Power consumption350 Ohm 16 Channels typ. 8 W@ 5 VDC excitation350 Ohm 16 Channels typ. 8 W120 Ohm 16 Channels typ. 15 W@ 10 VDC350 Ohm 16 Channels typ. 15 W		Hardware support for TEDS (Transducer Electronic Data Sheet)			
@ 5 VDC excitation350 Ohm 16 Channels typ. 8 W 120 Ohm 16 Channels typ. 15 W@ 10 VDC350 Ohm 16 Channels typ. 15 W	Supported TEDS chips	DS2406, DS2430A, DS	2432, DS2433		
@ 10 VDC   120 Ohm 16 Channels typ. 15 W     350 Ohm 16 Channels typ. 15 W	Power consumption				
		120 Ohm 16 Channels t	typ. 15 W		
	Standard operating temperature	0 °C to 70 °C	( 32 °F to 158 °F)		

#### MDAQ-SUB-V-200-xx

- **1**6 programmable ranges from  $\pm 0.125$  V to  $\pm 200$  V
- Bandwidth 300 kHz
- Programmable sensor supply 0 to 12 V
- High signal to noise ratio
- TEDS support



MDAQ-SUB-V-200-xx					
Input voltage range:	Divider Off	±0.125 V, 0.25 V, 0.5	V, 1 V, 1.25 V, 2.5 V, 5 V	/, 10 V (common mode voli	age up to 12 V)
	Divider On	±2.5 V, 5 V, 10 V, 20 \	/, 25 V, 50 V, 100 V, 200	V (common mode voltage	e up to 250 V)
Input impedance		1 MOhm to GND, 2 M	Ohm differential		
DC accuracy	Divider Off			Without software corre	ction table
±0.125 to ±1 V		±0.03% of reading	±400 μV	±0.15% of reading	400 µV
±1.25 V; ±2.5 V		±0.03% of reading	±1 mV	±0.15% of reading	±1 mV
±5; ±10V		±0.02% of reading	±0.03% of range	±0.15% of reading	±0.03% of range
±2.5 to ±20 V	Divider On	±0.06% of reading	±8 mV	±0.25% of reading	±8 mV
±25 V; ±50 V		±0.03% of reading	±20 mV	±0.25% of reading	±20 mV
±100; ±200 V		±0.02% of reading	±0.03% of range	±0.25% of reading	±0.03% of range
Gain drift		Typ. 15 ppm/K (max.	40 ppm/K)		
Input offset drift					
125 mV to 10 V	Divider Off	Typ. 10 μV/K (max. 20	0 μV/K)		
2.5 V to 200 V	Divider On	Typ. 100 µV/K (max. 2	200 µV/K)		
Overvoltage protection		±250 V <sub>DC</sub>			
Bandwidth ( -3 dB)	Divider Off	300 kHz (200 kHz at r	ange 0.125 V and 1.25	V)	
	Divider On	300 kHz (200 kHz at r	ange 2.5 V and 25 V)		
Channel separation @ 10 kHz	2	> 80 dB			
CMRR @ 50 Hz (@ 1 kHz)	Divider Off	> 94 dB (> 80 dB)			
	Divider On	> 70 dB (> 56 dB)			
Typ. SNR @ 50 kHz BW	Divider Off				
±0.125 V and ±0.25 V		> 87 dB			
±0.5 V to ±10 V		> 96 dB			
±2.5 V and ±10 V	Divider On	> 84 dB			
±10 V to ±25 V		> 88 dB			
±25 V to ±200 V		> 93 dB			
Programmable sensor supply	(1)	0 to 12 V short circuit	protected; 50 mA currer	nt limmitation	
Sensor supply accuracy <sup>(1)</sup>		±0.05 % ±2 mV			
Fixed sensor supply <sup>(1)</sup>		±15 V (50 mA/channe	l)		
Output voltage		±5 V			
Output impedance		5 Ohm			
Output current		±20 mA			
Programming interface		RS-485, RS-232, USI	3		
Power supply		±15 V			
Power consumption		Typ. 4.5 W / 10 W <sup>(1)</sup>			
Sensor connection		BNC or DSUB (1) fema	ale		
Output connector		68-pin Amplimite serie	es (AMP Nr. 174339-6)		
Supported TEDS chips (1)		DS2406, DS2430A, D	S2432, DS2433		
Dimensions (W x D x H)		BNC: 175 x 61 x 30 m	nm (6.9 x 2.4 x 1.2 in.)	DSUB: 175 x 82 x 22 (6.9	x 3.2 x 0.9)
(1) MDAQ-SUB-V-200-D only!					

#### **MDAQ-SUB-ACC**

- 16 channel IEPE<sup>®</sup> amplifier
- Several voltage measurement modes (AC/DC coupling, single ended/differential)
- Bandwidth up to 300 kHz
- Channel separation 96 dB
- TEDS support
- Ideally suited for sound and vibration measurement



MDAQ-SUB-ACC			_	
Input voltage range	±0.125 V, 0.25 V, 0.5 V	V, 1 V, 1.25 V, 2.5 V,	5 V, 10 V	
Gain	0.5, 1, 2, 4, 5, 10, 20, 40			
Input modes Voltage modes	IEPE <sup>®</sup> or voltage Single ended or differential DC or AC coupled (3 Hz standard, on request down to 0.1 Hz)			
Input impedance	1 MOhm			
DC accuracy			without software corre	ction table
±0.125 to ±1 V	±0.03% of reading	400 µV	±0.15% of reading	400 µV
±1.25 V; ±2.5 V	±0.03% of reading	±1 mV	±0.15% of reading	±1 mV
±5;10 V	±0.02% of reading	±0.03% of range	±0.15% of reading	±0.03% of range
Gain drift	typ. 10 ppm/K (max. 2	20 ppm/K)		
Input offset drift	typ. 3 µV/K (max. 12 µ	JV/K)		
Over voltage protection	IN+ differential ±40 V IN- differential: max ±40 V IN- Single ended: max 300 mA			
Max. common mode voltage	IN differential mode: ±12 V			
Bandwidth ( -3 dB)	300 kHz (200 kHz at r	ange 1.25 V and 0.1	25 V)	
Channel separation @ 10 kHz	> 96 dB			
CMR @ 50 Hz (@ 1 kHz)	> 94 dB (> 80 dB)			
Typ. SNR @ 50 kHz bandwidth Range $\pm$ 0.125 V Range $\pm$ 0.25 V Range $\pm$ 0.5 V to $\pm$ 1.25 V Range $\pm$ 2.5 V to $\pm$ 10 V	> 87 dB > 93 dB > 96 dB > 100 dB			
Sensor excitation	4 or 8 mA, 5 % up to 2	24 V <sub>DC</sub>		
Current noise	150 nA * sqrt (Hz)			
Input connectors	BNC			
Output voltage	±5 V			
Output impedance	5 Ohm			
Output current	±20 mA			
Programming interface	RS-485, RS-232			
Power supply	±15 V <sub>DC</sub>			
Power consumption:	Typ. 10 W (max 12 W @ 8 mA sensor excitation)			
Sensor connection:	BNC female			
Output connector	68-pin Amplimite series (AMP Nr. 174339-6)			
TEDS	DS 2406, DS 2430A,	DS 2432, DS2433		

## MDAQ-SUB-ACC-A-BNC

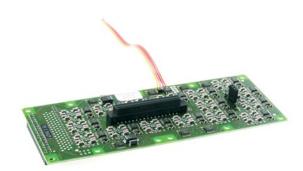
- 16 channel IEPE<sup>®</sup> amplifier
- AC and DC coupled voltage measurement mode
- 2 programmable high-pass filters
- Bandwidth up to 300 kHz
- Channel separation 96 dB
- TEDS support
- Ideally suited for sound and vibration measurement



MDAQ-SUB-ACC-A				
Input voltage range	±0.125 V, 0.25 V, 0.5 V	/, 1 V, 1.25 V, 2.5 V,	5 V, 10 V	
Gain	0.5, 1, 2, 4, 5, 10, 20, 40			
Input modes Voltage modes	ICP <sup>®</sup> or Voltage Single ended DC or AC coupled with two selectable high pass filter (0.15 and 3.4 Hz as standard, others on request)			
Input impedance	1 MOhm			
DC accuracy <sup>1)</sup>			Without software corre	ction table
±0.125 V and ±0.25 V	±0.03% of reading	350 µV	±0.15% of reading	350 µV
±0.5 V to ±1.25 V	±0.03% of reading	±0.04% of range	±0.15% of reading	±0.04% of range
±2.5 V to ±10 V	±0.02% of reading	±0.03% of range	±0.15% of reading	±0.03% of range
Gain drift	Typ. 10 ppm/K (max. 2	20 ppm/K)		
Input offset drift	Typ. 3 μV/K (max. 12 μ	JV/K)		
Over voltage protection	IN+ ±40 V IN- Single ended: max	300 mA		
Bandwidth (-3 dB)	300 kHz (200 kHz at range 1.25 V and 0.125 V)			
Channel separation @ 10 kHz	> 96 dB			
CMR @ 50 Hz (@ 1 kHz)	> 94 dB (> 80 dB)			
Typ. SNR @ 50 kHz bandwidth Range ±0.125 V Range ±0.25 V Range ±0.5 V to ±1.25 V Range ±2.5 V to ±10 V	> 87 dB > 93 dB > 96 dB > 100 dB			
Sensor excitation	4 or 8 mA, 5 % up to 2	4 V <sub>DC</sub>		
Current noise	150 nA * sqrt (Hz)			
Input connectors	BNC			
Output voltage	±5 V			
Output impedance	5 Ohm			
Output current	±20 mA			
Programming interface	RS-485, RS-232			
Power supply	15 V <sub>DC</sub>			
Power consumption:	Typ. 10 W (max 12 W	@ 8 mA sensor exc	itation)	
Sensor connection:	BNC female			
Output connector	68-pin Amplimite series	s (AMP Nr. 174339-	6)	
Dimensions (W x D x H)	175 x 61 x 30 mm (6.9	x 2.4 x 1.2 in.)		

#### **MDAQ-FILT-5-Bx**

- MDAQ-FILT-5-BE: Bessel characteristics MDAQ-FILT-5-BU: Butterworth characteristics
- 16 channel 2nd order low pass filter
- 5 selectable filters including bypass function
- 5 different cut off frequencies
- Discrete low noise filter design
- Independent filter settings for each channel
- Direct control from MDAQ-xx amplifier series



MDAQ-FILT-5-Bx	
Filter range (-3 dB) Standard MDAQ-FILT-5-Bx Ordering option MDAQ-FILT-5-BU-S1	30 Hz, 100 Hz, 300 Hz, 1 kHz, 10 kHz, bypass 100 Hz, 1 kHz, 10 kHz, 30 kHz, 100 kHz, bypass other frequencies on request
Bypass bandwidth	> 700 kHz
Filter characteristics	2-Pole Bessel characteristic 2-Pole Butterworth characteristic
Attentuation slope	40 dB/decade (12 dB/octave)
Filter accuracy	±1.5 dB @ f <sub>c</sub>
DC gain	1 (0 dB)
Offset Error	Max. 1 mV (typ <0.2 mV) Max. 0.02% of range with MDAQ-BASE-5
Input voltage range	±10 V <sub>PP</sub>
Channel separation @ 50 kHz	> 96 dB
Input configuration	Single ended, designed for use with MDAQ-V and MDAQ-BASE-5
Output configuration	Single ended
SNR @ bandwidth	> 100 dB
Output impedance	5 Ohm
Output current	Max. ±20 mA
Output connector	68-pin Amplimite series (AMP Nr. 174339-6), SCSI II Type
Power supply	±7.5 V to ±15 V direct via MDAQ-BASE or -V
Power consumption	Тур. 3 W
Dimensions (W x D x H)	175 x 61 x 14 mm (6.9 x 2.4 x 0.9 in.)

#### MDAQ-AAF4-5-Bx

- MDAQ-AAF4-5-BE: Bessel characteristics MDAQ-AAF4-5-BU: Butterworth characteristics
- 16 channel 4th order low pass filter
- 5 selectable filters including bypass function
- 5 different cut off frequencies
- Discrete low noise filter design



MDAQ-AAF4-5-Bx			
ordering option MDAQ-AAF4-5-BU-S2	100 Hz, 1 kHz, 10 kHz, 30 kHz, 100 kHz, bypass 163 Hz, 500 Hz, 2.5 kHz, 10 kHz, bypass, bypass 10 Hz, 100 Hz, 1 kHz, 10 kHz, 20 kHz, bypass 100 Hz, 1 kHz, 10 kHz, 20 kHz, 30 kHz, bypass other frequencies on request		
Bypass Bandwidth	> 700 kHz		
Filter characteristics	Ordering option BE: 4-Pole Bessel characteristic Ordering option BU: 4-Pole Butterworth characteristic		
Attentuation slope	80 dB/decade (24 dB/octave)		
Filter accuracy	±1.5 dB @ f <sub>0</sub>		
DC gain	1 (0 dB)		
Offset Error	Max. 1 mV (typ <0.2 mV) max. 0.02% of range with MDAQ-BASE-5		
Input voltage range 2)	±10 V <sub>PP</sub>		
Channel separation @ 50 kHz	> 96 dB		
Input configuration	Single ended; designed for use with MDAQ-V and MDAQ-BASE-5		
Output configuration	Single ended		
SNR @ full Bandwidth	> 100 dB		
Output impedance	5 Ohm		
Output current	Max. ±20 mA		
Output connector	68-pin Amplimite series (AMP Nr. 174339-6), SCSI II Type		
Power supply	±7.5 V to ±15 V direct via MDAQ-BASE or -V		
Power consumption	Typ. 3 W		
Dimensions (W x D x H)	175 x 61 x 25 mm (6.9 x 2.4 x 1 in.)		

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