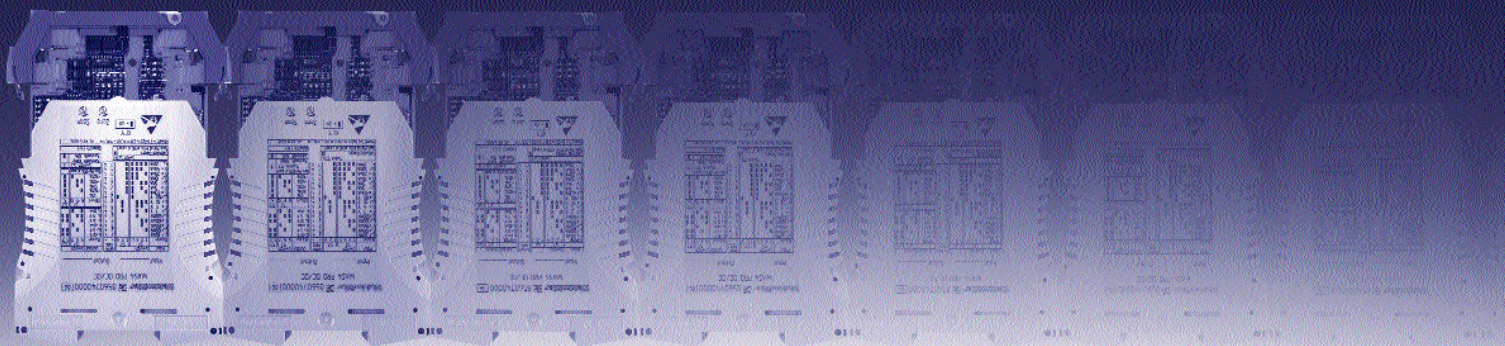


# ANALOG SIGNAL CONDITIONING ANALOG SIGNAL CONDITIONING



WAVESERIES MICROSERIES MCZ SERIES  
WAVESERIES MICROSERIES MCZ SERIES  
WAVESERIES MICROSERIES MCZ SERIES

## PRODUCT INFORMATION

When good enough just isn't good enough

**Weidmüller** 

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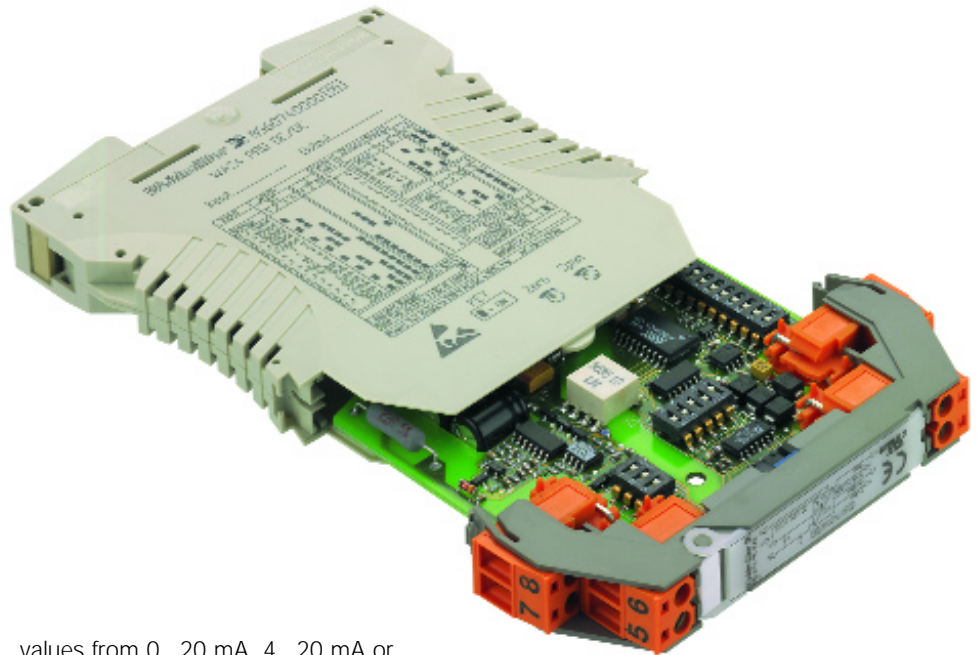
## Preface

The real world can be measured in many ways, for example, via temperature, humidity, air pressure and so on. The parameters of these different physical quantities change continuously.

Elements that check the status and changes in status of a given environment, and then report on this changed environment, must reflect these continual changes. Within the framework of industrial monitoring tasks, the status of an environment is monitored using sensors.

Sensors have the task of providing signals that enable connected evaluating and monitoring installations to draw detailed conclusions concerning the status of, for example, a production process. The sensor signals reflect the continuous changes in the monitored range. The signals can be in analog or digital form; which means in normal cases, an electrical voltage or current value is produced that corresponds, in proportion, to the monitored physical quantities.

Increasing automation with the intention of achieving or maintaining a certain status makes the processing of analog values increasingly important. This is also true of fields beyond those where this has been necessary and standard for a long time, for example, in processing technology in the chemical industry. Electrical signal values are standard within the framework of this processing technology. Current

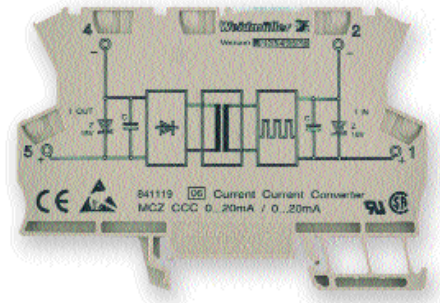


values from 0...20 mA, 4...20 mA or voltage values from 0...10 V have been introduced as sensor output values for differing physical quantities.

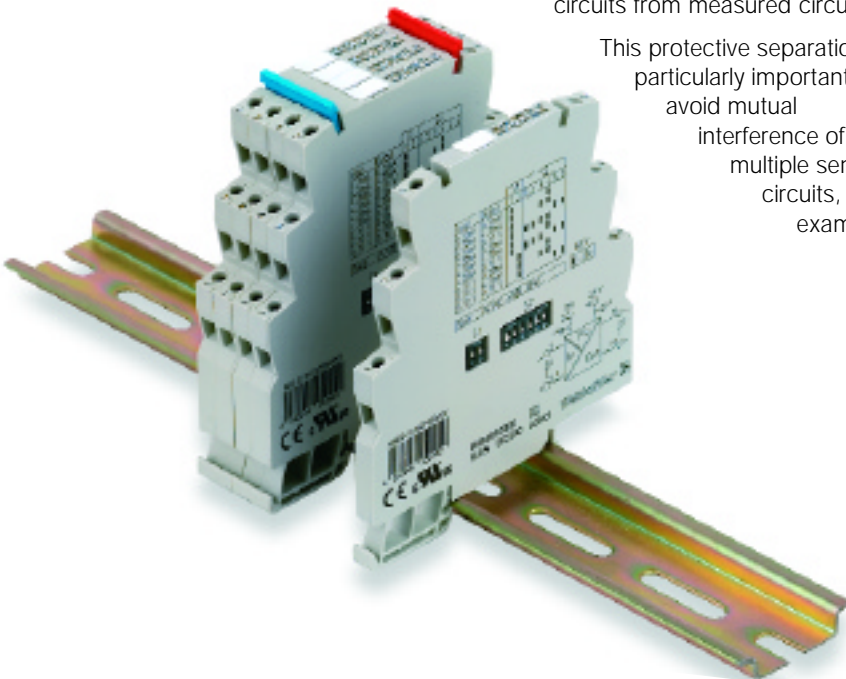
Weidmüller is supporting the need for increasing automation with the processing of these analog signals and is offering a wide range of products that are designed to deal with the demands required when handling sensor signals. This means units are made available for standard signals (0...20 mA, 4...20 mA, 0...10 V) that generate output signal values proportional to the variable input signals, and at the same time enable the protective separation of, for example, sensor circuits from measured circuit.

This protective separation is particularly important to avoid mutual interference of multiple sensor circuits, for example,

ground loops in interlinked measurement circuits. The wide range of products includes all functions for converting, separating and monitoring signals. The different designs in connection with the respective function covers practically all applications in industrial measurement technology.



