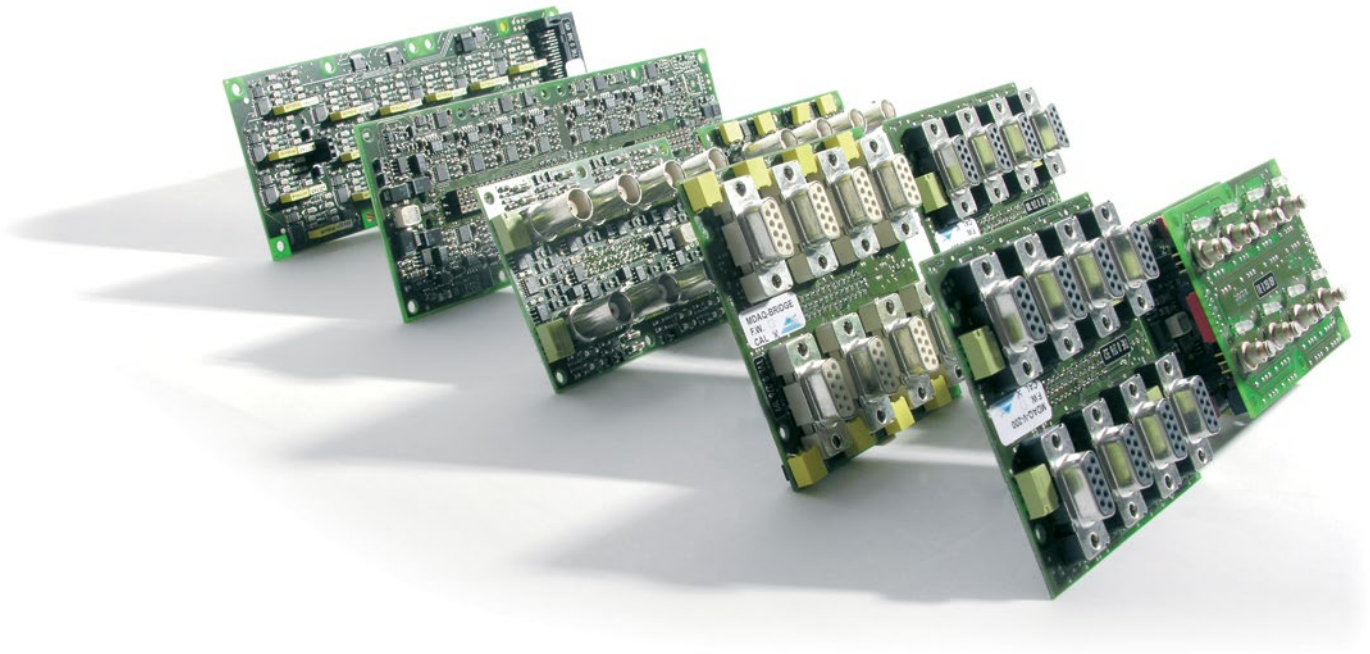
Automotive
Energy & Power Analysis
Aerospace & Defense
Transportation
General Test & Measurement



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 multi-pin 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 ±5 V. A range of MDAQ-SUB modules define the supported input signals. Finally a filter board MDAQ-FILT can be added.

worldwide DEWETRON

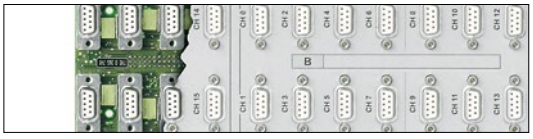
MDAQ Series Amplifiers

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

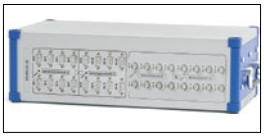
Selection Guide

SUB Modules for MDAQ-BASE-x

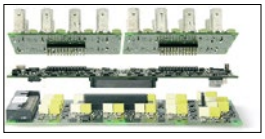
Module	# CH	Input type	Ranges	TEDS	Bandwidth (BW), Highpass filters (HP)	Excitation
MDAQ-SUB-STG-D Connector: DB-9	8	Strain-gage (Full-, half and quarter-bridge, incl. shunt calibration) for strain gage application	14 ranges from ±0.5 to 1000 mV/V (@ 5 V_{DC} excitation	✓	BW: 30 kHz	0 to 12 V_{DC}
	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



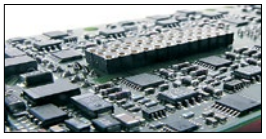
MDAQ modules - available in most of the DEWETRON multichannel systems



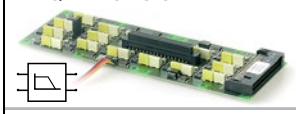
DEWE-51-USB2-32 2x MDAQ-SUB-V-200-D, 2x MDAQ-SUB-ACC-A modules and USB-A/D converter



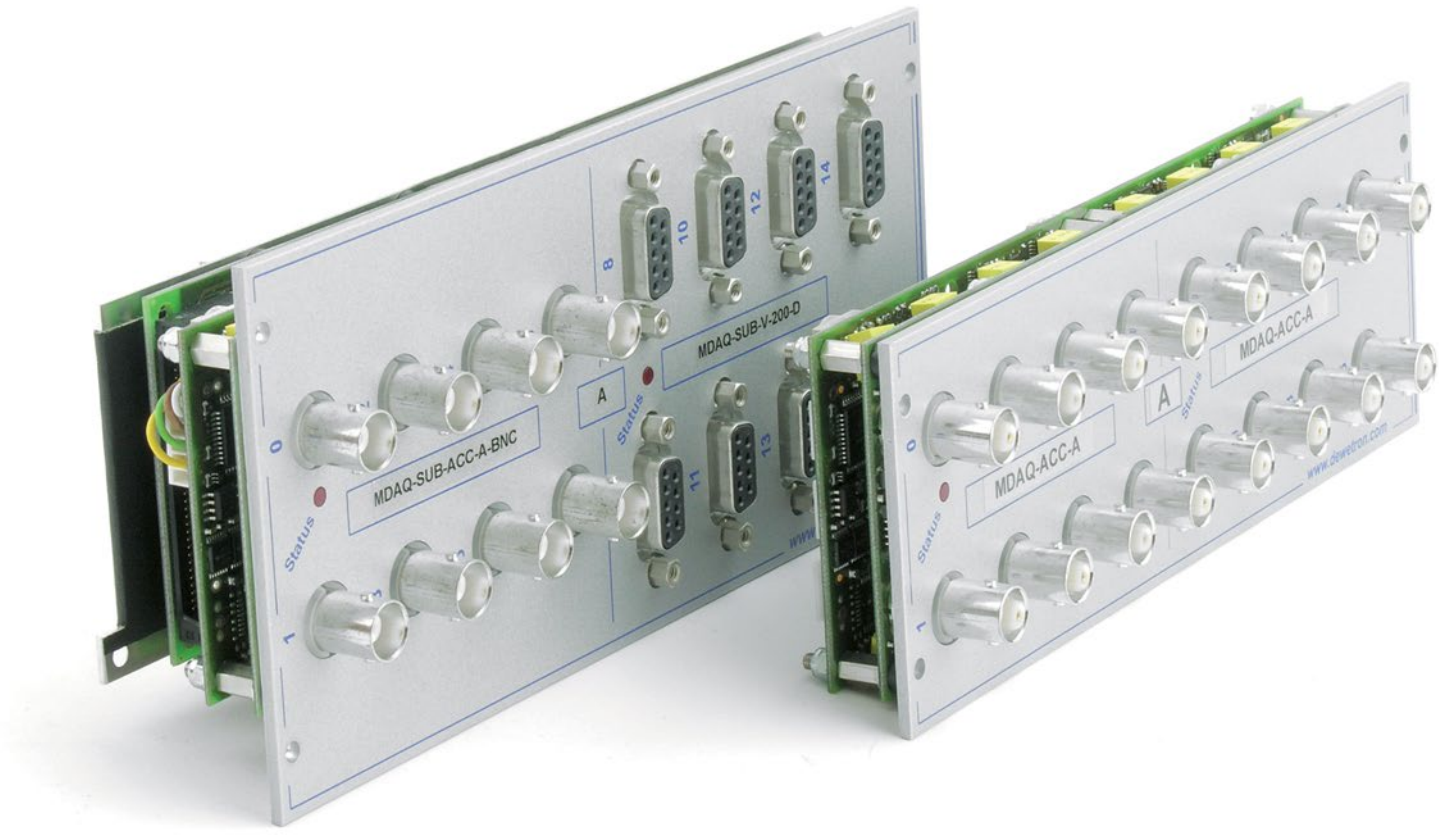
Typical combination with two SUB modules mounted on a BASE module, and FILTER board (optional)



All MDAQ boards are equipped with highest quality components

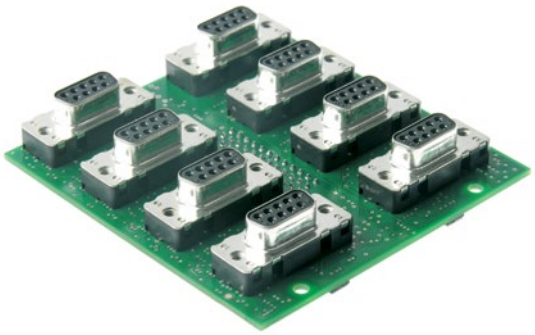
Filter modules for MDAQ				
Module	**# CH**	**Filter characteristics**	**Cut-off frequencies**	**Order**
MDAQ-AAF4-5-BU 	16	Butterworth	100 Hz, 1, 10, 30, 100 kHz, Bypass *Note:* *not possible in all system configurations.* *Please contact factory for details.*	4th
MDAQ-FILT-5-BU 	16	Butterworth	30,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

MDAQ-BASE boards			
	Sub modules	**Bandwidth**	**Output**
MDAQ-BASE-5 	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*

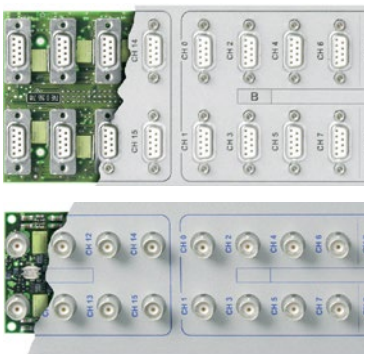


Specifications

MDAQ-SUB-STG-D combined with MDAQ-BASE-5				
Gain	0.5 to 2000			
Input ranges	±2.5, 5, 10, 20, 25, 50, 100, 200, 250, 500, 1000, 1250, 2500, 5000, 10 000 mV			
@ 5 V_{DC} excitation	±0.5, 1, 2, 4, 5, 10, 20, 40, 50, 100, 200, 250, 500, 1000 mV/V			
Input impedance	>100 MOhm			
Input noise	3.5 nV * √Hz			
Typ. input offset drift	0.5 µV/K (for ranges < 200 mV)			
DC Accuracy High Gain			Without software correction table	
±2.5 mV;5 mV/V;10 mV/V;±25 mV	±0.03% of reading	±15 µV [±3 µV/V @5 V_{EXC}]	±0.15% of reading	±15 µV [±3 µV/V @5 V_{EXC}]
20 mV	±0.03% of reading	±0.12% of range	±0.15% of reading	±0.12% of range
50 mV	±0.03% of reading	±0.06% of range	±0.15% of reading	±0.06% of range
±100 mV to ±200 mV	±0.03% of reading	±0.03% of range	±0.15% of reading	±0.03% of range
±0.250 to ±1 V Low Gain	±0.03% of reading	400 µV [±80µV/V@5 V_{EXC}]	±0.15% of reading	400 µV [±80µV/V @5V_{EXC}]
±1.25 V; ±2.5 V	±0.03% of reading	±1mV	±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 @ 5 V_{DC} excitation	10 ppm/K of range ±0.02 µV/V/K			
Excitation voltage	0 to 12 V programable in 1 mV steps. (5 V default)			
Excitation accuracy	±0.05 % ±0.7 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 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 [1]	absolute Voltage	mV/V @ 5 V_{EXC}	µm/m @ 5V_{EXC} k=2 Quarter bridge	
2.5 mV to 20 mV	±10 mV	±2 mV/V	±4000 µm/m	
25 mV to 200 mV	±100 mV	±20 mV/V	±40000 µm/m	
250 mV to 1 V	±0.5 V	±100 mV/V	±200,000 µm/m	
2 V to 10 V	± 5 V	±1000 mV/V	±2,000,000 µm/m	
Bandwidth (-3 dB)	30 kHz			
Filters (lowpass)	In combination with MDAQ-FILT-xx			
Typ. SNR @ 30 kHz [1 kHz]	64 dB [82 dB] @ 1 mV/V			
and 5 V_{DC} excitation	82 dB [96 dB] @ 50 mV/V			
Typ. CMR @ 0.1 mV/V [1 mV/V]	125 dB [120 dB] @ DC			
and 5 V_{DC} excitation	115 dB [110 dB] @ 400 Hz			
	110 dB [105 dB] @ 1 kHz			
Max. common mode voltage range	±12 V			
Input overvoltage protection	±25 V_{DC}			
Output voltage	±5 V			
Output resistance	< 10 Ohm			
Output current	Max. 5 mA			
Output protection	Continuous short to ground			
TEDS	Hardware support for TEDS (Transducer Electronic Data Sheet)			
Supported TEDS chips	DS2406, DS2430A, DS2432, DS2433			
Power consumption				
@ 5 VDC excitation	350 Ohm 16 Channels typ. 8 W			
	120 Ohm 16 Channels typ. 15 W			
@ 10 VDC	350 Ohm 16 Channels typ. 15 W			
Standard operating temperature	0 °C to 70 °C (32 °F to 158 °F)			

MDAQ-SUB-V-200-xx

- *16 programmable ranges from ±0.125 V to ±200 V*
- *Bandwidth 300 kHz*
- *Programmable sensor supply 0 to 12 V*
- *High signal to noise ratio*
- *TEDS support*



Specifications

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 voltage up to 12 V)			
	Divider On	±2.5 V, 5 V, 10 V, 20 V, 25 V, 50 V, 100 V, 200 V (common mode voltage up to 250 V)			
Input impedance		1 MOhm to GND, 2 MOhm differential			
DC accuracy	Divider Off			Without software correction 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 µV/K)			
2.5 V to 200 V	Divider On	Typ. 100 µV/K (max. 200 µV/K)			
Overvoltage protection		±250 V_{DC}			
Bandwidth (-3 dB)	Divider Off	300 kHz (200 kHz at range 0.125 V and 1.25 V)			
	Divider On	300 kHz (200 kHz at range 2.5 V and 25 V)			
Channel separation @ 10 kHz		> 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 current limmitation			
Sensor supply accuracy (1)		±0.05 % ±2 mV			
Fixed sensor supply (1)		±15 V (50 mA/channel)			
Output voltage		±5 V			
Output impedance		5 Ohm			
Output current		±20 mA			
Programming interface		RS-485, RS-232, USB			
Power supply		±15 V			
Power consumption		Typ. 4.5 W / 10 W (1)			
Sensor connection		BNC or DSUB (1) female			
Output connector		68-pin Amplimite series (AMP Nr. 174339-6)			
Supported TEDS chips (1)		DS2406, DS2430A, DS2432, DS2433			
Dimensions (W x D x H)		BNC: 175 x 61 x 30 mm (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

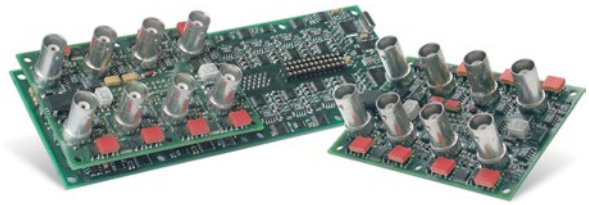
- *16 channel IEPE® amplifier*
- *Several voltage measurement modes (AC/DC coupling, single ended/differential)*
- *Bandwidth up to 300 kHz*
- *Channel separation 96 dB*
- *TEDS support*
- *Ideally suited for sound and vibration measurement*

Specifications

MDAQ-SUB-ACC				
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	IEPE® 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 correction 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. 20 ppm/K)			
Input offset drift	typ. 3 µV/K (max. 12 µV/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 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 24 V_{DC}			
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_{DC}			
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® 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*

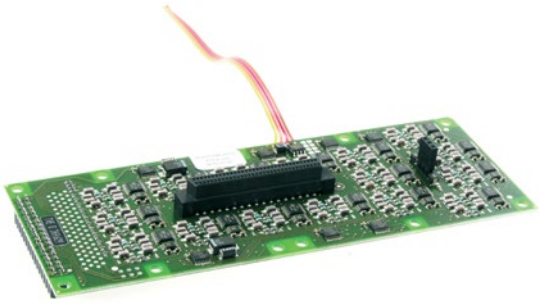


Specifications

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® 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 [1]			Without software correction 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. 20 ppm/K)			
Input offset drift	Typ. 3 µV/K (max. 12 µV/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 24 V_{DC}			
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_{DC}			
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)			
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

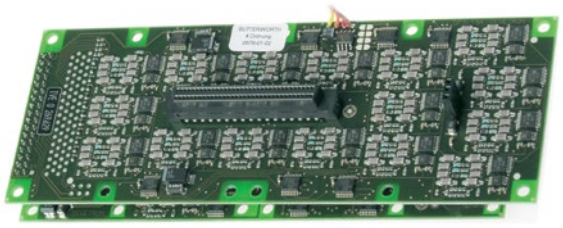
- *MDAQ-FILT-5-BE: Bessel characteristics*
  MDAQ-FILT-5-BU: Butterworth characteristics
- *16 channel 2nd order low pass filter*
- *5 selectable filters including bypass function*
- *5 different cut off frequencies*
- *Discrete low noise filter design*
- *Independent filter settings for each channel*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



Specifications

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
Attenuation slope	40 dB/decade (12 dB/octave)
Filter accuracy	±1.5 dB @ f_c
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_{PP}
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	Typ. 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*

Specifications

MDAQ-AAF4-5-Bx	
Filter range (-3 dB) standard ordering option MDAQ-AAF4-5-BU-S1 ordering option MDAQ-AAF4-5-BU-S2 ordering option MDAQ-AAF4-5-BE-S1	 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_0
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_{PP}
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.)


MDAQ-SUB-I-200
Status
www.dewetron.com
MDAQ-SUB-I-200
Status
www.dewetron.com
B0 CNT0 B0 CNT1