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Electronics & Software

Type 5073B…

Industrial Charge Amplifier for Multi-purpose with Ethernet

The industrial charge amplifier for multi-purpose (ICAM-B) can be used wherever mechanical quantities are measured with piezoelectric sensors. Piezoelectric sensors produce an electric charge which varies in direct proportion to the load acting on the sensor. The charge amplifier Type 5073B… converts a charge signal into a low-impedance voltage signal. It covers slow, quasi-static signals as well as dynamic processes. Depending on variant, up to four sensors can be connected at the same time.

The 5073B… combines proven analog signal routing with parallel IIoT connection and remote data processing, providing solid performance on both paths.

- Variants with 1, 2, 3 or 4 channels
- Wide measurement range from ±20 pC to ±1 000 000 pC
- Analog voltage output +/-10 V or current output 4 … 20 mA
- Fast analog signal throughput with 20 kHz bandwidth
- 6 analog outputs with fully flexible scaling and internal routing
- Digital control interface for stand-alone operation
- Selectable low-pass filter and switchable high-pass filter
- Web-UI for configuration and control via Ethernet
- Network and channel status indicators via individual LEDs
- Digital data streaming up to 1 kSps
- Virtual channels for real-time calculations using one or more sensor channels
- REST-API for configuration from other systems
- IIoT connectivity with OPC-UA and MQTT
- Industrial variants with degrees of protection IP50, IP65 and IP67
- Reverse compatibility to 5073A… with optional RS232 interface

Description

The charge amplifier Type 5073B... with its sealed metal case is designed for harsh industrial environments. Depending on the variant, up to four measuring channels can be accommodated in a single case. The amplifier features a wide measuring range and a rich set of signal processing features. The 5073B… is configured via an intuitive web user interface. The web user interface is not only to configure the device but also to display various measurement values (e.g., live value, min and max value, RMS value) as well as the measurement curve in a y/t graph.

With its adjustable measurement range, acquisition of peak values, programmable offset, excellent technical data and galvanic isolation the ICAM-B is extremely versatile. The low-pass filter can be selected from a wide range of available filters. The switchable high-pass filter allows monitoring of fast processes without interrupting the measurement – even during continuous operation.

The input signals can be flexibly routed to six analog outputs, where the output signal mode can be chosen among the many available options such as instant value, RMS, integral, min, max and peak to peak values.

The virtual channel functionality allows real-time calculations (sum, weighted sum and subtraction) of different input signals.

Application

The 5073B… is suitable for applications with nearly all piezoelectric sensors. The combination of new features and extended measuring range makes the 5073B… suitable for many new applications in micromechanics, medical technology and the semiconductor industry where small forces have to be measured. The flexible signal assignment and weighted sum of several sensor signals enables more precise measurement on dynamometers and platforms. Internally calculated RMS and peak values simplify the condition monitoring of systems and processes. Additionally, the process limits can be monitored using threshold value monitoring and output directly as a switching signal.

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The measurement data can also be sent in parallel to a system controller or a measuring computer via the Ethernet connection. In addition to the web-UI, the 5073B... can be configured via the REST-API or OPC UA. With all these possibilities, users benefit from the high rigidity and dynamics of piezoelectric measurement technology as well as the interference resistance of digital data and continuous communication right down to sensor level.

Technical specifications

Connections

Number of channels		1, 2, 3, 4
Charge input connector type		BNC neg., TNC neg., KIAG 10-32 UNF neg.
Analog output/ power/Digital IO connector type		D-Sub 15-pol. pos.
Ethernet interface		1x M12 4-pole neg. D-coded
RS-232C (optional)		D-Sub 9-pol. neg.

Virtual channels

Number of channels		2

Charge input

Measuring ranges	pC	±20 … 1 000 000
Measurement uncertainty		
Measuring range ≤100 pC	%FSO	<±1
Measuring range >100 pC	%FSO	<±0.5
Input noise (typ.)		
1 Hz … 100 kHz		
900 pC	pCrms	<0.1
31 000 pC	pCrms	<3
1 000 000 pC	pCrms	<100
Drift		
at 25°C, max. relative humidity RH of 60% (non-condensing)	pC/s	<±0.03
at 25°C, max. relative humidity RH of 70% (non-condensing)	pC/s	<±0.05
at 50°C, max. relative humidity RH of 50% (non-condensing)	pC/s	<±0.2
Frequency range (-3dB)		
Q <31 000 pC (-3 dB, cable capacitance 1nF)	kHz	≈0 ... <20
Q <100 000 pC (-3 dB, cable capacitance 1nF)	kHz	≈0 ... <18
Q <200 000 pC (-3 dB, cable capacitance 1nF)	kHz	≈0 ... <16
Q <500 000 pC (-3 dB, cable capacitance 1nF)	kHz	≈0 ... <11
Q <1 000 000 pC (-3 dB, cable capacitance 1nF)	kHz	≈0 ... <2
Measure-Reset jump	pC	<±2
Reset-measure delay time	ms	≤0.5
Measure-reset delay time	ms	<1.5
Range switching time		
≤900 pC ↔ >900 pC	ms	≤30
≤31 000 pC ↔ >31 000 pC	ms	≤30
Linearity error typ.	%FSO	<0.05
Crosstalk between channels	dB	≤-80
Sensor impedance	MΩ	>10

Time constants

Hardware high-pass filter Time constant Short		
Q<900 pC	s	0.03 (±10%)
Q<31 000 pC	s	1 (±10%)
Q<1 000 000 pC	s	36 (±10%)
Time constant Long	s	>10 000

Low Pass Filter

Filter type		Bessel
Order		4th
Cut-off frequency (-3dB)	Hz	10, 20, 50, 100, 500
Cut-off frequency (-3dB)	kHz	1, 2, 5, 10, 20, (LP off)
Group delay (complete system)		
Low-pass (LP)		
LP= 20 kHz	ms	≤0.048
LP= 10 kHz	ms	≤0.067
LP= 5 kHz	ms	≤0.105
LP= 2 kHz	ms	≤0.210
LP= 1 kHz	ms	≤0.380
LP= 500 Hz	ms	≤0.720
LP= 100 Hz	ms	≤3.6
LP= 50 Hz	ms	≤7.2
LP= 20 Hz	ms	≤18
LP= 10 Hz	ms	≤36

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Voltage output

Nominal output range	V	±10
Output voltage range	V	±10.8
Output current, max.	mA	±2
Output impedance	Ω	10
Output noise (all ranges)		
1 Hz ... 10 kHz, typ	mVrms	≤1.6
Group delay (input to output, filters off)	µs	≤40
Zero error	mV	<±6
DAC resolution	Bit	14

Current output

Nominal output range	mA	4 … 20
Output current range	mA	3 … 21
Output impedance	MΩ	>2
Max. load	Ω	500
Output noise (all ranges)		
1 Hz ... 10 kHz, typ.	mArms	≤ 0.003
Group delay (input to output, filters off)	µs	≤45
Zero error	mA	<±0.01
DAC resolution	Bit	≥14

Data acquisition

ADC resolution	Bit	16
Internal ADC sampling rate	kSps	100
Acquisition data rate per channel	kSps	100

Ethernet interface

Baud rate	Mbps	100
Supported protocols		TCP/IP, MQTT
Configuration interfaces		REST API, OPC UA
Streaming protocols		MQTT
Maximum streaming rate	kSps	1

RS-232C Interface

ANSI/TIA standard		RS-232C
Transmission speed	Bits per second (baud rate)	115 200
Data bit		8
Stop bit		1
Parity		none
Handshake		none
Max. cable length	m	5

Remote control (Digital I/O and 24V supply)

Digital input level when common control voltage (Vcc) =0 V*		
High	V	2.4...30
Low		De-energized
Digital input level when common control voltage (Vcc) =3... 30 V*		
High		De-energized
Low	V	0...Vcc-2.4
Maximum input voltage	V	±30
Supply (output)	VDC	±24(±10%)
Output current (short circuit proof)	mA	≤60
Delay time		
Measure or Trigger	ms	<1
Digital output level		
High	V	Power supply dependent (18-30 V)
Low	V	0

*Please note that the logic can be inverted through the web UI.

Power supply

Supply voltage range	VDC	18…30
Power consumption	W	≤5
Current consumption at 24V	mA	≤200
Power supply requirement		- Galvanic isolation - PE and GND not connected

General data

Operating temperature range	°C	-20 … 65
Storage temperature	°C	-40 … 85
Degree of protection as per EN60529 (only with cables fitted and/or covered connectors)	IP	BNC (IP50) TNC (IP65) KIAG 10-32 (IP67)
Housing material		Die-cast aluminium
Weight	g	≈325
Dimensions (Width x Height x Length)	mm	64 x 34.5 x 115
Vibration resistance IEC60068 Part 2–6 (58 Hz … 150 Hz)	g	10
Shock resistance IEC60068 Part 2–27 (6 ms)	g	100

LED status indicator

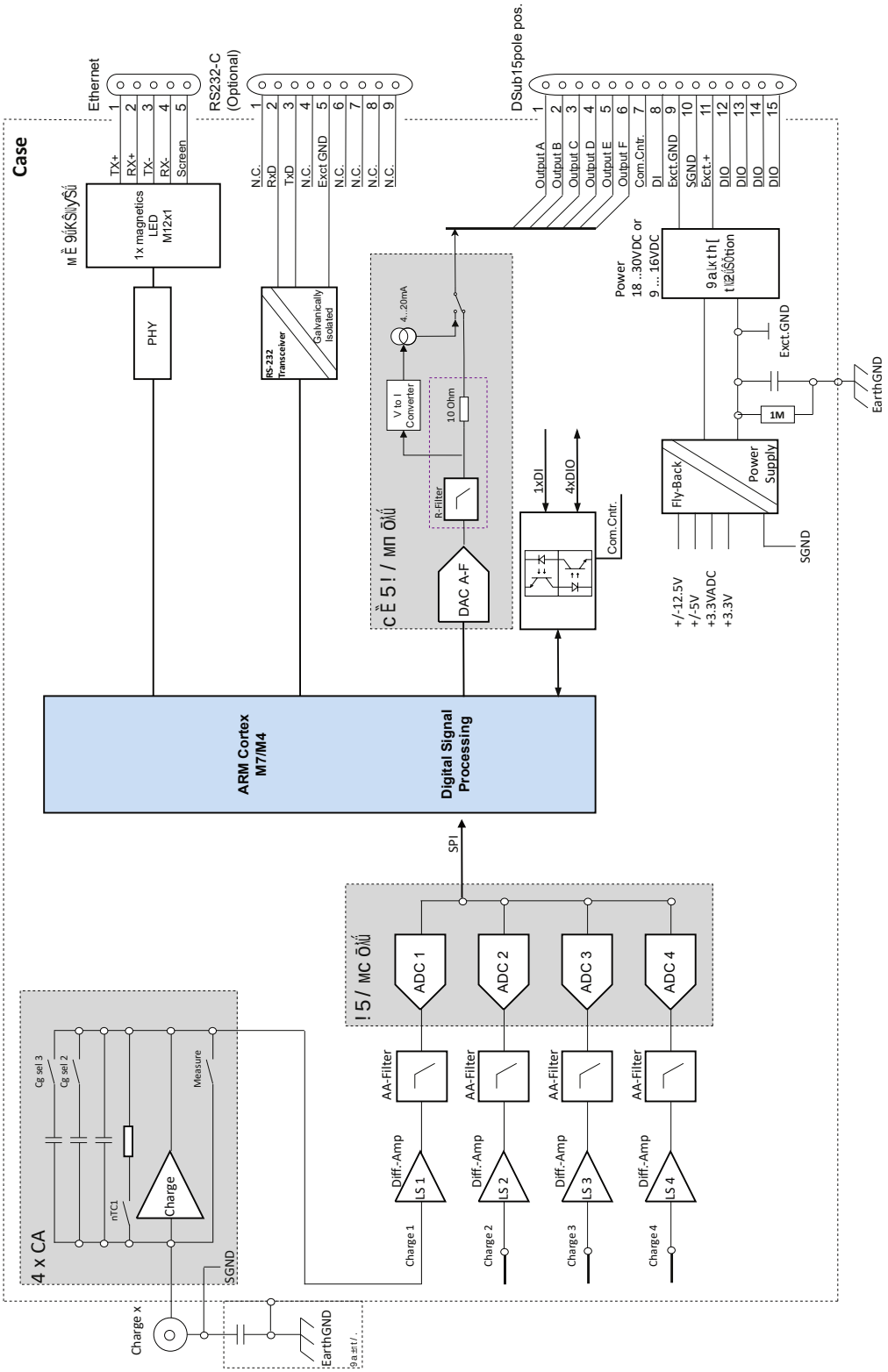
Sensor LED per channel		
Initialization		yellow 1Hz blinking
Operate / Measure		blue
Reset, waiting for trigger		blue 1Hz blinking
Overload		red
Device LED		
Device boot/ initialization		yellow 1Hz blinking
Network connected, but initializing / waiting for IP-address assignment		yellow 1Hz blinking
MQTT configured broker not available / no response		yellow 1Hz blinking
Waiting for internal/external action/ factory reset button pressed		blue 3Hz blinking
Device state "ok"		blue
Device state "error"		red
• Overload on one or more channels		
• Operating temperature out of specification		
• Hardware error (device broken / not responding)		
Device state "error" Reset/Measure timing violation (55 ms)		red 3Hz blinking
• Range switch during measure		
Device state "connection lost"		yellow
• Network connection lost (unplugged ethernet cable)		

Licensed features

The charge amplifier supports two standardized IIoT protocols which can be enabled by purchasing the licensed IIoT feature package. The licensed IIoT package features configurability and parametrization capabilities through the implementation of OPC UA. OPC UA is a widely adopted industrial communication protocol that facilitates secure data exchange between devices in the industrial automation. An additional feature that comes in the IIoT licensed package is MQTT for data streaming, which makes the amplifier suitable for a variety of applications across industries by providing efficient communication.

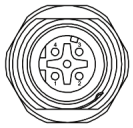
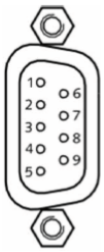
License	Function
IIoT feature package	OPC UA for device configuration and parametrization • Standard communication framework enables compatibility and interoperability of different devices • Secure data exchange ensures that configuration and parameterization data are exchanged securely • Remote configuration and parameterization of the device • Real-time update capabilities of OPC UA enable dynamic updates to configurations and parameters
	MQTT for remote data streaming • Different levels of Quality of Service (QoS) to ensure reliable message delivery • MQTT supports security features such as username/password authentication and Transport Layer Security (TLS) encryption • Low latency • Publish/subscribe architecture • Asynchronous communication enables devices to send and receive messages independently • Persistent connections for minimizing the overhead associated with establishing and breaking down connections for each message. • Last will ensures that the device can communicate its status in the event of an unexpected disconnection

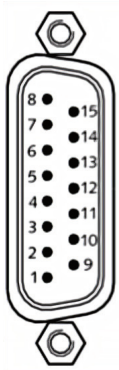
Block diagram



Connections

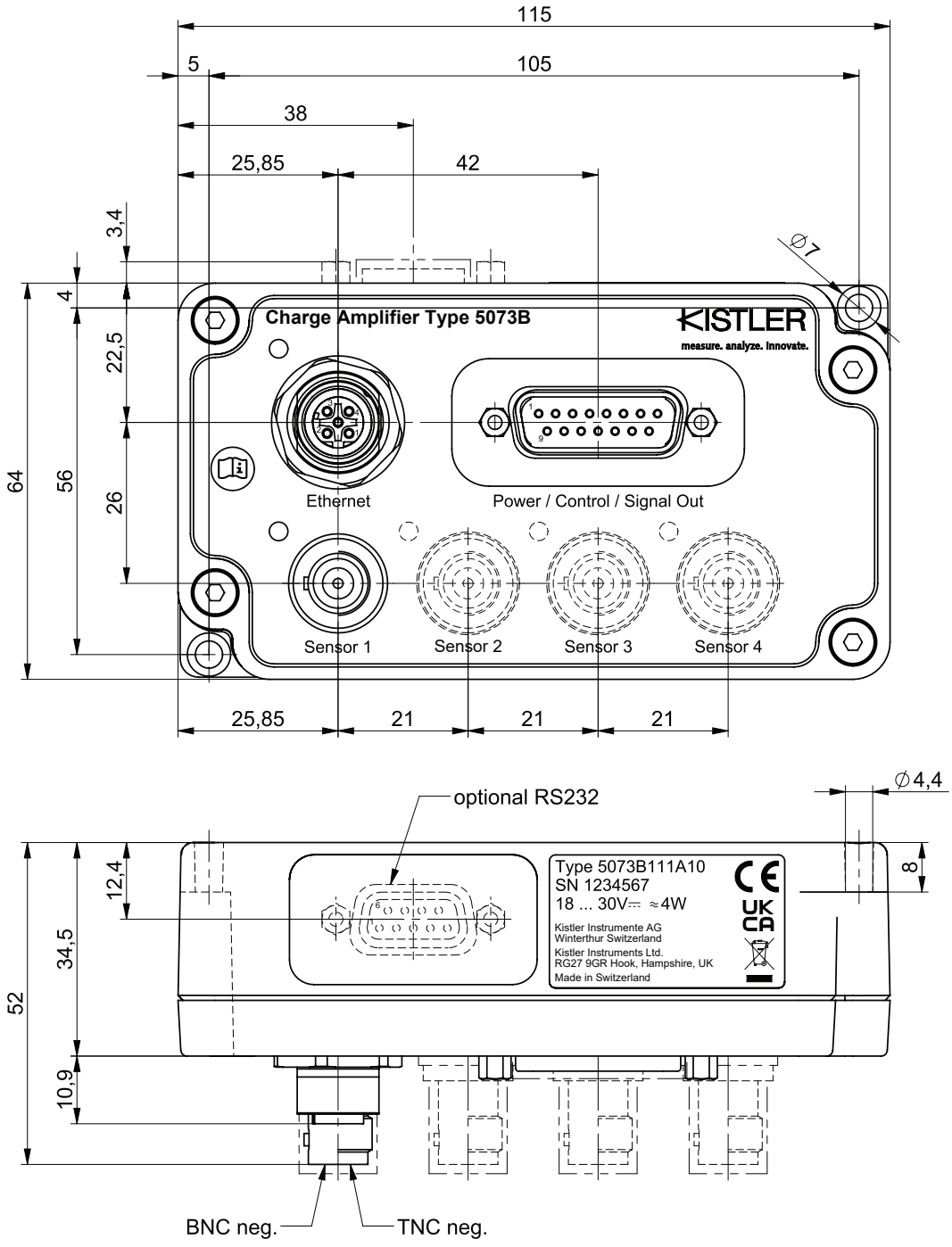
Interface	Connector	Pin	Function
Sensor input	BNC 	Pin	Charge input
		Shield	GND
	TNC 	Pin	Charge input
		Shield	GND
	KIAG10-32 	Pin	Charge input
		Shield	GND

Interface	Connector	Pin	Function
Data Interfaces	M12 4-pole neg. D-coded 	1	TX+
		2	RX+
		3	TX-
		4	RX-
		5	Shield
	D-Sub 9 pole neg. (optional) 	1	Not connected
		2	RxD
		3	TxD
		4	Not connected
		5	Exct. GND
		6	Not connected
		7	Not connected
		8	Not connected
		9	Not connected

Interface	Connector	Pin	Function	Range (variants with voltage output)	Range (variants with current output)
System Connector	D-Sub 15-pol. pos 	1	Analog output 1	±10 V	±10 V / 4…20 mA
		2	Analog output 2	±10 V	±10 V / 4…20mA
		3	Analog output 3	±10 V	±10 V / 4…20 mA
		4	Analog output 4	±10 V	±10 V / 4…20 mA
		5	Analog output 5	±10 V	±10 V / 4…20 mA
		6	Analog output 6	±10 V	±10 V / 4…20 mA
		7	Common Control	Hi / Lo [1]	Hi / Lo [1]
		8	DI (08)	Lo ≤0.8 V / Hi ≥2.4 V	Lo ≤0.8 V / Hi ≥2.4 V
		9	Exct. GND	0 V	0 V
		10	Signal GND	0 V	0 V
		11	Exct.+	18 … 30 VDC	18 … 30 VDC
		12	DIO (12)	DI: Lo ≤0.8 V / Hi ≥2.4V DO: Lo ≈ 0 V / Hi ≈ Power supply dependent (18-30 V)	DI: Lo ≤0.8 V / Hi ≥2.4V DO: Lo ≈ 0 V / Hi ≈ Power supply dependent (18-30 V)
		13	DIO (13)	DI: Lo ≤0.8 V / Hi ≥2.4V DO: Lo ≈ 0 V / Hi ≈ Power supply dependent (18-30 V)	DI: Lo ≤0.8 V / Hi ≥2.4V DO: Lo ≈ 0 V / Hi ≈ Power supply dependent (18-30 V)
		14	DIO (14)	DI: Lo ≤0.8 V / Hi ≥2.4V DO: Lo ≈ 0 V / Hi ≈ Power supply dependent (18-30 V)	DI: Lo ≤0.8 V / Hi ≥2.4V DO: Lo ≈ 0 V / Hi ≈ Power supply dependent (18-30 V)
		15	DIO (15)	DI: Lo ≤0.8 V / Hi ≥2.4V DO: Lo ≈ 0 V / Hi ≈ Power supply dependent (18-30 V)	DI: Lo ≤0.8 V / Hi ≥2.4V DO: Lo ≈ 0 V / Hi ≈ Power supply dependent (18-30 V)

1) As soon as at least one DIO is configured as output, Pin7 must be permanently connected to the GND (+24V at Pin7 might damage the device).

Dimensions



Included accessories	**Type/Mat. No.**
• Quick start guide	55274765
• Protective cap IP54 for sensor input BNC neg.	18000844
• Protective cap IP54 for sensor input TNC neg.	18000850
• Protective cap IP54 for sensor input KIAG 10-32 neg.	18000855
• Protective cap for M12 socket (IP67)	55160137
• Protective cap for D-Sub 15-pole	55273284
RS232 Option only:	
• Null modem mini adapter, D-Sub 9-pole pos. – D-Sub 9-pole neg.	1489
• Protective cap for D-Sub 9-pole	55066918

Optional accessories	**Type/Mat. No.**
• Sensor cable PFA, IP65 plug KIAG 10–32 UNF pos. plug KIAG 10–32 UNF pos.	1635Cxx
• Sensor extension cable PFA, IP65 socket KIAG 10–32 UNF neg. plug KIAG 10–32 UNF pos.	1637Cxx
• Network connection cable plug RJ45 – plug, plug M12 male 4-Pole D-coded, length 2m	1200A195A2
• Connector D-Sub 15-pole neg., IP40, with metallized cover and lifting screws	65016033
• Connector D-Sub 15-pole neg., IP67, with lifting screws M20x1,5 for cable diameter 6 … 12 mm	65016052
• Cable D-Sub 15-pole neg. – open ends, Length according to order (Lmin = 1 m / Lmax = 10 m)	1500A41Asp
• RS-232C cable, D-Sub 9-pole pos. – D-Sub 9-pole neg.	1200A27
• Null modem mini adapter, D-Sub 9-pole pos. – D-Sub 9-pole neg.	1489

Ordering key

Type 5073B

			Basic					Options		ODM	
						H		A			

Amplifier basic type	Channels	1-channel	1
		2-channel	2
		3-channel	3
		4-channel	4
	Connector	BNC (IP50)	1
		TNC (IP65)	2
		KIAG 10-32UNF (IP67)	3
	Output	Voltage +/-10V	1
		Current 4 … 20 mA	2
Licence extension	Hardware/Software	H&SW	H
		SW only	S
	Software extension	Basic	0
		IIoT feature package	1
Options	Specific modification	End of standard Order Key	-
		On-demand modifications	A
	RS232 connection	No RS232 connector	0
		RS232 connector	1
	Power supply	Default power supply	0
		Supply voltage 9…16 V	1
On demand modification	Time constant modification	Default time constant	-
		Customer specific time constant	Y0542

Example w. no modifications	5073B	1	1	1	H	0				
Example software update only	5073B	-	-	-	S	1				
Example with RS232	5073B	1	1	1	H	0	A	1	0	-

The type written on the device label only shows the hardware variant and might differ from the order key.

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