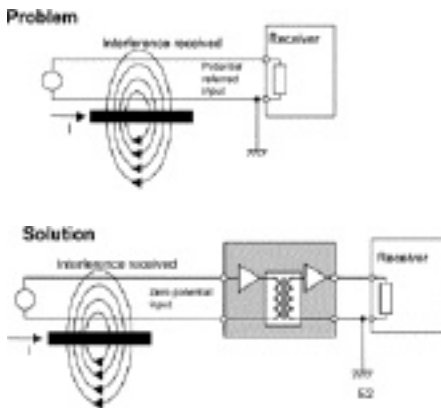
With these new products, Weidmüller is offering the option of taking into account the demands of modern automation technology by incorporating analog signals. These products guarantee an elementary function between signals from the field and the local control system. The mechanical characteristics of these products correspond to those of the well-known Weidmüller products and are part of an ongoing concept. The signal conditioners can be used together with other Weidmüller products. They have been electrically and mechanically designed so that only a minimum of wiring and maintenance costs are required.





## Common Mode Noise Elimination

- Generally, signals emitted by sensors have low levels and are thus susceptible to capacitive and inductive interference, such as those generated by motors, frequency changers and other change processes. This noise contents the measuring value and frequently destroy expensive analog I/O cards in the control electronics. Through the utilisation of analog signal isolators this interference, which usually action both signal lines in common mode (push push), is effectively eliminated through the zero potential input.



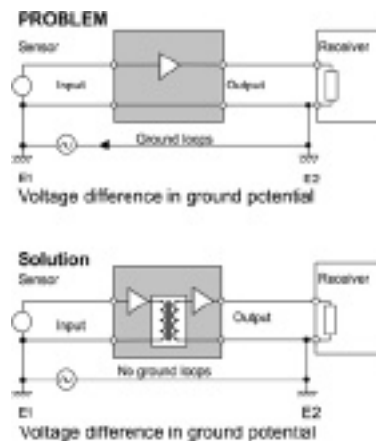
## Active Isolator / Passive Isolator

- Active isolators draw their power supply from a separate supply terminal to ensure that they can operate perfectly. Depending upon the applications the input, output and additionally the power supply are isolated from each other. Only one supply is required for 3-port isolation. However, it is isolated from the input and output circuits. Thus even in the event of a short circuit, surge voltage or reverse polarity, the downstream control electronics cannot be damaged. Isolating the signals between the input and output can be conducted either optically or by transformer barrier depending upon the transfer rate. Active isolators are non interacting, i.e. a change in the load does not exert any influence on an input circuit.

- Passive isolators generate the current required for the supply from the measuring signal. The current required internally is so small that transfer problems do not occur here.
- The feed can be effected from either the input or the output side. Isolation is by transformer barrier. The advantages are: cessation of network influences, outstanding accuracy, low signal delay and low potential requirement. Passive isolators are not non interacting; a change in load in the output circuit will influence the input circuit.

## Ground Loops

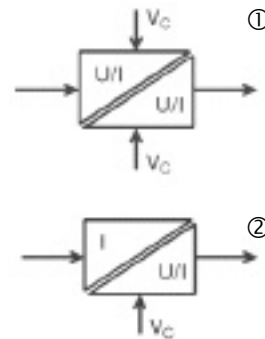
- The voltage supply's secondary side is earthed for the purpose of setting up fast and secure ground loop monitoring. If an analog signal is fed in from a separate voltage supply or if the sensing device itself is earthed, then transient currents will flow between the ground potentials across the interconnected ground connectors, which in turn corrupts the measuring signal. Analog signal isolating amplifiers prevent this form of measuring signal corruption and influence.



## 2-port Isolation

- The simplest form of analog signal isolator is that of 2-port isolation. It serves to isolate the input circuit from

the output circuit as well as the two auxiliary voltages from each other. Depending upon the isolator design and the observed isolation data one refers here to base isolation (galvanic isolation) or safe separation. ① For current signals, 4...20 mA input current loop fed modules are available. An additional auxiliary voltage for the input circuit is not required with here. ② By connecting the input and output side voltage supplies, the 2-port isolation can be converted to operate as a simple signal converter. This is of particular interest where isolation is not required for an application, but a signal conversion has to be performed.

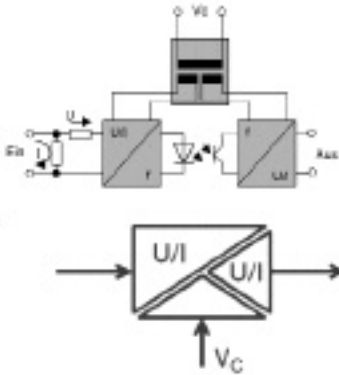


## 3-port Isolation

- 3-port isolation is the most universal form of signal isolator
- An optical coupler or transformer isolates the input from the output circuit. Together with the clearance and creepage distances it serves to define the isolation level. For example, the input signal is converted by means of pulse-width modulation into a frequency signal and demodulated again on the output side to form an analog value. An amplifier then generates a standardised analog signal. A galvanic isolated DC/DC converter feeds the input and output circuit with a potential free supply voltage. It too determines the isolation level through its data, air and creepage distances. In the case of these three isolation paths

## Description of technical data

(input/output, input/auxiliary voltage, output/auxiliary voltage) one refers to 3-port isolation.

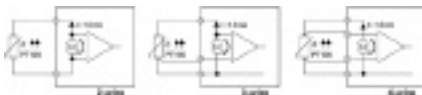


### Temperature Signal Measuring Method

- Measurement using resistors (RTD)
  - When measuring with temperature-dependent resistors a current of approx. 1.5mA is passed through the resistor from a constant current source in the signal converter.
  - An operational amplifier is used to measure the potential drop at the resistor (2-wire circuit).
  - In order to take account of lead length, the voltage drop is measured at the return conductor and calculated with double the value (3-wire circuit). This thus simulates the wire resistances from the feed and return lines.
  - Accurate measurements are achieved by separately measuring the voltage drop at the feed and return lines (4-wire circuit). The values for the supply lines are calculated against the measured value.

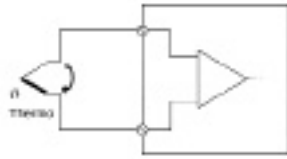
### Temperature Signal Measuring Method

- Measurements using thermocouples
  - When conducting measurements using



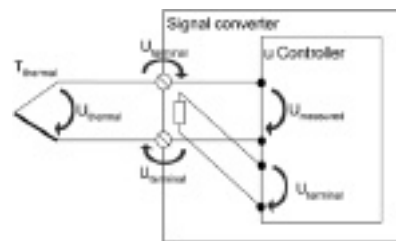
thermocouples the voltage that is generated when two differently alloyed metals come into contact with each other is measured. A differential amplifier is then used to recondition the signal. The easiest (and thus the most cost effective) method of subsequent processing is conducted by means of an amplifier circuit, which converts these

signals into standard signals. High-end components process the measuring signal using a microprocessor, which simultaneously reconditions the signal (filtering, linearization).



### Cold Junction Compensation For Thermocouples

- Recording temperatures by using thermocouples encounters the problem of a thermal voltage forming at the clamping terminals on the signal converter on account of the different materials in the conductors and bus bar. This voltage then counteracts the thermal element's voltage. In order to compensate for the error to the measured value which arises here, the temperature is measured at the clamping terminal. The microprocessor in the signal converter reads the value measured there and calculates it against the measured value.



This procedure is known as cold junction compensation.

$$\begin{aligned} & \text{Voltage at the measuring point (V}_{\text{meas}}) \\ & + \text{Voltage at the terminal (V}_{\text{terminal}}) \\ & = \text{Voltage at the thermocouple (V}_{\text{thermo}}) \\ \implies & \text{Temperature at the thermocouple (T}_{\text{thermo}}) \end{aligned}$$

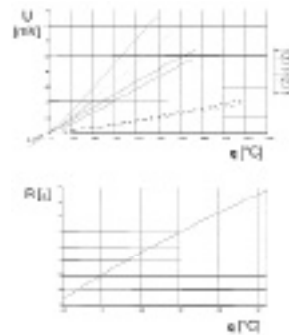
### Linearisation

- Temperature-dependent components do not normally have linear characteristic curves. To ensure that further processing can take place with the necessary accuracy, these characteristic curves have to be linearised to some extent.

The graph showing measurements of thermocouples, in particular, reveals significant deviations at some points from the "ideal graph". As a consequence, the signal which has been measured is worked up by a

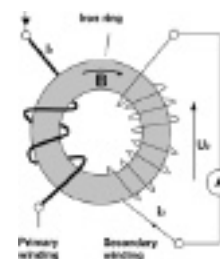
microprocessor. The microprocessor compares the value measured with the characteristic curve for the thermocouple in its memory and calculates the corresponding value on the "ideal characteristic curve". At the output, it supplies the latter to an amplifier, which produces the analog value in linear form. The output stage converts this into a standardised value or into a switching output with a switching threshold.

The linearisation of PT100-elements can be undertaken via simple amplifier stages. The first stage corrects the peak value of the graph of the measurements. The deviation at the end of the graph resulting from this is corrected by a second stage. The under- and overshooting generated in this way is very slight and is covered by the tolerance for the module.



### Current Measurement Using A Measuring Transformer

- Transformer principle Each conductor through which current flows is surrounded by a magnetic field H, the intensity of which is proportional to the current. The field, which is bundled in a magnetic core, generates a magnetic flux B, through which suitable sensors are used to measure current. Converters with transformer-type couplings are used to establish the most cost effective measurement method for simple sinusoidal currents. The current to be measured flows directly through the measuring transformer's primary winding. The secondary winding supplies the measuring electronics with a

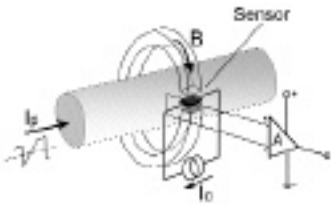


## Description of technical data

proportional current signal. Because of power loss this method of measuring current is limited to smaller currents up to 5A. These converters react sensitively to peak loads and therefore have to be fused on the primary winding side.

### Measuring Current Using A Hall-type Sensor

- Hall-type sensor principle  
Hall-type sensors also measure the magnetic flux B and supply a proportional voltage at the measured output, which is then reconditioned to form a standard signal by an amplifier

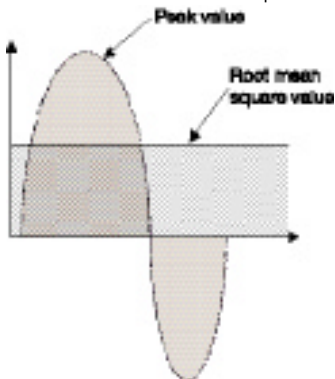


circuit.

- Components with Hall-type sensors are ideally suited to measuring higher currents, as any possible high residual currents from motors or peak loads cannot damage the component. Additionally, they are also ideal for measuring direct and alternating currents of various curve shapes.

### Root Mean Square Measurement / Crest Factor

- The root mean square value (r.m.s) of a sinusoidal shaped alternating current is the value, which in an ohmic resistor converts the same (effective) output as that of an equal sized direct current.
- Non sinusoidal shaped signals can only be measured with "True RMS" capable devices and/or further processed.



- True RMS = True root mean square
- Root mean square measurement is required where the (effective) output content of alternating voltages or currents are to be measured or evaluated.
- The crest factor indicates the ratio of the crest factor to the root mean square value.

### Load / Load Resistor

- The load is a load resistor on the output side of a measuring transducer or isolating amplifier.  
For current outputs the load is generally 500 ohm.  
Voltage outputs usually have a 10KOhm load.

### Galvanic Isolation / Safe Separation

- Galvanic isolation is understood to mean an electrical isolation between the input and output circuit and the circuit's supply voltage. It can be set up either optically using an opto coupler or with a transformer. The isolation serves to safeguard the measuring circuit against damage and to eliminate ground loops, which could cause the measured signal to be corrupted.
- Safe separation is specified under the German DIN VDE 0106 Section 101 standard. This fundamental safety standard is intended to safeguard persons against hazardous body currents and describes the basic requirements for safe separation in electrical operating equipment. Thus, for instance, the voltage supply of 50V ac/120V dc as under 50178 may not be exceeded. If this voltage is exceeded a reinforced or double insulated and thus an increase in the clearance and creepage distances is stipulated.

### Cut-off Frequency

- Cut-off frequencies indicate the dynamic transfer characteristic of an isolation amplifier.
- The given frequency is the (-3dB) limit, at which a distinct change occurs to the signal.
- An increased cut-off frequency leads to a transmission of higher-frequency alternating components, which corrupts the required signal.

### Hysteresis

- Hysteresis indicates the percentage difference between the input and output points of a switching contact. It should not be lower than a given minimum value, as otherwise a specified chase can no longer be implemented.

### Broken-wire Detection

- When measuring transformers with broken wire detection the input signal is monitored permanently. In the event of a fault (broken wire) the output signal exceeds its rated range. The downstream control circuit can then analyse the fault case.

### Response Time

- Response time refers to the change in output signal for an input signal jump(10...90%). It is directly related to the cut-off frequency (inversely proportional).

### Accuracy / Temperature Coefficient

- Accuracy describes the capability of a measuring device to deliver a measured value as accurately as possible. It relates to the end value and is given for ambient temperature (23°C).

Example:

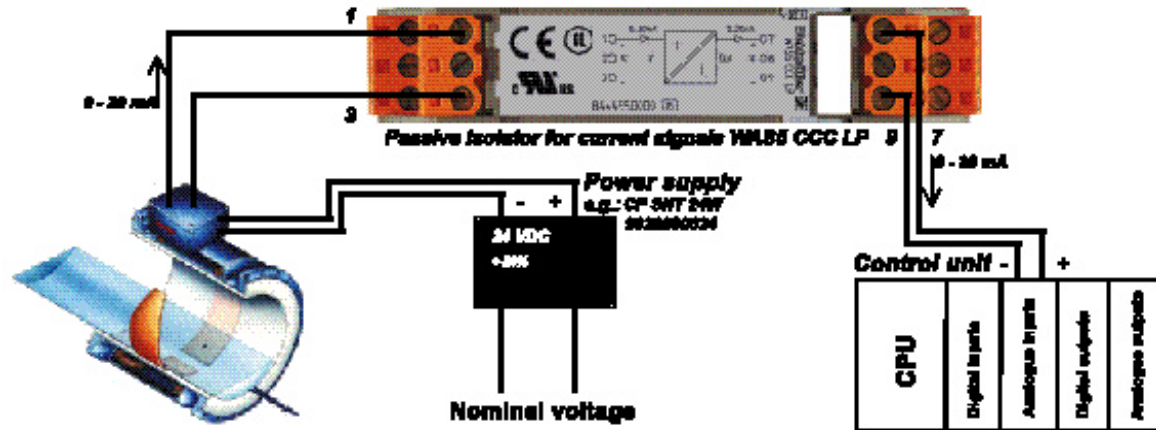
An RTD is given with an accuracy of 1%. The measuring range is set to 0-200 °C. The expected effective error of:  
 $200 \cdot 1\% = \pm 2K$

applies across the entire measurement range.

- Temperature coefficient describes the deviations in accuracy of the measuring devices dependent on the ambient temperature. It is given as a % or in parts per million / Kelvin (ppm / K).  
Example:

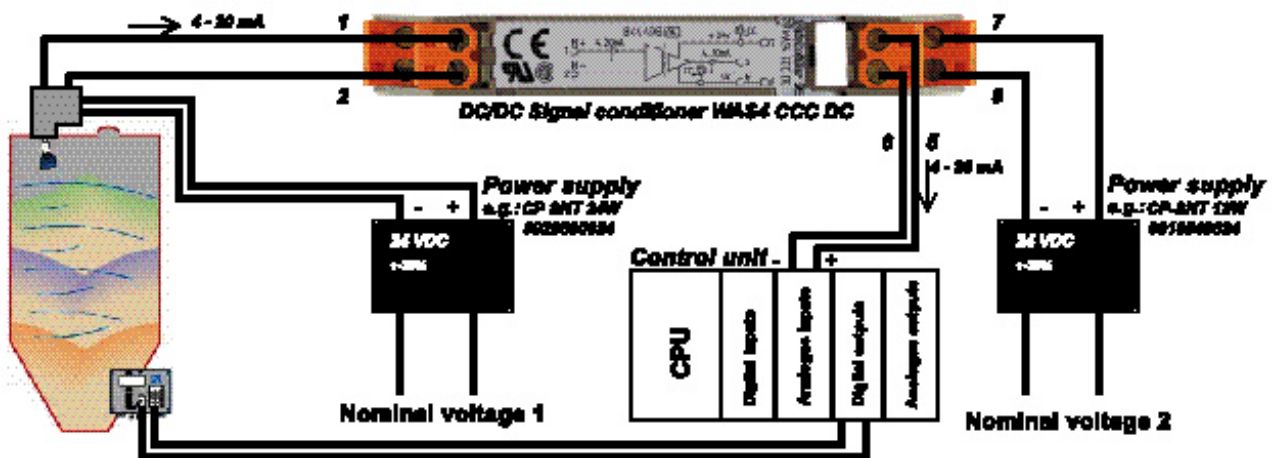
An RTD with an accuracy of 1% and a measuring range of 0-200 °C has a temperature coefficient of 250 ppm / K. If the device is operated at +40°C, it will then contribute the following to an expected absolute error:  
 $(([40^{\circ}C - 23^{\circ}C] \cdot 250ppm/K) + 1\%) \cdot 200K$   
 $= \pm 2,85K$   
across the entire measurement range.

### Magnetic – Inductive flow measurement

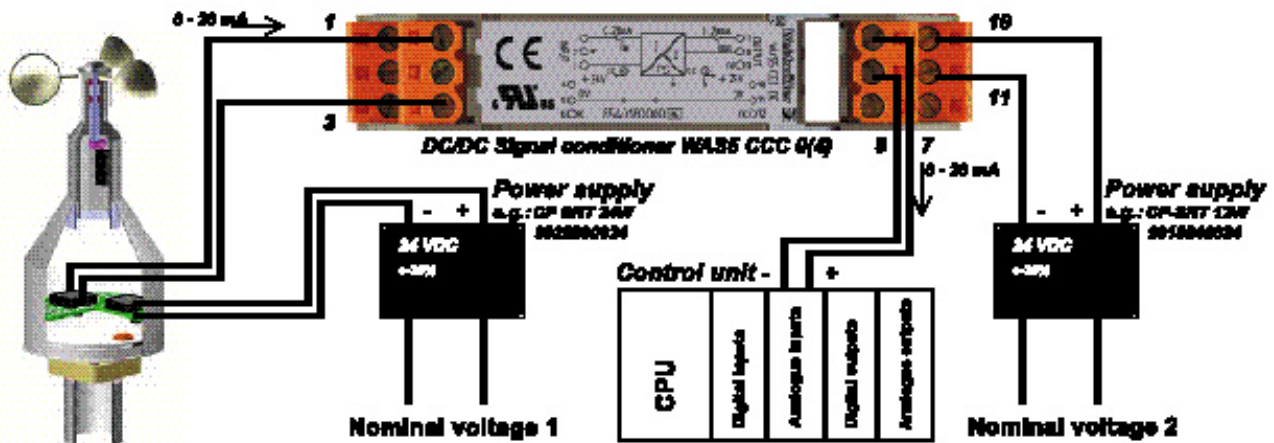


Magnetic – Inductive flow measurement

### Level measurement with microwaves



### Wind speed measurement

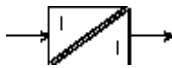


# ANALOG SIGNAL CONDITIONING - overview

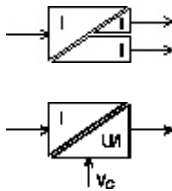
## Signal Conditioners DC/DC

- Loop Powered Isolator
  - Input loop powered
  - Output loop powered
  - Loop splitter
- 2-way-isolation
  - Signal Conditioner with voltage supply on output side
  - Signal Conditioner with voltage supply on both sides

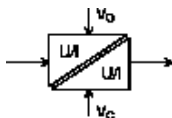
Loop Powered Isolator  
(Input Loop Powered)



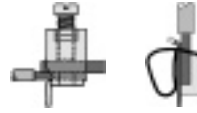
Signal Conditioner with  
voltage supply on output  
side



Signal Conditioner with  
voltage supply on both  
sides



Signal conversion	Connecton type	Type	Part No.	Page
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Input

Output

Loop Powered Isolator					
Input loop powered					
1-channel					
0(4) ... 20 mA	0(4) ... 20 mA	X		WAS5 CCC LP	8444950000 17
0(4) ... 20 mA	0(4) ... 20 mA		X	WAZ5 CCC LP	8444960000 17
0(4) ... 20 mA	0(4) ... 20 mA		X	MCZ CCC	8411190000 16
2-channel					
0(4) ... 20 mA	0(4) ... 20 mA	X		WAS5 CCC LP	8463580000 17
0(4) ... 20 mA	0(4) ... 20 mA		X	WAZ5 CCC LP	8463590000 17
Output loop powered					
0(4) ... 20 mA	0(4) ... 20 mA	X		WAS5 CCC OLP	8543720000 14
0(4) ... 20 mA	0(4) ... 20 mA		X	WAZ5 CCC OLP	8543730000 14
Loop splitter					
4 ... 20 mA (1 Kanal)	4 ... 20 mA (2 Kanäle)	X		WAS5 CCC 2OLP	8581160000 15
4 ... 20 mA (1 Kanal)	4 ... 20 mA (2 Kanäle)	X		WAS5 CCC 2OLP	8581170000 15
Signal Conditioner with voltage supply on output side					
4 ... 20 mA	4 ... 20 mA	X		WAS4 CCC DC	8444980000 18
4 ... 20 mA	4 ... 20 mA		X	WAZ4 CCC DC	8444990000 18
4 ... 20 mA	0 ... 20 mA	X		WAS4 CCC DC	8445010000 18
4 ... 20 mA	0 ... 20 mA		X	WAZ4 CCC DC	8445020000 18
4 ... 20 mA	0 ... 10 V	X		WAS4 CVC DC	8445040000 18
4 ... 20 mA	0 ... 10 V		X	WAZ4 CVC DC	8445050000 18
Signal Conditioner with voltage supply on both sides					
0 ... 20 mA	0 ... 20 mA	X		WAS4 CCC DC	8445070000 19
0 ... 20 mA	0 ... 20 mA		X	WAZ4 CCC DC	8445080000 19
0 ... 20 mA	4 ... 20 mA	X		WAS4 CCC DC	8446970000 19
0 ... 20 mA	4 ... 20 mA		X	WAZ4 CCC DC	8446990000 19
0 ... 20 mA	0 ... 10 V	X		WAS4 CVC DC	8447020000 19
0 ... 20 mA	0 ... 10 V		X	WAZ4 CVC DC	8447030000 19
0 ... 10 V	0 ... 20 mA	X		WAS4 VCC DC	8447050000 20
0 ... 10 V	0 ... 20 mA		X	WAZ4 VCC DC	8447080000 20
0 ... 10 V	4 ... 20 mA	X		WAS4 VCC DC	8447100000 20
0 ... 10 V	4 ... 20 mA		X	WAZ4 VCC DC	8447110000 20
0 ... 10 V	0 ... 10 V	X		WAS4 VVC DC	8447130000 20
0 ... 10 V	0 ... 10 V		X	WAZ4 VVC DC	8447140000 20



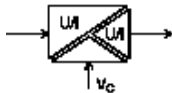
# ANALOG SIGNAL CONDITIONING - overview

## Signal Conditioners DC/DC

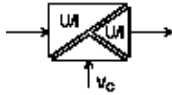
- 3-way-isolation
  - transmission frequency 10 Hz
  - transmission frequency 20 kHz
  - free configurable

## DC Alarm conditioners

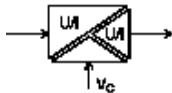
3-way-isolation  
transmission  
frequency 10 Hz



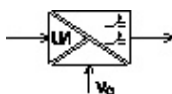
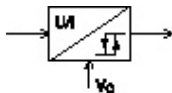
3-way-isolation  
transmission  
frequency 20 kHz



3-way-isolation  
(universal)



DC Alarm conditioners



Signal conversion	Connecton type	Type	Part No.	Page
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Input

Output

3-way-isolation transmission frequency 10 Hz				
0 ... 20 mA	0 ... 20 mA	X	WAS5 CCC	8540180000 21
0 ... 20 mA	0 ... 20 mA	X	WAZ5 CCC	8540190000 21
0 ... 20 mA	4 ... 20 mA	X	WAS5 CCC	8540250000 21
0 ... 20 mA	4 ... 20 mA	X	WAZ5 CCC	8540260000 21
0 ... 20 mA	0 ... 10 V	X	WAS5 CVC	8540270000 21
0 ... 20 mA	0 ... 10 V	X	WAZ5 CVC	8540280000 21
4 ... 20 mA	0 ... 20 mA	X	WAS5 CCC	8540200000 22
4 ... 20 mA	0 ... 20 mA	X	WAZ5 CCC	8540210000 22
4 ... 20 mA	0 ... 10 V	X	WAS5 CVC	8540230000 22
4 ... 20 mA	0 ... 10 V	X	WAZ5 CVC	8540240000 22
0 ... 10 V	0 ... 20 mA	X	WAS5 VCC	8540310000 23
0 ... 10 V	0 ... 20 mA	X	WAZ5 VCC	8540320000 23
0 ... 10 V	4 ... 20 mA	X	WAS5 VCC	8540290000 23
0 ... 10 V	4 ... 20 mA	X	WAZ5 VCC	8540300000 23
0 ... 10 V	0 ... 10 V	X	WAS5 VVC	8540330000 23
0 ... 10 V	0 ... 10 V	X	WAZ5 VVC	8540340000 23

3-way-isolation transmission frequency 20 kHz				
0 ... 20 mA	0 ... 20 mA	X	WAS5 CCC HF	8447160000 24
0 ... 20 mA	0 ... 20 mA	X	WAZ5 CCC HF	8447170000 24
0 ... 20 mA	4 ... 20 mA	X	WAS5 CCC HF	8447190000 24
0 ... 20 mA	4 ... 20 mA	X	WAZ5 CCC HF	8447200000 24
0 ... 20 mA	0 ... 10 V	X	WAS5 CVC HF	8447220000 24
0 ... 20 mA	0 ... 10 V	X	WAZ5 CVC HF	8447230000 24
4 ... 20 mA	0 ... 20 mA	X	WAS5 CCC HF	8447250000 25
4 ... 20 mA	0 ... 20 mA	X	WAZ5 CCC HF	8447260000 25
4 ... 20 mA	0 ... 10 V	X	WAS5 CVC HF	8447280000 25
4 ... 20 mA	0 ... 10 V	X	WAZ5 CVC HF	8447290000 25
0 ... 10 V	0 ... 20 mA	X	WAS5 VCC HF	8447310000 26
0 ... 10 V	0 ... 20 mA	X	WAZ5 VCC HF	8447320000 26
0 ... 10 V	4 ... 20 mA	X	WAS5 VCC HF	8447340000 26
0 ... 10 V	4 ... 20 mA	X	WAZ5 VCC HF	8447350000 26
0 ... 10 V	0 ... 10 V	X	WAS5 VVC HF	8447370000 27
0 ... 10 V	0 ... 10 V	X	WAZ5 VVC HF	8447380000 27
-10 ... +10 V	-10 ... +10 V	X	WAS5 VVC HF	8561610000 27
-10 ... +10 V	-10 ... +10 V	X	WAZ5 VVC HF	8587000000 27

3-way-isolation free configurable				
universal		X	WAS4 PRO DC/DC	8560740000 30
universal		X	WAZ4 PRO DC/DC	8560750000 30

0(4) ... 20 mA	0(4) ... 20 mA	X	MAS DC/DC select	8594810000 31
0 ... 10 V	0 ... 10 V			
0(4) ... 20 mA	0(4) ... 20 mA	X	MAZ DC/DC select	8594840000 31
0 ... 10 V	0 ... 10 V			

Alarm Conditioners				
2 times PNP output		X	MCZ SC	8260280000 32
0 ... 10 V	2 times PNP			
2 times PNP output			MCZ SC	8227350000 32
0 ... 20 mA	2 times PNP	X		
0 ... 10 V / 0(4) ... 20 mA	2 CO	X	WAS5 DC/Alarm	8543820000 33
0 ... 10 V / 0(4) ... 20 mA	2 CO	X	WAZ5 DC/Alarm	8543830000 33

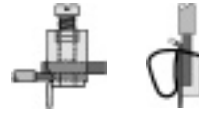
# ANALOG SIGNAL CONDITIONING - overview

Signal Conditioners RTD  
Thermo Signal Conditioners  
Frequency Signal Conditioners  
Bridge Signal Conditioners  
Interface Converter

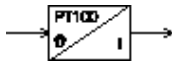
- PT100 Select
- PT100 Output select
- RTD universal (3-way-isolation)
- Thermo Select
- Thermo universal (3-way-isolation)
- Frequency Signal Conditioner

- Frequency Signal Conditioner (3-way-isolation)
- Bridge Signal Conditioners (3-way-isolation)
- Interface Converter for RS232 to RS485/TTY

Signal conversion	Connection type	Type	Part No.	Page
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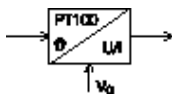


PT 100  
Output loop powered



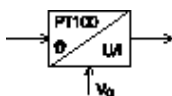
Input	Output	Connection type	Type	Part No.	Page
<b>MCZ PT100 CLP</b>					
PT 100/2/3 0...100°C	4 ... 20 mA	X	MCZ P100/3 CLP	8425720000	35
PT 100/2/3 0...120°C	4 ... 20 mA	X	MCZ P100/3 CLP	8483680000	35
PT 100/2/3 0...150°C	4 ... 20 mA	X	MCZ P100/3 CLP	8604420000	35
PT 100/2/3 0...200°C	4 ... 20 mA	X	MCZ P100/3 CLP	8473010000	35
PT 100/2/3 0...300°C	4 ... 20 mA	X	MCZ P100/3 CLP	8473020000	35
PT 100/2/3 -50...150°C	4 ... 20 mA	X	MCZ P100/3 CLP	8473000000	35
PT 100/2/3 -40...100°C	4 ... 20 mA	X	MCZ P100/3 CLP	8604430000	35

PT 100 Select



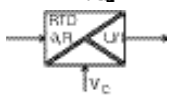
<b>WAVEANALOG PT100 Select</b>					
PT100/2	0(4) ... 20 mA	X	WTS4 PT100/2 C	8432210000	37
PT100/2	0(4) ... 20 mA	X	WTZ4 PT100/2 C	8432220000	37
PT100/2	0 ... 10 V	X	WTS4 PT100/2 V	8432180000	37
PT100/2	0 ... 10 V	X	WTZ4 PT100/2 V	8432190000	37
PT100/3	0(4) ... 20 mA	X	WTS4 PT100/3 C	8432150000	38
PT100/3	0(4) ... 20 mA	X	WTZ4 PT100/3 C	8432160000	38
PT100/3	0 ... 10 V	X	WTS4 PT100/3 V	8432090000	38
PT100/3	0 ... 10 V	X	WTZ4 PT100/3 V	8432130000	38
PT100/4	0(4) ... 20 mA	X	WTS4 PT100/4 C	8432270000	39
PT100/4	0(4) ... 20 mA	X	WTZ4 PT100/4 C	8432280000	39
PT100/4	0 ... 10 V	X	WTS4 PT100/4 V	8432240000	39
PT100/4	0 ... 10 V	X	WTZ4 PT100/4 V	8432250000	39

PT 100 Output select  
2-way-isolation



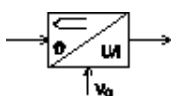
<b>MICROANALOG PT100 output select</b>					
PT100 2/3	0 ... 100°C	X	MAS PT100 output select	8594820000	36
PT100 2/3	0 ... 100°C	X	MAZ PT100 output select	8594850000	36

PRO RTD (configurable)  
3-way-isolation



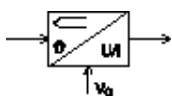
<b>WAVEANALOG PRO RTD</b>					
universal		X	WAS5 PRO RTD	8560700000	40
universal		X	WAZ5 PRO RTD	8560710000	40

Thermo Select



<b>WAVEANALOG Thermo Select</b>					
°C	0 ... 20 mA, 4 ... 20 mA, 0 ... 10 V	X	WTS4 Thermo Select	8432300000	43
°C	0 ... 20 mA, 4 ... 20 mA, 0 ... 10 V	X	WTZ4 Thermo Select	8432310000	43

Thermo Output select  
2-way-isolation



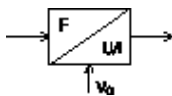
<b>MICROANALOG Thermo output select</b>					
Thermoelement Typ K		X	MAS Thermo-K Output select	8594830000	44
Thermoelement Typ K		X	MAZ Thermo-K Output select	8594860000	44
Thermoelement Typ J		X	MAS Thermo-J Output select	8615210000	44
Thermoelement Typ J		X	MAS Thermo-J Output select	8615240000	44

PRO Thermo (configurable)  
3-way-isolation



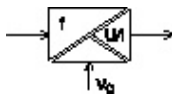
<b>WAVEANALOG PRO Thermo</b>					
°C	0 ... 20 mA, 4 ... 20 mA, 0 ... 10 V	X	WAS5 PRO Thermo	8560720000	45
°C	0 ... 20 mA, 4 ... 20 mA, 0 ... 10 V	X	WAZ5 PRO Thermo	8560730000	45

Frequency Signal  
Conditioner



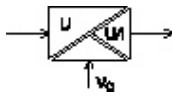
<b>MCZ Frequency Signal Conditioner</b>					
0...10 V	f-configurable	X	MCZ VFC	8461470000	48
0...20 mA	f-configurable	X	MCZ CFC	8461480000	48
4...20 mA	f-configurable	X	MCZ CFC	8461490000	48

Frequency Signal  
Conditioner  
(3 way isolation)



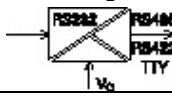
<b>WAVEANALOG PRO Frequency</b>					
configurable	configurable	X	WAS4 PRO Freq	8581180000	46
configurable	configurable	X	WAZ4 PRO Freq	8581190000	46

Bridge Signal Conditioners  
(3 way isolation)



<b>WAVEANALOG PRO Bridge</b>					
configurable	configurable	X	WAS5 PRO Bridge	8581200000	49
configurable	configurable	X	WAZ5 PRO Bridge	8581210000	49

Interface Converter

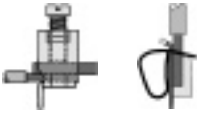
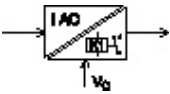
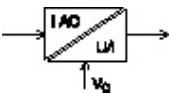
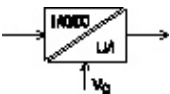
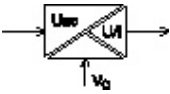


<b>WAVEDATA</b>					
RS232	RS485/422	X	WAS RS232/RS485/422	8615700000	50
RS485	TTY	X	WAS RS232/TTY	8615690000	50

# ANALOG SIGNAL CONDITIONING - overview

Current monitoring up to 60 A ac/dc  
 Voltage monitoring up to 450 Vac<sub>eff</sub>  
 Power supply

- Current monitoring with relay output
- Current monitoring with analog output
- Voltage monitoring with analog output
- Power supply 24V/0.5A

Signal conversion	Connection type	Type	Part No.	Page
				
<b>Current monitoring</b>				
				
				
				
<b>Voltage monitoring</b>				
				
<b>Power supply</b>				
<b>WAVECONTROL Current monitoring</b>				
1/5/10 A ac	relay	X	WAS2 CMR	8516560000 52
1/5/10 A ac	relay		X WAZ2 CMR	8516570000 52
20/40/60 A ac	relay	X	WAS2 CMR	8513340000 52
20/40/60 A ac	relay		X WAZ2 CMR	8526600000 52
1/5/10 A ac	0(4) ... 20 mA 0 ... 10 V	X	WAS1 CMA	8523400000 53
1/5/10 A ac	0(4) ... 20 mA 0 ... 10 V		X WAZ1 CMA	8523410000 53
1/5/10 A ac	4 ... 20 mA	X	WAS1 LP CMA	8528650000 53
1/5/10 A ac	4 ... 20 mA		X WAZ1 LP CMA	8528660000 53
5/10 A ac/dc	0(4) ... 20 mA 0 ... 10 V	X	WAS2 CMA	8526610000 54
5/10 A ac/dc	0(4) ... 20 mA 0 ... 10 V		X WAZ2 CMA	8526620000 54
20/25/30 A ac/dc	0(4) ... 20 mA 0 ... 10 V	X	WAS2 CMA	8545830000 54
20/25/30 A ac/dc	0(4) ... 20 mA 0 ... 10 V		X WAZ2 CMA	8545840000 54
40/50/60 A ac/dc	0(4) ... 20 mA 0 ... 10 V	X	WAS2 CMA	8513330000 55
40/50/60 A ac/dc	0(4) ... 20 mA 0 ... 10 V		X WAZ2 CMA	8526590000 55
<b>WAVECONTROL voltage monitoring</b>				
0...450 Vac <sub>eff</sub>		X	WAS2 VMA Vac	8581220000 56
0...450 Vac <sub>eff</sub>			X WAZ2 VMA Vac	8581230000 56
<b>WAVEPOWER Power supply</b>				
115-230 Vac	24 Vdc	X	CP-SNT 12W	9918840024 57

## Concept

WAVESERIES - a new generation of analog signal conditioners. The WAVESERIES range of modules from Weidmüller brings together the compact, space-saving enclosure design (WAVEBOX) and a wide variety of functions. The product family provides a comprehensive range of signal conditioners.

Independent connection technology – screw-type or tension clamp via pluggable terminal connectors

Mounting without tools

Quick power-up – pluggable circuit board

Standardized current and voltage signals

Minimum wiring thanks to cross-connections

High functionality

Easy selection thanks to clear type designation

Space-saving – more space in switchgear cabinet

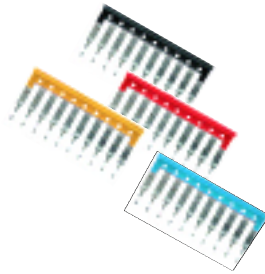
Saves costs

## Replacement

The circuit board can be removed from the enclosure without using tools. Just press the locking clips on the head piece, and pull out the circuit board along with the connection terminals.

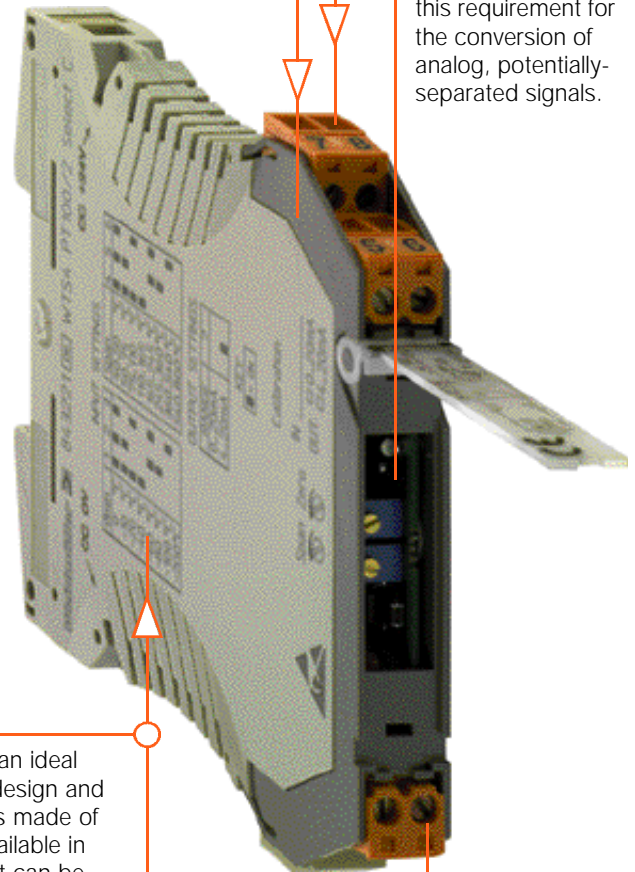
## Cross-connection

Enclosures from the same family, can be joined together using cross-connections in order to connect the supply voltage from one module to another.



## Safety

"Safety separation" according to EN 50178 is a standard that nowadays is taken for granted. WAVESERIES fulfils this requirement for the conversion of analog, potentially-separated signals.



## The housing (WAVEBOX)

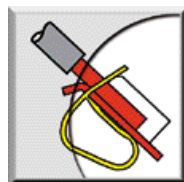
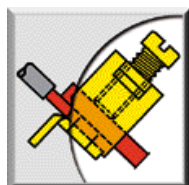
The WAVEBOX enclosure is an ideal combination of technology, design and functionality. The enclosure is made of recyclable plastics, and is available in four different overall widths. It can be mounted without tools. Fulfilling the necessary EMC requirements, the enclosure also provides good thermal dissipation thanks to the ventilation slots on the side.

## Coding

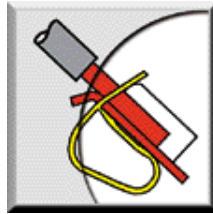
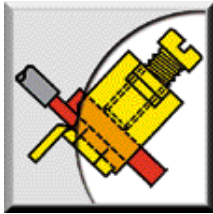
The coding element enables screw-type connections as well as tension clamp connections to be coded without reducing the number of poles. This ensures that the connectors cannot be reversed.

## Connection

High flexibility during wiring thanks to BLZ screw-type connections and the BLZF tension clamp connector system (up to 2.5 mm<sup>2</sup>).



# MCZ / MICROSERIES benefits



## Connection

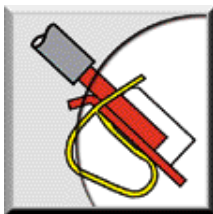
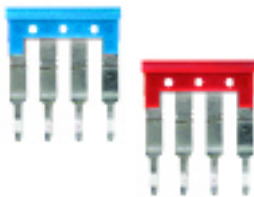
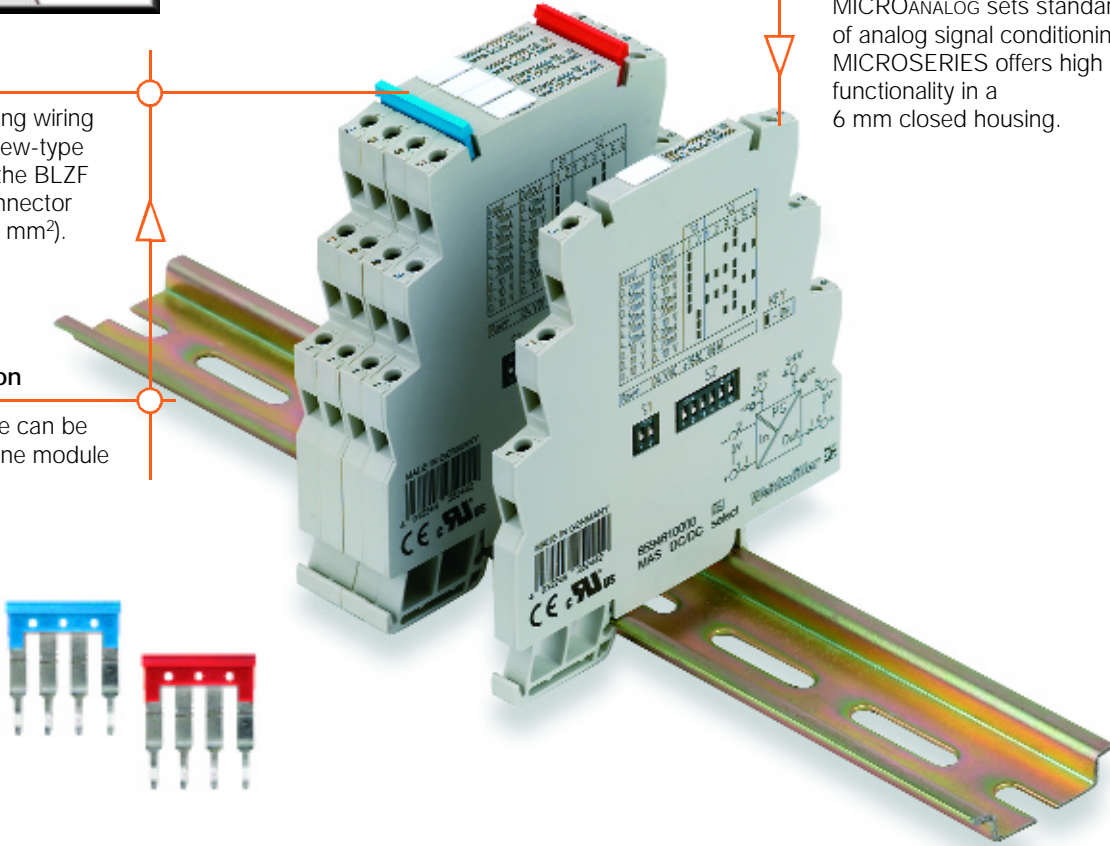
High flexibility during wiring thanks to BLZ screw-type connections and the BLZF tension clamp connector system (up to 2.5 mm<sup>2</sup>).

## Cross-connection

The supply voltage can be connected from one module to another.

## Width

MICROANALOG sets standards of analog signal conditioning. MICROSERIES offers high functionality in a 6 mm closed housing.



## Connection

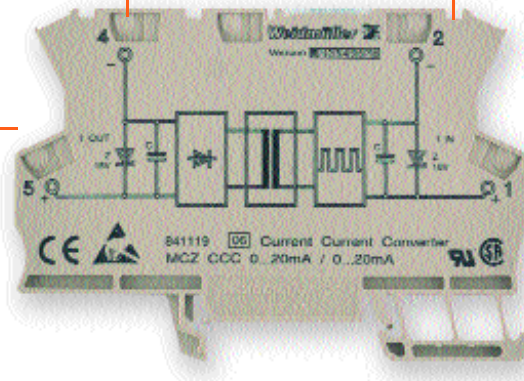
Tension clamp connector

## Cross-connection

The power supply is cross connectable from one module to the other.

## Width

6 mm width (without end plate) offers MCZ-SERIES enough space for electronic circuits.



# DC/DC Loop Powered Isolator(Output loop powered)

## WAVEANALOG OLP

- Galvanic isolation
- Output Loop Powered
- Low power consumption
- Input range adjustable by DIP-Switches
- No adjustment required

### Approvals:



### Schematic circuit diagram



### Ordering data

Screw connection

Tension clamp connection

### Technical data\*

#### Input (adjustable by DIP-Switches)

Input voltage

Maximum input voltage

Input resistance

Input current

Maximum input current

Input resistance

#### Output

Output current

Output current limitation

Load resistance

Transmission frequency (adjustable by DIP-Switch)

Response time

Accuracy

Temperature coefficient

### Coordination of insulation according to DIN EN 50178, 04/98

Supply voltage

Rated voltage

Rated surge voltage

Oversvoltage category

Contamination class

Clearance and creepage distances

Test voltage

### General Data

Operating temperature

Storage temperature

Standards/Specifications

EMC standards

Factory setting

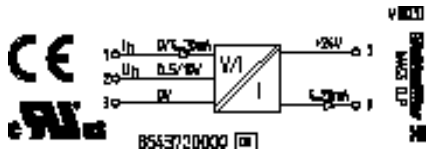
Dimensions L/H/W

Weight

Approvals

\* Tu 23°C, single module

## CCC OLP



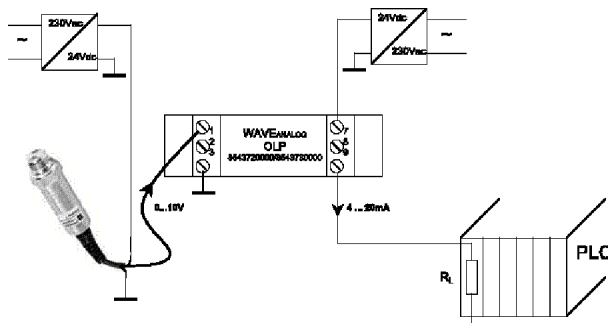
Type	Part No.
WAS5 CCC OLP	8543720000
WAZ5 CCC OLP	8543730000

Input voltage	0...5 V, 0...10 V
Maximum input voltage	30 V
Input resistance	0...5 V, 210 k ; 0...10 V, 430 k
Input current	0/4...20 mA
Maximum input current	40 mA
Input resistance	51
Output current	4...20 mA (current loop)
Output current limitation	approx. 24 mA
Load resistance	RL=(Ub-12 V) / 20 mA, e.g. 600 at 24 V
Transmission frequency (adjustable by DIP-Switch)	10 Hz, 100 Hz
Response time	<10 Hz(typ 8 Hz) = 80 ms 100 Hz = 8 ms
Accuracy	0.2 %
Temperature coefficient	± 200 ppm/K
Supply voltage	min. 12 Vdc max. 30 Vdc
Rated voltage	300 V
Rated surge voltage	4 kV
Oversvoltage category	III
Contamination class	2
Clearance and creepage distances	5.5 mm
Test voltage	4 kV <sub>eff</sub>
Operating temperature	0...+55 °C (mounted on horizontal DIN rail)
Storage temperature	-20 °C...+85 °C
Standards/Specifications	EN 50178
EMC standards	EN 50082-2, EN 50081-1, EN 50081-2 EN 55011
Factory setting	0...20 mA, 10 Hz
Dimensions L/H/W	92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)
Weight	100 g (0.22 lbs.)
Approvals	CE, cULus

Input	SW 1			
	1	2	3	4
0...20 mA	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4...20 mA	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0...5 V	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
0...10 V	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Transmission frequency				
10 Hz	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
100 Hz	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

■ = on  
□ = off

### Application



# DC/DC Loop Powered Isolator (Loop splitter)

## WAVEANALOG 20LP

- Galvanic isolation
- Input and output Loop Powered
- Low power consumption
- No adjustment required

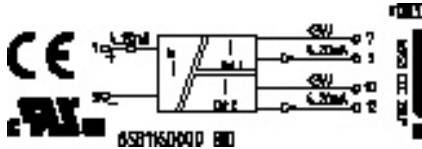
## CCC 20LP



### Approvals:



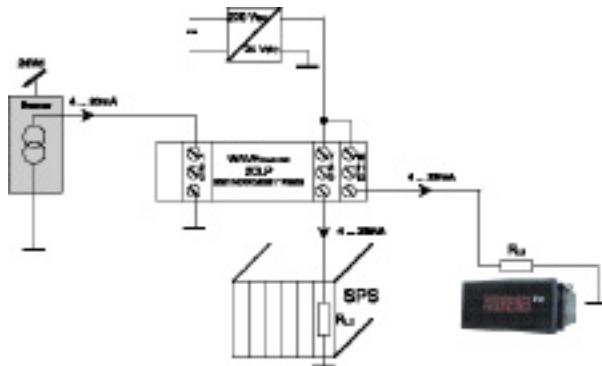
### Schematic circuit diagram



Ordering data	Type	Part No.
Screw connection	WAS5 CCC 20LP	8581160000
Tension clamp connection	WAZ5 CCC 20LP	8581170000
Technical data*		
<b>Input</b>		
Input current	4...20 mA (current loop)	
max. input current	40 mA	
Input voltage drop	3.8 V	
<b>Output</b>		
Output current (Channel 1)	4...20 mA (current loop)	
Output current (Channel 2)	4...20 mA (current loop)	
Output current limitation	approx. 31 mA	
Load resistance	RL=(V <sub>I</sub> -RV) / 20 ma, e.g. 600 Ω at 24 V	
Minimum voltage supply	12 Vdc	
Transmission frequency	30 Hz	
Response time	< 20 ms	
Accuracy	0.2 % (typ. 0.1 %)	
Temperature coefficient	± 250 ppm/K	
Coordination of insulation according to DIN EN 50178, 04/98		
Supply voltage	min. 12 Vdc max. 30 Vdc	
Rated voltage	300 V	
Rated surge voltage	4 kV	
Overvoltage category	III	
Contamination class	2	
Clearance and creepage distance	5.5 mm	
Test voltage	4 kV <sub>eff</sub>	
General Data		
Operating temperature	0...+55 °C (mounted on horizontal DIN rail)	
Storage temperature	-20 °C...+85 °C	
Standards/Specifications	EN 50178	
EMC standards	EN 50082-2, EN 50081-1, EN 50081-2 EN 55011	
Dimensions L/H/W	92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)	
Weight	100 g (0.22 lbs.)	
Approvals	CE, cULus	

\* Tu 23°C, single module

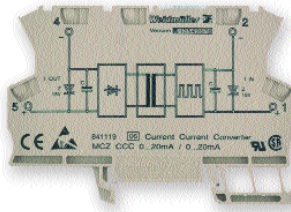
### Application



## DC/DC Loop Powered Isolator (Input loop powered)

This module is a reasonably priced passive separator for galvanically separating standard 0.4...20 mA signals. It draws its power from the measurement signal and requires no further auxiliary power. The measurement signal is transmitted 1:1. The module is distinguished by its low power consumption as well as a response current <math>< 100 \mu\text{A}</math>.

### MCZ CCC 0...20 mA/0...20 mA



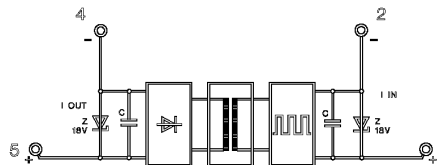
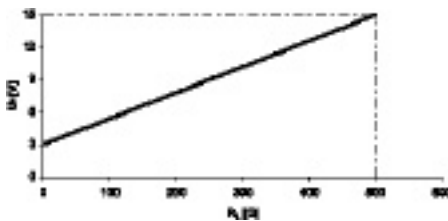
#### Approvals:



#### Schematic circuit diagram



#### Working resistance diagram



#### Ordering data

for TS 35

#### Technical data

Input	Type	Part No.
	MCZ CCC 0...20 mA/0...20 mA	8411190000
	without power supply	
	<b>0...20 mA (max. 15 V)</b>	
Response current	<math>< 100 \mu\text{A}</math>	
Voltage drop	2.5...3 V (at 20 mA)	
Maximum overload capacity at input	50 mA, 15 V	
	<b>0...20 mA (max. 10 V)</b>	
Set time (T99)	approx. 5 ms at 500 $\Omega$ working resistance impedance	
Residual ripple	<math>< 10 \text{ mV}_{\text{eff}}</math>	
Chopper frequency	approx. 200 kHz	
Transmission error	<math>< 0.1\%</math> from end value, + 0.05 % from mean/100 working resistance	
Temperature effect	<math>< 50 \text{ ppm/K}</math> from measurement value for working resistance 0	
	<b>Voltage strength</b>	
Input / Output	510 $V_{\text{eff}}$	
	<b>EMC</b>	
	EMVG	
	EN 50081-1	
	EN 50082-2	
Approvals	CE, cULus, CSA	
Operating temperature	-25 °C...+60 °C	
Storage temperature	-40 °C...+85 °C	
Conductor	AWG 22...12	
Conductor cross-section	1.5 mm <sup>2</sup>	
Overall width	6 mm (0.24 in.)	



# DC/DC Loop Powered Isolator input loop powered

## WAVEANALOG DC/DC

- