

# Multichannel charge amplifier

## For the injection molding machine

Type 5159A...

The multichannel charge amplifier Type 5159A... converts the charge signal from one or four piezoelectric cavity pressure sensors or two piezoelectric cavity pressure sensors and the signal from two thermocouples into a proportional voltage signal or a digital signal according to EUROMAP 75 with Varan- or EtherCAT real-time protocol. This amplifier has been developed for the industrial application with injection molding machines.

- Charge and thermocouple amplifier
- Interface option:  
Analog output 0 ... 10 V or digital signal according to EUROMAP 75 with Varan- or EtherCAT real-time protocol
- Digital versions are cascable
- Optional self-optimizing switch-over output (SLP-Option)
- Industrial case with IP54 protection

### Description

The multichannel charge amplifier Type 5159A... is provided with one or four charge signals from piezoelectric cavity pressure sensors. Amplifiers equipped with two temperature inputs are provided with two charge signals from piezoelectric cavity pressure sensors. In addition to the conventional single-channel connector type BNC, the 4 channel charge amplifiers also feature the advanced multi-channel cable technology for connecting up to all 4 cavity pressure sensors with only one cable. An analogue variant with a voltage signal of 0 ... 10 V and two digital variants according to EUROMAP 75 specifications are available as the interface to the injection molding machine. For the EUROMAP specification the two real-time ethernet protocols Varan and EtherCAT are available. The Varan and Ether CAT-version have bus connectors which allow cascading to achieve a higher number of channels on the injection molding machine.

The option SLP (Switch Level Processing – self-optimizing switch-over point output) automatically detects the volumetric filling of the mold, and in each cycle sends a control signal to the injection molding machine. The mold must be equipped with a measuring cavity pressure sensor near the gate.



Photo of version:  
Digital charge amplifier according to EUROMAP 75  
2-channel charge amplifier (BNC) +  
2-channel thermocouple amplifier

### Application

The multichannel charge amplifier Type 5159A... is intended for use with all types of cavity pressure piezoelectric sensors and Typee K/J/L/N thermocouples. The output signals can be used to monitor, control and optimize the injection molding process.

The charge amplifier has been optimized for installation in injection molding machines and developed for OEM equipment. The injection molding machine must have the appropriate hardware connections for the analog and digital variants and the controller must be prepared accordingly. Retrofitting is carried out exclusively by the machine manufacturer.

The SLP function for self-optimizing switch-over point detection can be easily integrated into machine controls. This option considerably reduces the set-up effort of the processes, as the switch-over point is automatically set by the charge amplifier without manual optimization. During production, the option automatically controls this variable and thus leads to more consistent part quality in the event of process variations.

## Technical specifications

### Charge amplifier

Number of channels		1, 2, 4
Measuring range		
Type 5159A...1...(Analog)		
Measuring range II (FSO)	pC max.	±5,000
Measuring range I (FSO)	pC max.	±20,000
Measuring range		
Type 5159A...2... (Varan) and		
Type 5159A...3... (EtherCAT)		
Measuring range I (FSO)	pC max.	±2,000
Measuring range II (FSO)	pC max.	±5,000
Measuring range II (FSO)	pC max.	±10,000
Measuring range IV (FSO)	pC max.	±20,000
Measuring cut-off at FSO	% FSO	<±0,5
Drift		
25°C, max. relative Humidity RH of	pC/s	<±0,05
60 %, non-condensing type		
25°C, max. relative Humidity FH of	pC/s	<±0,05
70 %, non-condensing type		
50°C, max. relative Humidity RH of	pC/s	<±0,3
50 %, non-condensing type		
Reset-Operate transient	pC	<±2
Noise suppression between	dB	>50
sensor-GND and Analog		
output-GND		
(0 ... 0,3 kHz)		
Input signal without damage:		
Voltage (long term)	V	±10
Frequency range (–3 dB, Cable kap. <1nF)	kHz	≈0 ... >1

### Thermo couple amplifier

Number of channels		2
Type		K/J/N/L
Measuring range	°C	0 ... 300
Input resistance	MΩ	>1
Measuring (digital linearized	°C	<±1
Without cold junction error)		
Cold junction error	°C	<±1
Frequency range (–3dB)	kHz	0 ... >0,5
Highest input signal without		
damage – Voltage	V	<±10

### Data acquisition

Resolution (DeltaSigma)	bit	16
Sample rate	ksps	46,875
Group delay ADC (38/fData)	ms	0,811
Data processing, refresh rate	μs	250
Second order low pass filter	Hz	Off/10/100/
(cut-off frequency)		500/800

Group delay	TP = Off	ms	<1,6
(overall system)	TP = 800 Hz	ms	<1,7
(to analog signal)	TP = 500 Hz	ms	<1,8
	TP = 100 Hz	ms	<3,4
	TP = 10 Hz	ms	<23,4

### Analog output

Number	max.	4
Output voltage	V	0 ... ±10
Output voltage at "Overload"	V	±10,3
Output voltage at "Error status"	V	±10,5
Output current	mA	0 ... ±5
Error	%	<±0,1
Resolution (DAC)	Bit	14
Refresh rate	μs	400
Output resistance	Ω	10
Capacitive load (without oscillation)	μF	<1
Output noise signal (0,1 Hz ... 1 MHz)	mVpp	<10
Frequency range (–3dB)	kHz	0 ... >1

### Digital inputs

Number		9
Input voltage range	VDC	0 ... 30
(optocoupler activation at 24 V)	mA	>2)
Max. logic level Low	VDC	<5
Min. logic level High	VDC	>10
Input resistance	kΩ	>10
Delay period (for signal detection in SW)	ms	<1,6
Actuation bipolar and galvanically		
isolated with optocouplers		
Galvanic isolation (not safety relevant)	VDC	<50
type		
Voltage between input and ground	Vrms	<30

### Digital outputs

Number		4
Output voltage	V	Supply voltage
		– 1
Voltage range	VDC	18 ... 30
Logic	High-Side	Load to GND
Output current (current load)	mA	<50
Short circuit current	mA	<500
Delay period (signal to digital output)	ms	<1,6
Galvanic isolation (not safety relevant)	VDC	<50
type.		

**Current supply**

Supply voltage	VDC	18 ... 30
Current consumption for 24 V	mA	<130
Over voltage resistance (40 ms/max)	V	55
Galvanic isolation against measuring circuit and digital inputs type. (not safety relevant)	VDC	<50

**Fieldbus**

Hardware	Standard Ethernet IEEE 802.3 100 Base-Tx	
Transformer coupled		

**VARAN**

Client according standards		VNO
Support of the alternating buffer		
Protocol		Euromap 75
Refreshing rate minimal	kHz	2,5

**EtherCAT**

Slave according standard		ETG
Protocol		Euromap 75
Refreshing rate minimal	kHz	2,5

**Functionality of digital inputs**

The digital input can be connected either with the potential 18 ... 30 VDC or with GND. Therefore Test, Operate, Range II und Sensitivity will be controlled with opposite potential or, customer specific, with any potential.

**Control level:**

Operate	logic	High
Reset	logic	Low
Range II (5,000 pC)	logic	High
Range I (20,000 pC)	logic	Low

		TeSel2	TeSel1_
	Bit	2	1
Thermocouple K		Low	Low
Thermocouple J		Low	High
Thermocouple N		High	Low
Thermocouple L		High	High

Test signal (8 V) On	logic	High
Test signal Off	logic	Low

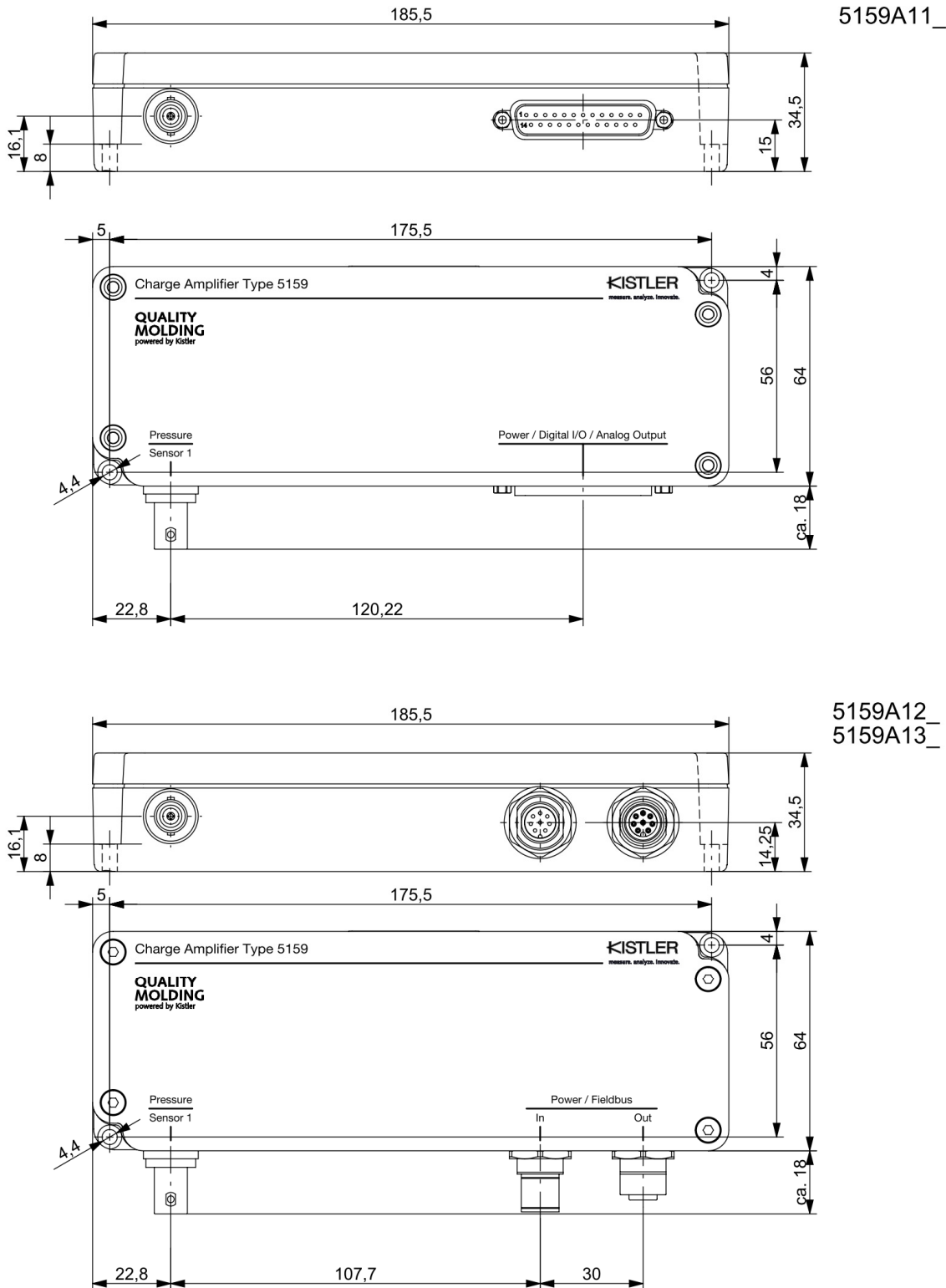
(Test signal of 8 V on all available output channels, when Range II is active)

**General data**

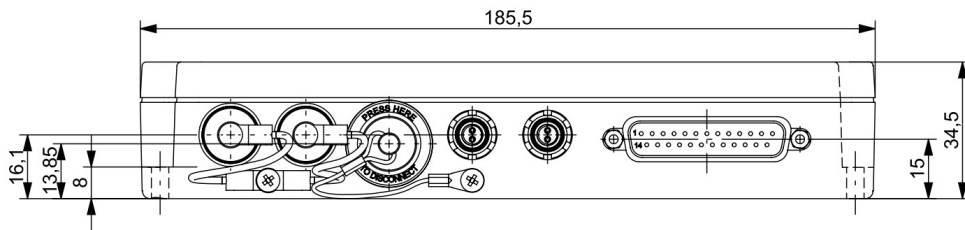
Operating temperatures	°C	0 ... 70
Storage temperature	°C	-20/80
Vibration resistance IEC60068 part 2-6 (58 ...150 Hz constant)	gp	1
Impact resistance IEC60068 part 2-27 (11ms)	g	11
Degree of protection (with mounted and/or cover connectors) EN60529	IP	54
Housing material	Alloy-Die casting	
Weight	g	460
Recommended mounting position: vertical surface, connectors down side.		

## Installation

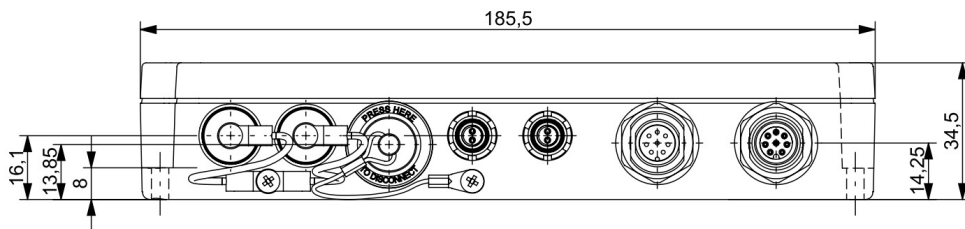
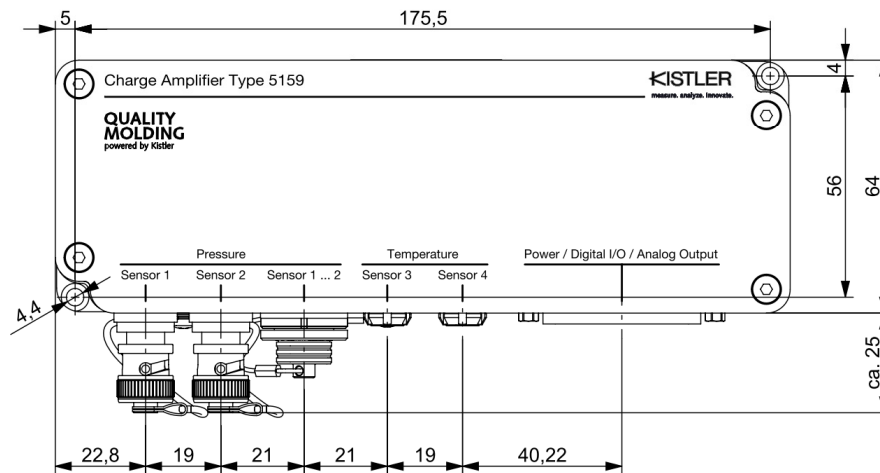
The device is installed with two M4 hexagon socket head cap screws.



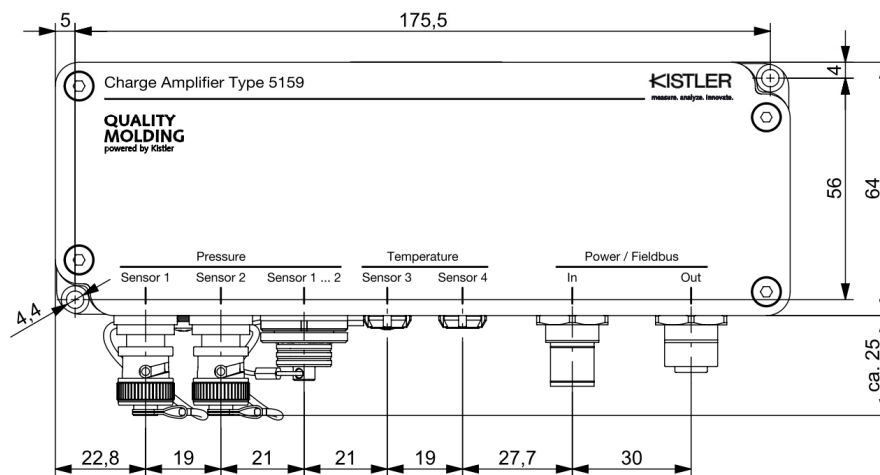
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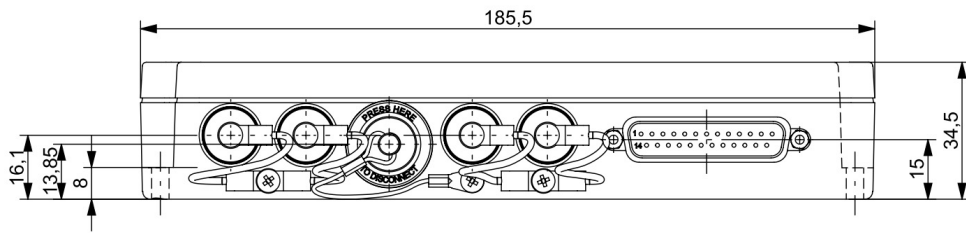
5159A31\_



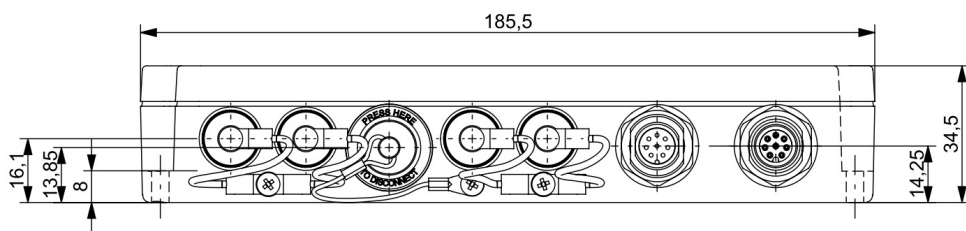
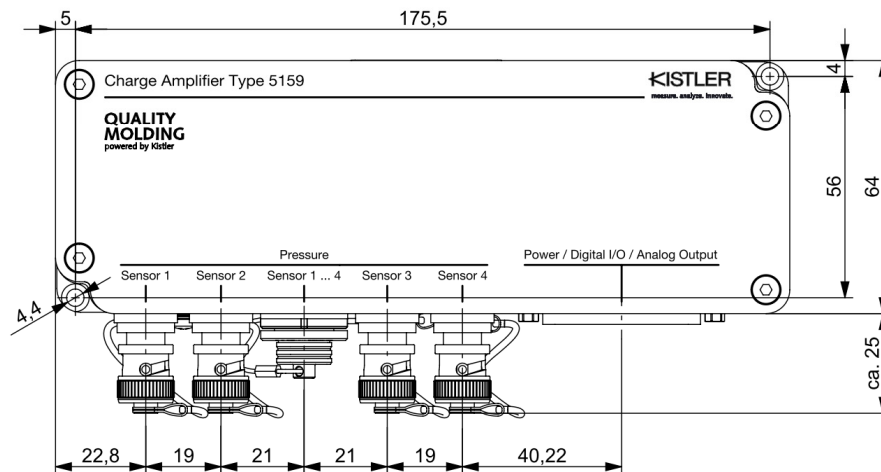
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5159A33\_



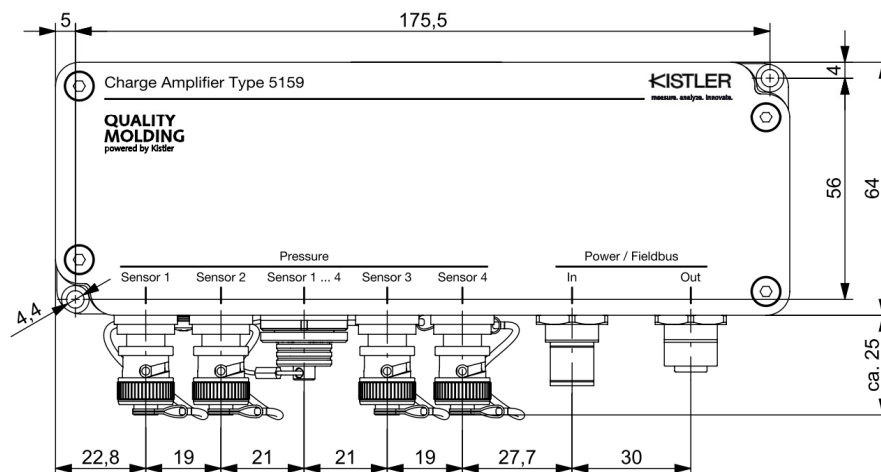
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5159A41\_



5159A42\_  
5159A43\_



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## Connections

- Sensor charge inputs

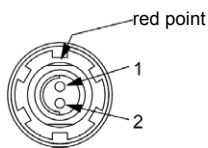


- 1 Channel 1
- 2 Channel 2
- 3 Channel 3
- 4 Channel 4
- 5 Sensor GND
- 6 NC

Type

 BNC neg. / TNC neg.  
 Channel no. >1  
 Fischer A103A056 male  
 (Parallel connected)

- Sensor thermocouple input



- 1 VIN+
- 2 VIN-

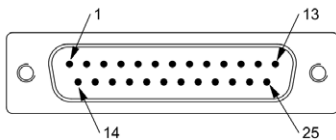
Type

 Fischer  
 DBPU 102 A051  
 female

- Supply, signal outputs, control inputs Type 5159A...1... (Analog)

Type

DSub 25 pol male



- |                                |                   |                   |
|--------------------------------|-------------------|-------------------|
| 1 Signal Out Ch1               | 10 SF2            | 18 Common Control |
| 2 Signal Out Ch2 <sup>a)</sup> | 11 NC             | 19 Operate        |
| 3 Signal Out Ch3 <sup>b)</sup> | 12 FIX / SF3*     | 20 Sensitivity    |
| 4 Signal Out Ch4 <sup>b)</sup> | 13 SL / SF4*      | 21 Test           |
| 5 NC                           | 14 Signal GND     | 22 Range II Ch1   |
| 6 Exct 18 ... 30 VDC           | 15 T.Element Sel1 | 23 Range II Ch2   |
| 7 Exct 18 ... 30 VDC           | 16 T.Element Sel2 | 24 Range II Ch3   |
| 8 Exct GND                     | 17 NC             | 25 Range II Ch4   |
| 9 SF1*                         |                   |                   |

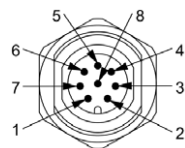
<sup>a)</sup> 1 channel version: NC

<sup>b)</sup> 1 and 2 channel version: NC

\*SF1 ... 4 = melt front 1 ... 4

- Varan fieldbus input, Type 5159A...2... (Varan) and Type 5159A...3... (EtherCAT)

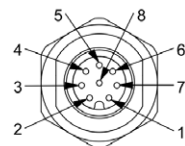
Type

 M12-connector  
 8-polig male,  
 Binder Connector  
 09-3481-116-08


- 1 NC
- 2 TX+
- 3 TX-
- 4 NC
- 5 RX+
- 6 GND (Exct GND)
- 7 +24VDC (Exct)
- 8 RX-

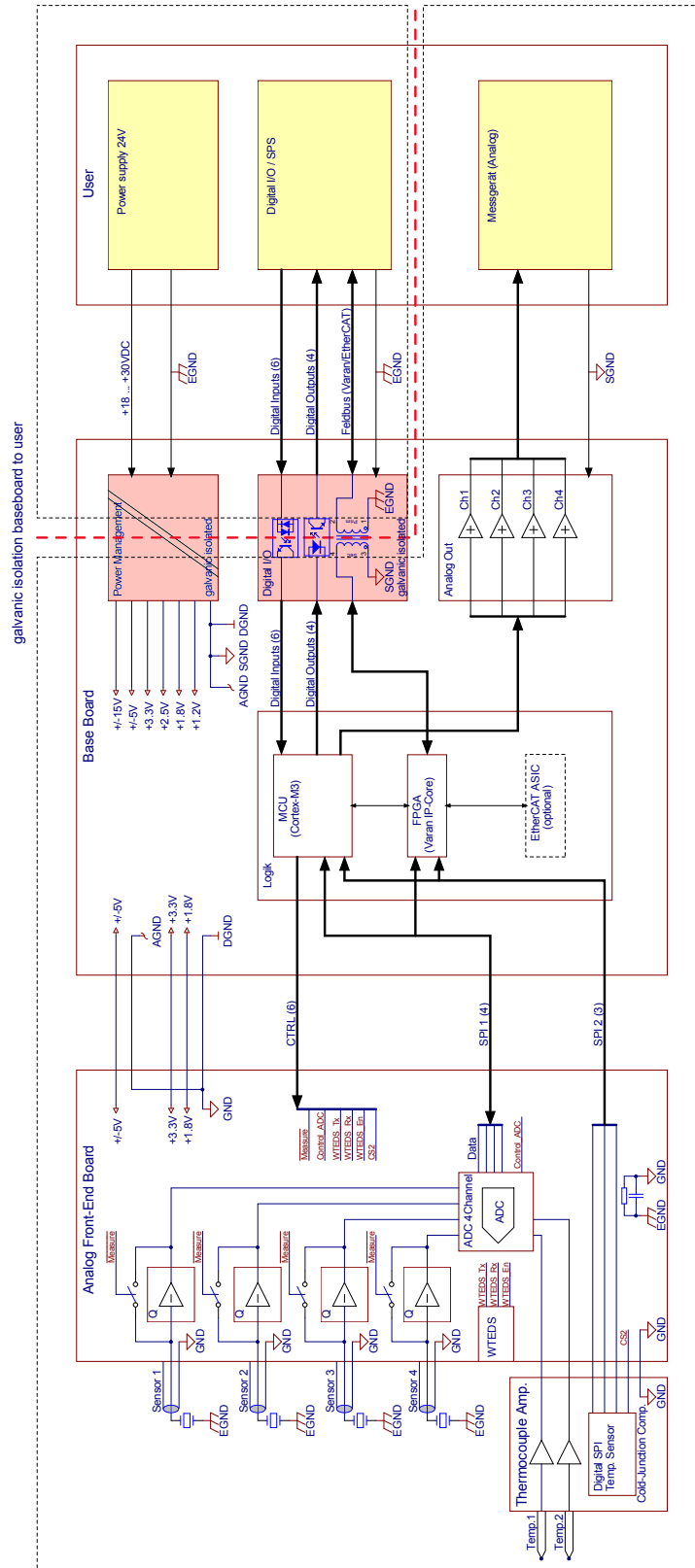
- Varan fieldbus output (Slave), Type 5159A...2... (Varan) and Type 5159A...3... (EtherCAT)

Type

 M12-connector  
 8-polig female,  
 Binder Connector  
 09-3482-116-08


- 1 NC
- 2 TX+
- 3 TX-
- 4 NC
- 5 RX+
- 6 GND (Exct GND)
- 7 +24VDC (Exct)
- 8 RX-

## Block diagram Type 5159A...



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Optional accessories	Type/Mat. Nr.
• BNC-TNC adapter	1719
• D-Sub connector, 25 pol female	65009205
• D-Sub plastic cover, water proof, shielded, for 25 pol D-Sub (Conec Art.No.: 165 X 15039 X)	65008375
• D-Sub-connector 25 pol female IP67 with screw fixation M20x1,5 for cable diameter 6 ... 12 mm	1557A10
• Compensation lead Type K (Fischer connector to Fischer connector)	2295A...
• Compensation lead Type K (Fischer connector to Fischer open end)	2290AQ01sp

Ordering key

		Type 5159A	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Input</b>					
1-channel charge	1				
2-channel charge + 2 channel	3				
4-channel charge	4				
<b>Output</b>					
Analog	1				
EUROMAP 75 Varan	2				
EUROMAP 75 EtherCAT	3				
<b>Logic function</b>					
Standard	0				
SLP (Switch Level Processing)	1				

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