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Differential charge amplifier

Type 5185A...

Ex-ec (increased safety)

The differential charge amplifier Type 5185A... is used for signal conversion of piezoelectric sensors with differential signal output. Type 5185A... is certified for explosion protection Ex-ec (increased safety) and is suitable for operation in Ex-zone 2, provided that the applicable regulations and standards for safe use are complied with.

- Executions
  - Aluminum die-cast enclosure (IP64)
  - Plastic DIN-Rail enclosure (IP30)
- Signal Output Options
  - Voltage Out Single Ended ±10 V; 5 ±5 V
  - Voltage Out Differential ±10 V
  - 3-Wire Current 14 ±6 mA
- Very large charge conversion range
  - 0.25 … 4,000 mV/pC
  - 0.25 … 2,400 µA/pC
- Selectable high- and low pass filters
- Electrical connections
  - Execution in aluminum enclosure: Connectors or cable glands
  - Execution in plastic DIN-Rail enclosure: Screw terminals
- Suitable for ground isolated measuring chains

Fig. 1: Differential charge amplifier in aluminum die-cast enclosure, Type 5185AA…

Fig. 2: Differential charge amplifier in plastic DIN-Rail enclosure, Type 5185AB…

Description

The differential charge amplifier is available in two enclosure executions and various voltage- and current output versions. Type 5185A... has a selectable charge conversion factor (sensitivity) which is factory set and contains no reset-function but a high-pass filter (time constant) at the input stage.

An internal compensation circuit eliminates the drift of the amplifier and compensates low frequency error-currents up to 5 nA. The 18 … 30 VDC supply voltage is galvanically separated which prevents ground loop issues.

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Technical data

		Output configuration			
		Single Ended voltage ±10 V	Single Ended voltage 5 ±5 V	Differential voltage ±10 V	3-wire current 14 ±6 mA
Supply					
Supply Voltage	VDC	18 ... 30	18 ... 30	18 ... 30	18 ... 30
Galvanic Separation		yes	yes	yes	no
Power Consumption (without load)	mA	≈25	≈25	≈25	≈25
Charge Amplifier					
Output signal nominal FS	V	±10	5 ±5	±10	–
	mA	–	–	–	14 ±6
Conversion range, standard	mV/pC	10 ... 400	5 ... 200	10 ... 400	–
	µA/pC	–	–	–	6 ... 240
Conversion range, extended	mV/pC	0.25 ... 4,000	0.125 ... 2,000	0.25 ... 4,000	–
	µA/pC	–	–	–	0.25 ... 2,400
Sensitivity error	%	<±0.2	<±0.2	<±0.2	<±0.2
Zero output	V	0	5	0	–
	mA	–	–	–	14
Zero output error	mV	≤±20	≤±20	≤±20	–
	µA	–	–	–	<±100
Temp. coeff. sensitivity	ppm/°C	<±100	<±100	<±100	<±100
Input current compensation	nA	<5	<5	<5	<5
Signal to Noise Ratio SNR (0.1 Hz … 1 MHz)	dB	<60	<60	<60	<60
Common Mode Rejection CMR	dB	<60	<60	<60	<60
Linearity	%	<0.5	<0.5	<0.5	<0.5
High-pass filter 4th order	Hz	0.5 ... 500	0.5 ... 500	0.5 ... 500	0.5 ... 500
Low-pass filter 2th order	Hz	500 ... 20 k	500 ... 20 k	500 ... 20 k	500 ... 10 k
Filter characteristics	%	Butterworth	Butterworth	Butterworth	Butterworth
Error cut-off frequency	%	±10	±10	±10	±10
Load resistance	Ω	>1,000	>1,000	>1,000	–
Burden resistance	Ω	–	–	–	50 ... 400

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Output configurations and dignal levels

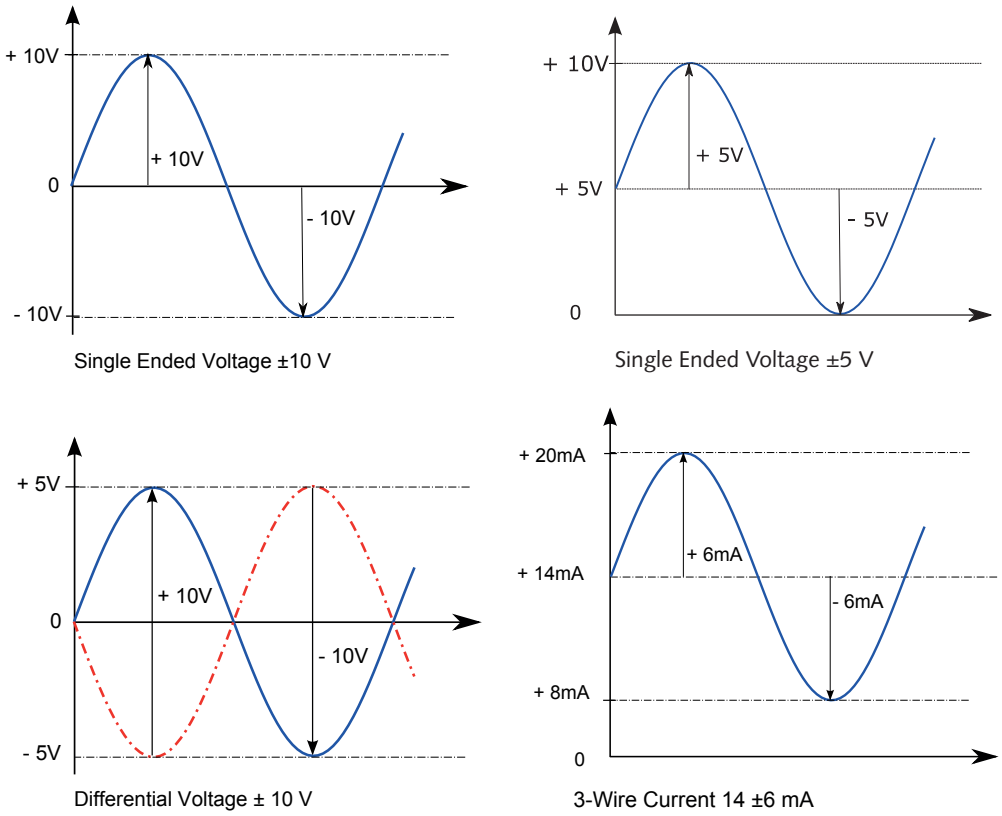

Fig. 3: Output configurations and signal levels

Executions

The differential charge amplifier Type 5185A... is available in two enclosure versions.
The characteristic features of the two executions are shown in the following table.

		Type 5185AA...	Type 5185AB...
Enclosure		Aluminum die-cast	Plastic, DIN-Rail mount
Operating temperature		–20 ... 60°C	–20 ... 60°C
Degree of protection		IP64	IP30
Electrical protection		Connector or cable gland and terminals on sensor side and on Power/Output side	Screw terminals
Hazardous area certifications	ATEX	II 3G Ex ec IIC T5 Gc SEV 23 ATEX 0696 X *)	
	IECEx	IEx ec IIC T5 Gc IECEx SEV 23.0009X *)	
Weight		0.35 kg	0.13 kg

*) **Special conditions for safe use:** These must be followed and are described in the instruction manual

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Version with aluminum Die-Cast Enclosure, Type 5185AA...

The charge amplifier with the aluminum die-cast enclosure meets IP64 and can be directly installed and operated in the hazardous area. Connection to the charge amplifier on the sensor side can be with connector or cable gland and terminals and on the Power/Output side with a cable gland and terminals.

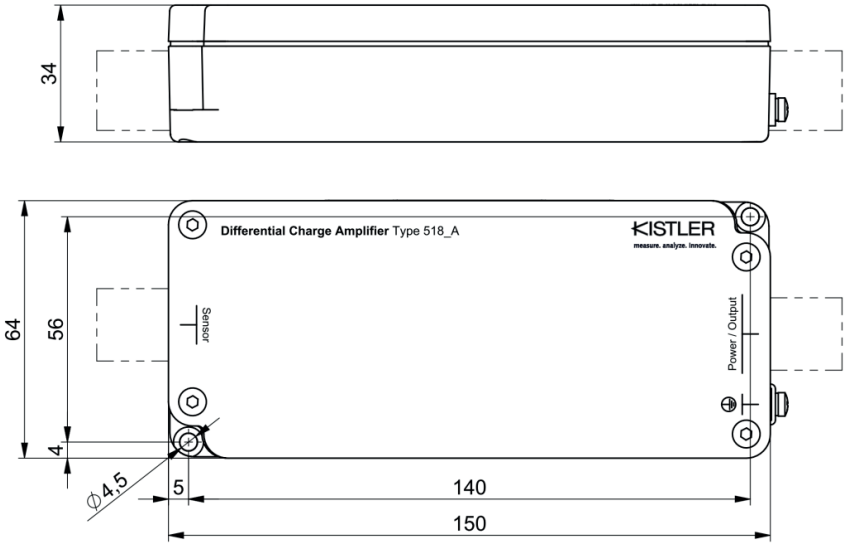


Fig. 4: Dimensions Type 5185A… in aluminum die-cast enclosure

Configuration option

The die-cast enclousure version can be ordered with plug connector or cable gland and terminals on the input and output sides.

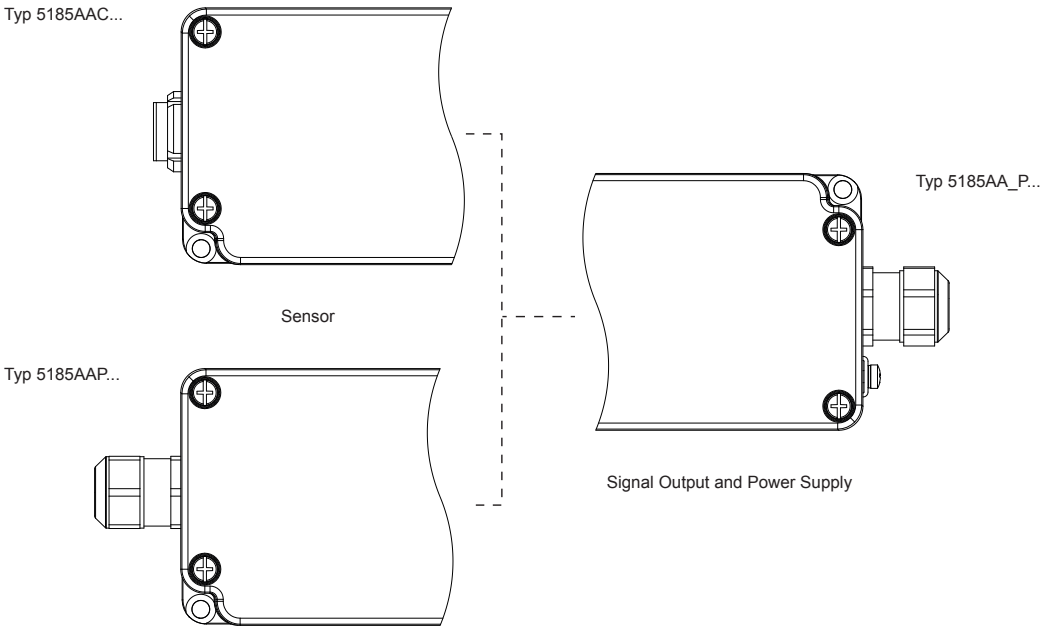
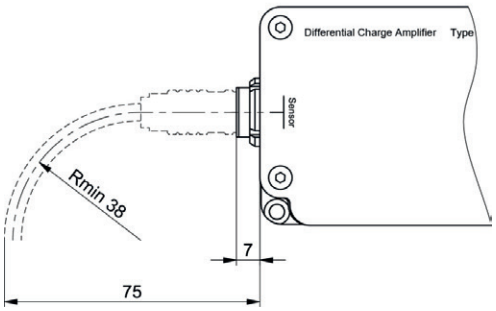
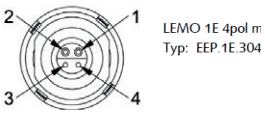


Fig. 5: Configuration options of the electrical connections

Electrical connections sensor

With connector (Type 5185AA_C...)

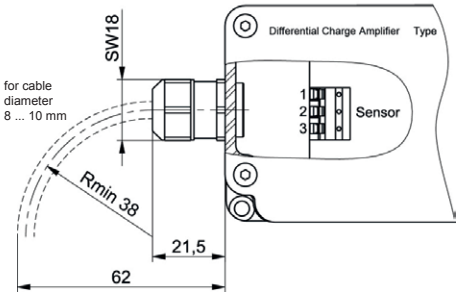




Sensor

Pin	Description
1	SGND
2	SGND
3	Qin+
4	Qin–

With cable gland (Type 5185AA_P...)

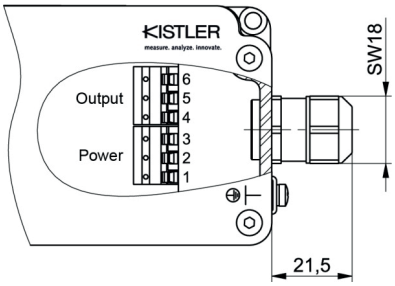


Sensor

Pin	Description
1	Qin–
2	SGND
3	Qin+

Electrical connections power/output signal

With cable gland (Type 5185AA__P)



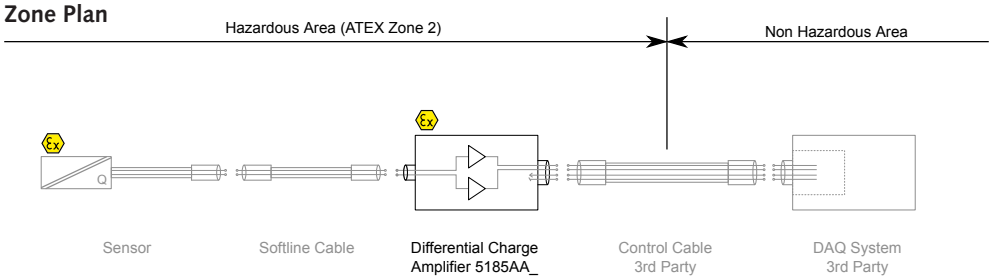
Supply

Pin	Description
1	EXC+
2	EXC–
3	SGND

Signal Output

Pin	Description
4	Signal+
5	Signal–
6	SGND

Zone Plan



Signal out: Single ended voltage (Type 5185AA1... or 5185AA2...)

First, the DAQ and power supply in use have to be checked if they are galvanically separated (table a) in order to install the differential charge amplifier with a correct wiring (figure b).

	Galvanic separated DAQ [a]		Non galvanic separated DAQ [b]	
	Galvanic separated supply [c]	Non galvanic separated supply [d]	Galvanic separated supply [c]	Non galvanic separated supply [d]
Connection ①	mandatory	mandatory	not allowed	not allowed
Connection ②	allowed	not allowed	allowed	not allowed

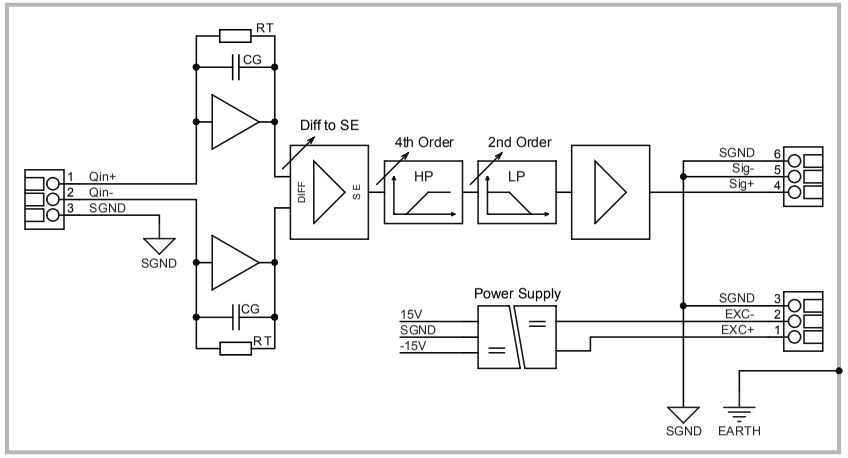
[a] Galvanic separated DAQ:
Connection ④ does not exist: GND (⊥) of DAQ and EARTH (⏚) not connected

[b] Non galvanic separated DAQ:
Connection ④ exist: GND (⊥) of DAQ and EARTH (⏚) connected

[c] Galvanic separated supply:
Connection ③ does not exist: Minus (–) of supply and EARTH (⏚) not connected

[d] Non galvanic separated supply:
Connection ③ exist: Minus (–) of supply and EARTH (⏚) connected

Table a: Wiring, depending on galvanic separation of DAQ and Power Supply



Differential Piezoelectric Sensor | Softline Cable 1652A... | Charge Amplifier (Die-Cast Enclosure) 5185AA1... or 5185AA2... | Data Acquisition and Supply

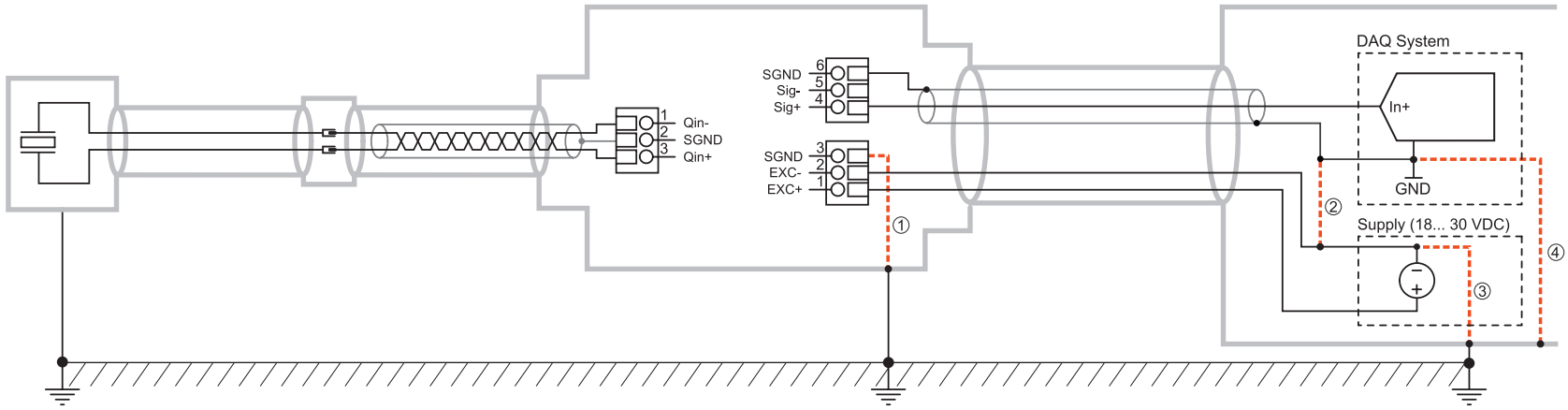


Figure b: Wiring configuration, depending on galvanic separation of DAQ and Power Supply

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Signal out: Differential voltage (Type 5185AA3...)

First, the DAQ and power supply in use have to be checked if they are galvanically separated (table a) in order to install the differential charge amplifier with a correct wiring (figure b).

	Galvanic separated DAQ [a]		Non galvanic separated DAQ [b]	
	Galvanic separated supply [c]	Non galvanic separated supply [d]	Galvanic separated supply [c]	Non galvanic separated supply [d]
Connection ①	mandatory	mandatory	not allowed	not allowed
Connection ②	allowed	not allowed	allowed	not allowed

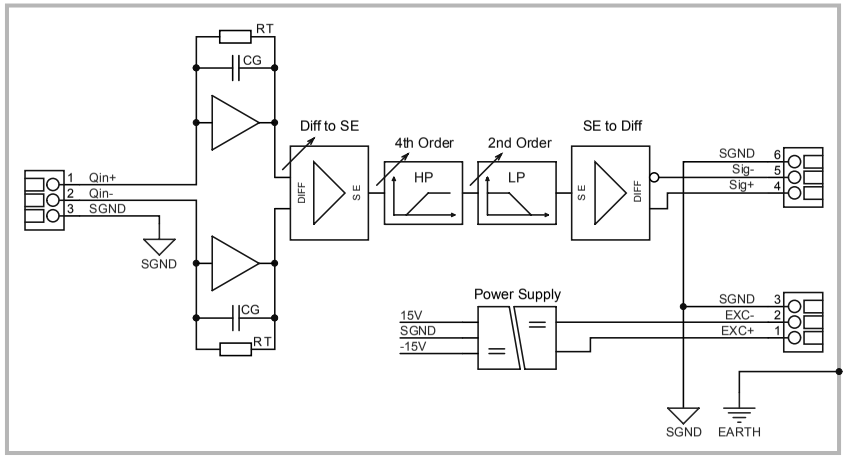
[a] Galvanic separated DAQ:
Connection ④ does not exist: GND (⊥) of DAQ and EARTH (⏚) not connected

[b] Non galvanic separated DAQ:
Connection ④ exist: GND (⊥) of DAQ and EARTH (⏚) connected

[c] Galvanic separated supply:
Connection ③ does not exist: Minus (–) of supply and EARTH (⏚) not connected

[d] Non galvanic separated supply:
Connection ③ exist: Minus (–) of supply and EARTH (⏚) connected

Table a: Wiring, depending on galvanic separation of DAQ and Power Supply



Differential Piezoelectric Sensor | Softline Cable 1652A... | Charge Amplifier (Die-Cast Enclosure) 5185AA3... | Data Acquisition and Supply

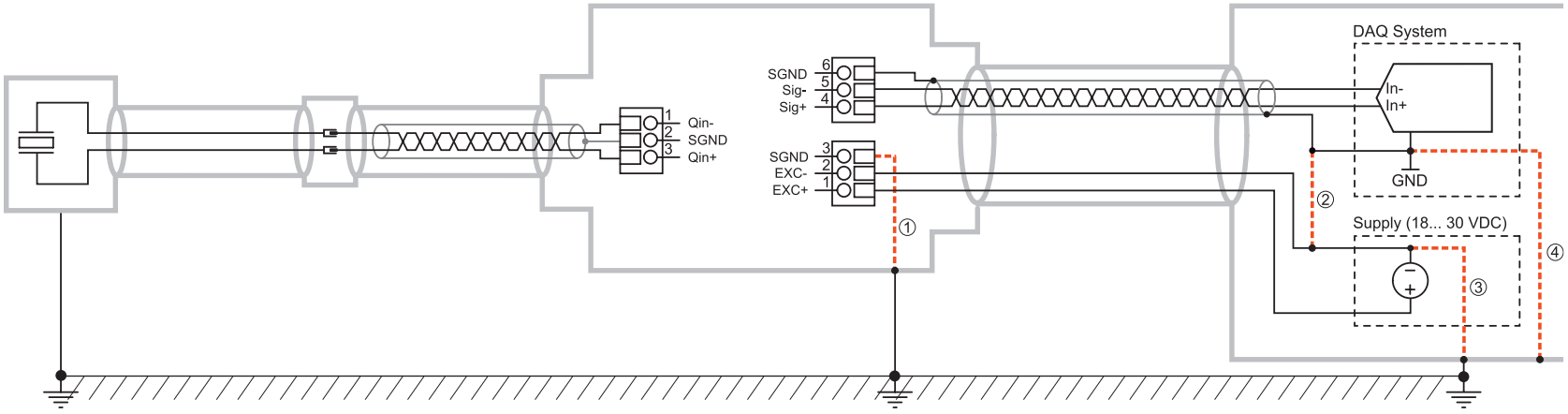


Figure b: Wiring configuration, depending on galvanic separation of DAQ and Power Supply

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Signal out: 3-wire current (Type 5185AA4...)

First, the DAQ and power supply in use have to be checked if they are galvanically separated (table a) in order to install the differential charge amplifier with a correct wiring (figure b).

	Galvanic separated DAQ [a]		Non galvanic separated DAQ [b]	
	Galvanic separated supply [c]	Non galvanic separated supply [d]	Galvanic separated supply [c]	Non galvanic separated supply [d]
Connection ①	mandatory	not allowed	not allowed	not allowed

[a] Galvanic separated DAQ:
Connection ④ does not exist: GND (⊥) of DAQ and EARTH (⏚) not connected

[b] Non galvanic separated DAQ:
Connection ④ exist: GND (⊥) of DAQ and EARTH (⏚) connected

[c] Galvanic separated supply:
Connection ③ does not exist: Minus (–) of supply and EARTH (⏚) not connected

[d] Non galvanic separated supply:
Connection ③ exist: Minus (–) of supply and EARTH (⏚) connected

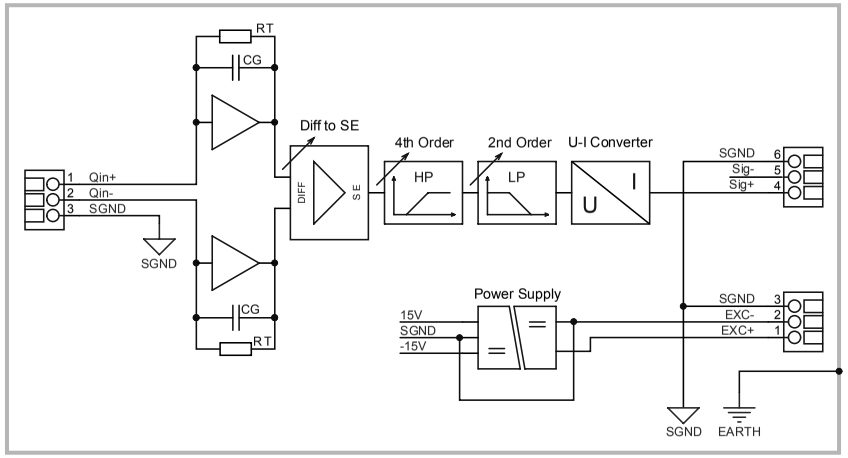

Table a: Wiring, depending on galvanic separation of DAQ and Power Supply

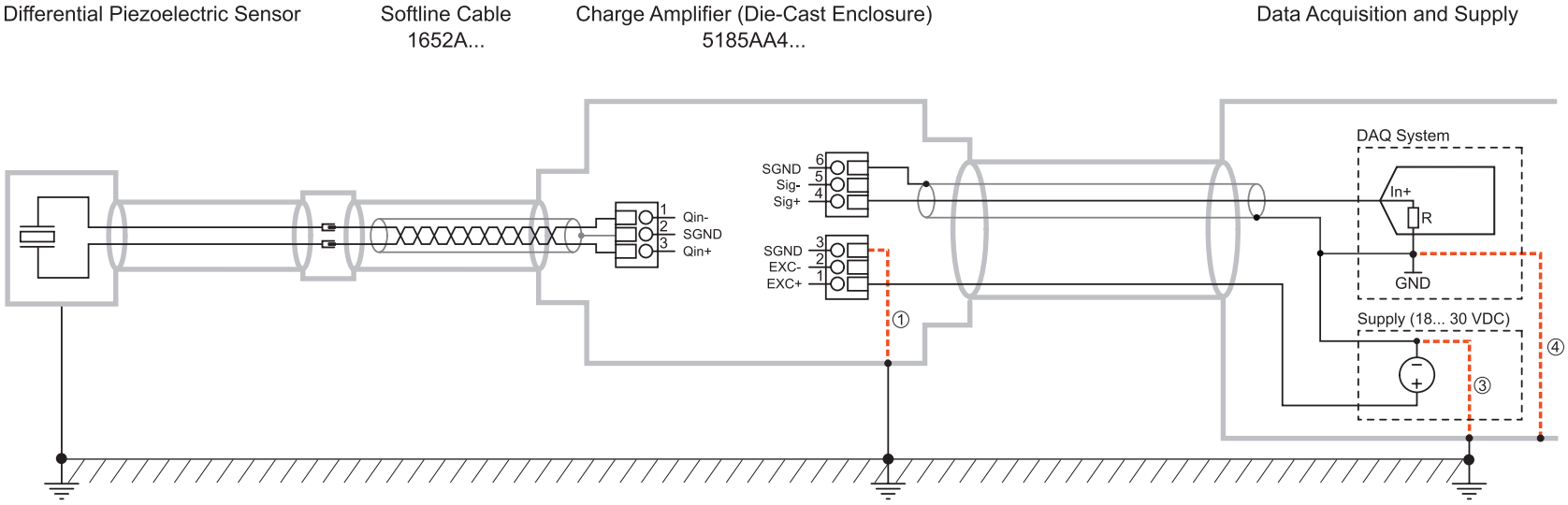

Figure b: Wiring configuration, depending on galvanic separation of DAQ and Power Supply

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Version with DIN-Rail Enclosure, Type 5185AB...

The version in the plastic DIN-Rail enclosure with screw terminals is specially suitable for applications with high channel count. For 'Ex' installations the amplifier must be installed in a certified enclosure in order to meet the required degree of ingress protection.

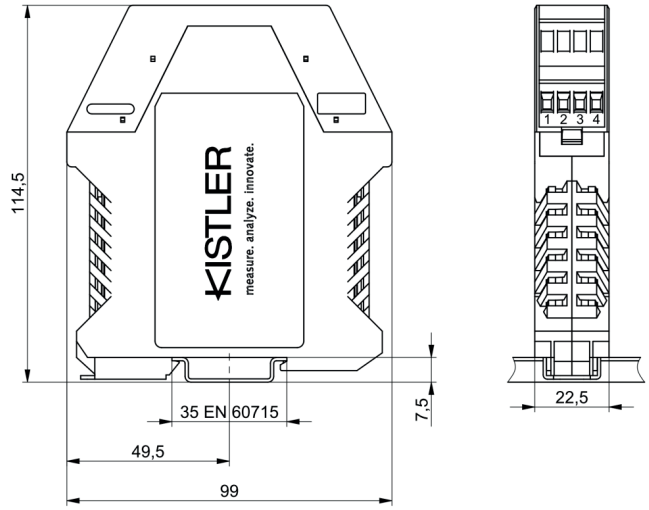


Fig. 6: Dimensions of the differential charge amplifier in the plastic DIN-Rail enclosure

Electrical Connections

Sensor

Pin	Description
1	Qin+
2	Qin-
3	SGND
4	EARTH

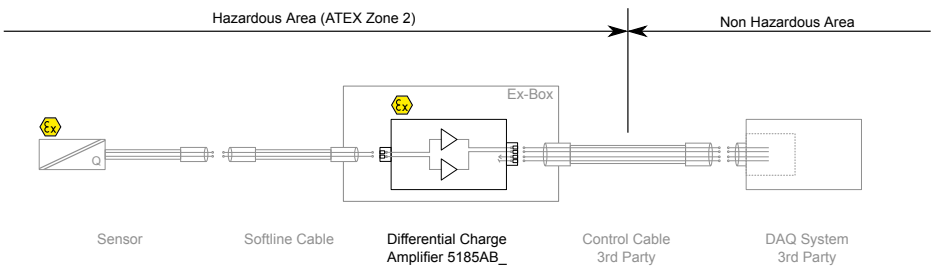
Power

Pin	Description
5	NC
6	EARTH
7	EXC+
8	EXC-

Signal

Pin	Description
9	Signal+
10	Signal-
11	SGND
12	EARTH

Zone Plan



Signal out: Single ended voltage (Type 5185AB1... or 5185AB2...)

First, the DAQ and power supply in use have to be checked if they are galvanically separated (table a) in order to install the differential charge amplifier with a correct wiring (figure b).

	Galvanic separated DAQ [a]		Non galvanic separated DAQ [b]	
	Galvanic separated supply [c]	Non galvanic separated supply [d]	Galvanic separated supply [c]	Non galvanic separated supply [d]
Connection ①	mandatory	mandatory	not allowed	not allowed
Connection ②	allowed	not allowed	allowed	not allowed

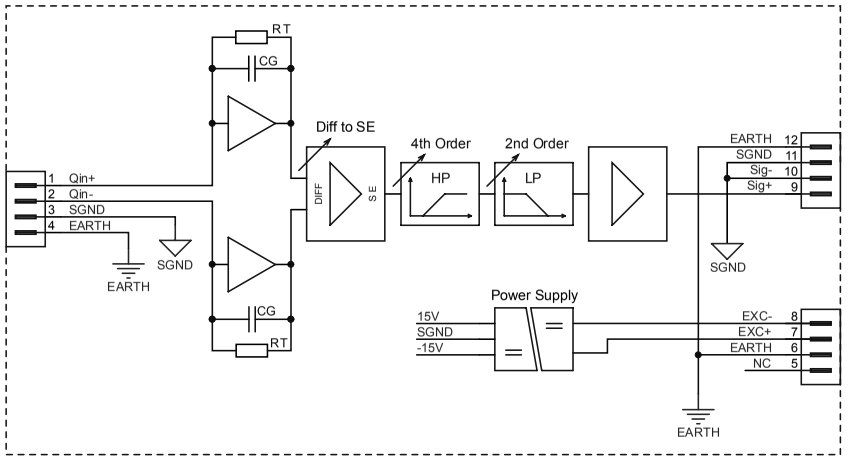
[a] Galvanic separated DAQ:
Connection ④ does not exist: GND (⊥) of DAQ and EARTH (⏚) not connected

[b] Non galvanic separated DAQ:
Connection ④ exist: GND (⊥) of DAQ and EARTH (⏚) connected

[c] Galvanic separated supply:
Connection ③ does not exist: Minus (–) of supply and EARTH (⏚) not connected

[d] Non galvanic separated supply:
Connection ③ exist: Minus (–) of supply and EARTH (⏚) connected

Table a: Wiring, depending on galvanic separation of DAQ and Power Supply



Differential Piezolectric Sensor | Softline Cable 1652A... | Charge Amplifier (DIN-Rail Enclosure) 5185AB1... or 5185AB2... | Data Acquisition and Supply

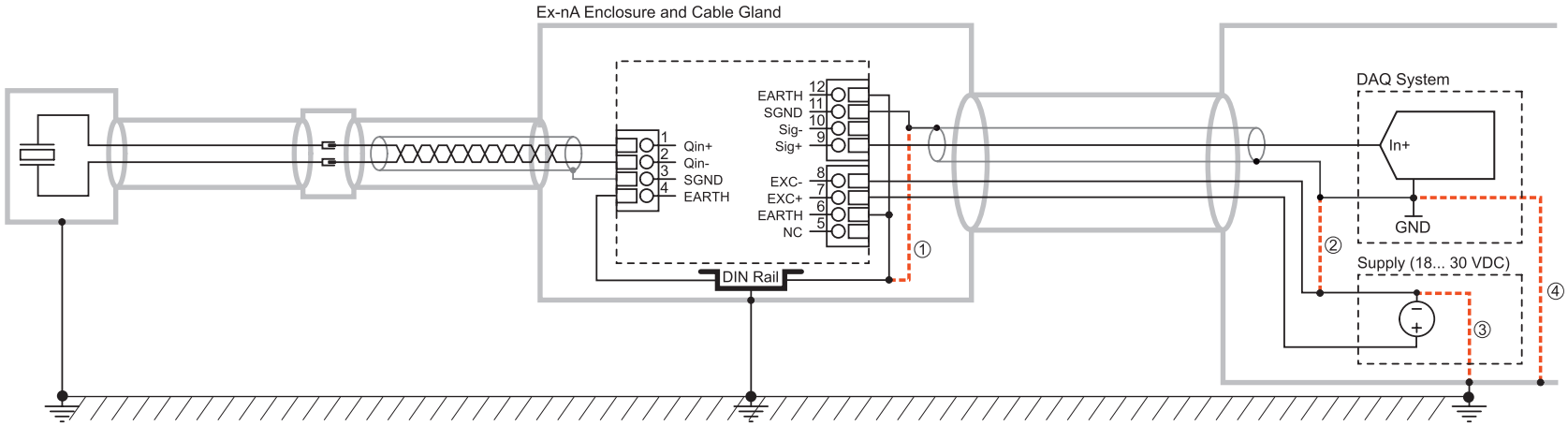


Figure b: Wiring configuration, depending on galvanic separation of DAQ and Power Supply

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Signal out: Differential voltage (Type 5185AB3...)

First, the DAQ and power supply in use have to be checked if they are galvanically separated (table a) in order to install the differential charge amplifier with a correct wiring (figure b).

	Galvanic separated DAQ [a]		Non galvanic separated DAQ [b]	
	Galvanic separated supply [c]	Non galvanic separated supply [d]	Galvanic separated supply [c]	Non galvanic separated supply [d]
Connection ①	mandatory	mandatory	not allowed	not allowed
Connection ②	allowed	not allowed	allowed	not allowed

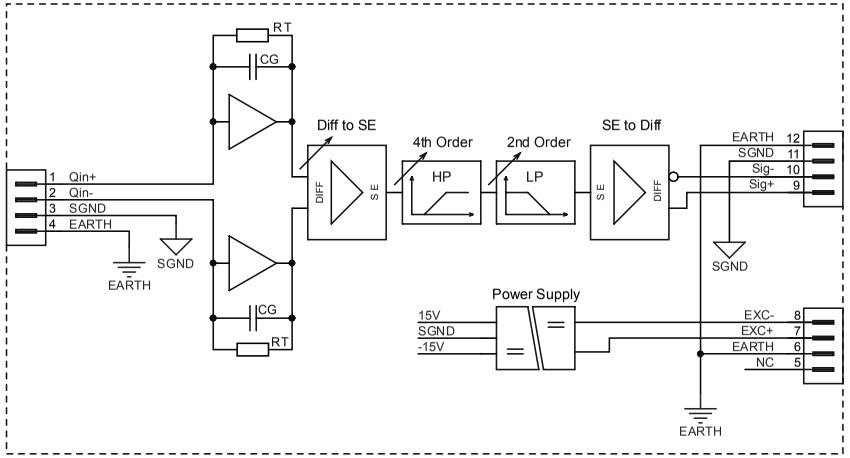
[a] Galvanic separated DAQ:
Connection ④ does not exist: GND (⊥) of DAQ and EARTH (⏚) not connected

[b] Non galvanic separated DAQ:
Connection ④ exist: GND (⊥) of DAQ and EARTH (⏚) connected

[c] Galvanic separated supply:
Connection ③ does not exist: Minus (–) of supply and EARTH (⏚) not connected

[d] Non galvanic separated supply:
Connection ③ exist: Minus (–) of supply and EARTH (⏚) connected

Table a: Wiring, depending on galvanic separation of DAQ and Power Supply



Differential Piezolectric Sensor | Softline Cable 1652A... | Charge Amplifier (DIN-Rail Enclosure) 5185AB3... | Data Acquisition and Supply

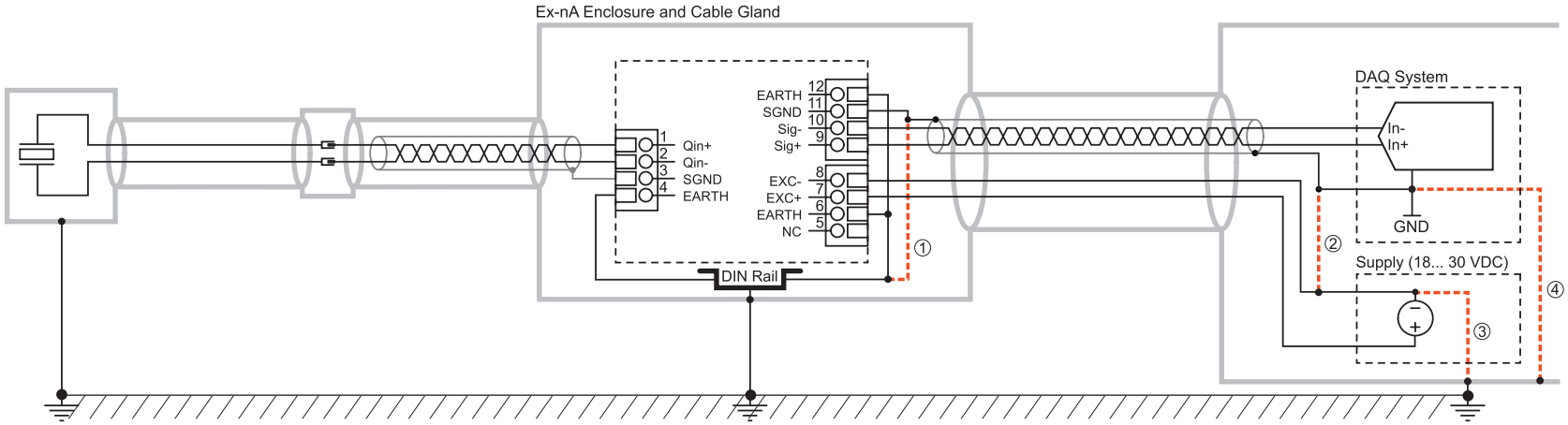


Figure b: Wiring configuration, depending on galvanic separation of DAQ and Power Supply

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Signal out: 3-wire current (Type 5185AB4...)

First, the DAQ and power supply in use have to be checked if they are galvanically separated (table a) in order to install the differential charge amplifier with a correct wiring (figure b).

	Galvanic separated DAQ [a]		Non galvanic separated DAQ [b]	
	Galvanic separated supply [c]	Non galvanic separated supply [d]	Galvanic separated supply [c]	Non galvanic separated supply [d]
Connection ①	mandatory	not allowed	not allowed	not allowed

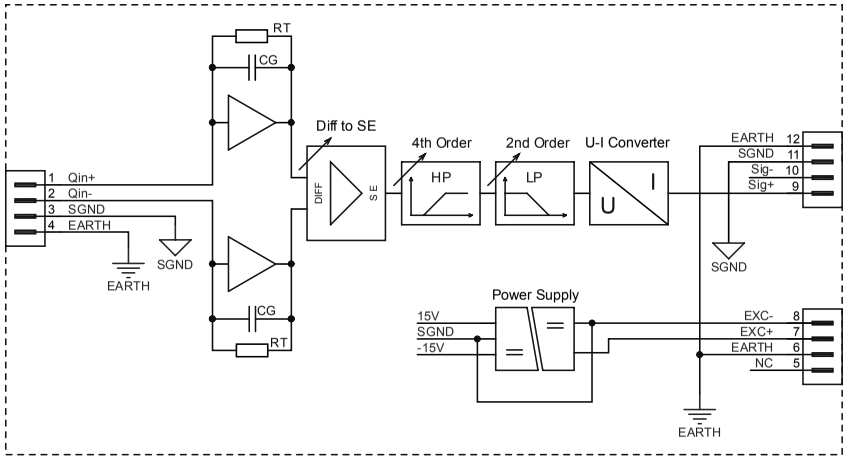
[a] Galvanic separated DAQ:
Connection ④ does not exist: GND (⊥) of DAQ and EARTH (⏚) not connected

[b] Non galvanic separated DAQ:
Connection ④ exist: GND (⊥) of DAQ and EARTH (⏚) connected

[c] Galvanic separated supply:
Connection ③ does not exist: Minus (–) of supply and EARTH (⏚) not connected

[d] Non galvanic separated supply:
Connection ③ exist: Minus (–) of supply and EARTH (⏚) connected

Table a: Wiring, depending on galvanic separation of DAQ and Power Supply



Differential Piezoelectric Sensor | Softline Cable 1652A... | Charge Amplifier (DIN-Rail Enclosure) 5185AB4... | Data Acquisition and Supply

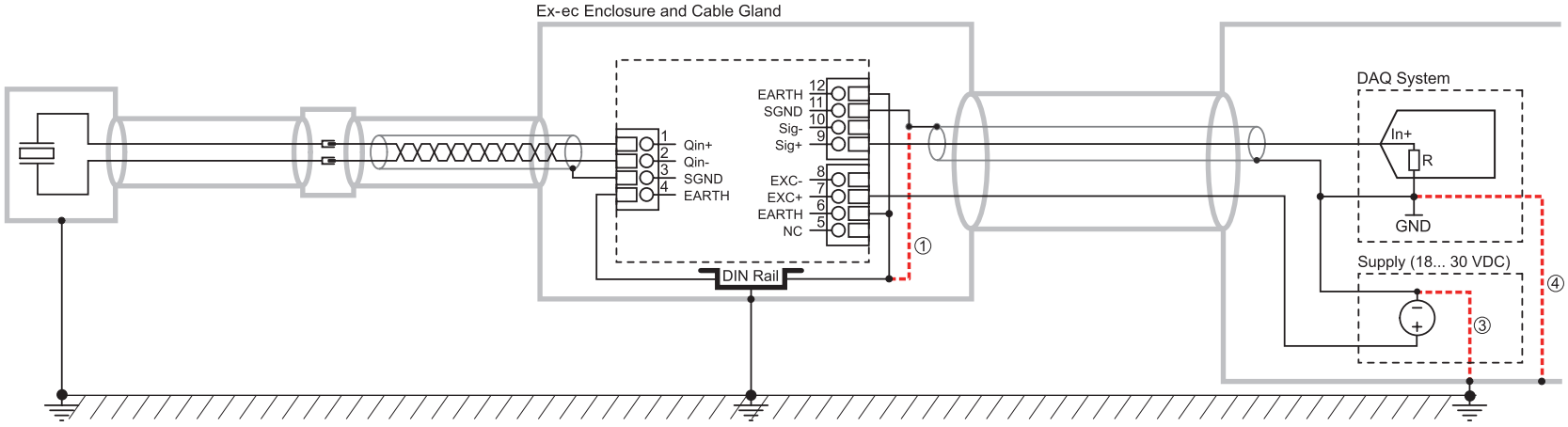


Figure b: Wiring configuration, depending on galvanic separation of DAQ and Power Supply

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Ordering Information

The desired execution can be configured according to the ordering key on page 10. Note that not all combinations are possible. The table below shows the available executions.

For the versions with custom specific filter settings (Filter option 'Custom') the desired high- and low pass filter setting must be selected according to the ordering key and must be specified in the order. Also note that the frequency of the low pass filter should be at least 10-times higher than the frequency of the high pass filter. Similarly, for versions with custom specific sensitivity (Sensitivity option 'Custom') the desired sensitivity in mV/pC respectively µA/pC must be specified in the order.

Included Accessories	Mat.-No.
for Al Die Cast Version 5185AA_:	
• 2x socket cap screws, M4x14	55064957

Optional Accessories	
for Version 5185AA_C_:	
• Mating connector (sensor side) LEMO FFA.1E.304.CLAC45, cable fixation 4.1 … 4.5 mm AWG 22 (0.34 mm²), solder cup	55126027

		Electrical Connection Input/Output	Charge to Voltage Conversion (Sensitivity) mV/pC; µA/pC							
			Default 10 mV/pC (6 µA/pC)				Custom 10 ... 400 mV/pC (6 ... 240 µA/pC)			
			Single Ended ±10 V	Single Ended 5 ±5 V	Diff ±10 V	3-wire Current 14 ±6 mA	Single Ended ±10 V	Single Ended 5 ±5 V	Diff ±10 V	3-wire Current 14 ±6 mA
Execution in Alu Die-Cast Enclosure	Filter Default f_{HP} 0.5 Hz; f_{TP} 10 kHz	Conn/Conn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Conn/PG	✓	✓	✓	✓	✓	✓	✓	✓
		PG/Conn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		PG/PG	✓	✓	✓	✓	✓	✓	✓	✓
		T/T	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Filter Custom f_{HP} 0.5 ... 500 Hz; f_{TP} 500 Hz ... 20 (10) kHz	Conn/Conn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Conn/PG	✓	✓	✓	✓	✓	✓	✓	✓
		PG/Conn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		PG/PG	✓	✓	✓	✓	✓	✓	✓	✓
		T/T	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Execution in DIN-Rail Enclosure	Filter Default f_{HP} 0.5 Hz; f_{TP} 10 kHz	Conn/Conn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Conn/PG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		PG/Conn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		PG/PG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		T/T	✓	✓	✓	✓	✓	✓	✓	✓
	Filter Custom f_{HP} 0.5 ... 500 Hz; f_{TP} 500 Hz ... 20 (10) kHz	Conn/Conn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Conn/PG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		PG/Conn	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		PG/PG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		T/T	✓	✓	✓	✓	✓	✓	✓	✓

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Type 5185A □ □ □ □ □

Enclosure

Aluminum die-cast enclosure	**A**
Plastic DIN-Rail enclosure	**B**

Output signal

Single ended voltage out, ±10 V	**1**
Single ended voltage out, 5 ±5 V	**2**
Differential voltage out, ±10 V	**3**
3-wire current, 14 ±6 mA	**4**

Electrical connections

		5185A		
IN	**OUT**	**5185AA**	**5185AB**	
Connector	Cable grand	✓	x	**CP**
Cable grand		✓	x	**PP**
Terminal block	Terminal block	x	✓	**TT**

Filter

Default (f_{HP} 0.5 Hz/f_{LP} 10 kHz)				**D**
Custom				**C**
f_{HP}	0.5 Hz	7 Hz	90 Hz	
	0.7 Hz	9 Hz	120 Hz	
	0.9 Hz	12 Hz	150 Hz	
	1.1 Hz	15 Hz	200 Hz	
	1.5 Hz	20 Hz	250 Hz	
	2 Hz	25 Hz	300 Hz	
	2.5 Hz	30 Hz	400 Hz	
	3 Hz	40 Hz	500 Hz	
	4 Hz	55 Hz		
	5.5 Hz	70 Hz		
f_{LP}*	0.5 kHz	2 kHz	7 kHz	
	0.7 kHz	2.5 kHz	10 kHz	
	0.9 kHz	3 kHz	12 kHz	
	1.1 kHz	4 kHz	15 kHz	
	1.5 kHz	5.5 kHz	20 kHz	
Restriction: f_{LP} >10* f_{HP}				
* For variant with current output: fLP max. 10 kHz				

Charge Conversion Factor (Sensitivity)

Default U-Out version: 10 mV/pC I-Out version: 6 µA/pC	**D**
Custom * SE voltage Out ±10 V: 10 … 400 mV/pC SE voltage Out 5 ±5 V: 5 … 200 mV/pC Diff. Out ±10 V: 10 … 400 mV/pC I-Out 14 ±6 mA: 6 … 240 µA/pC	**C**

* Extended ranges are available on request

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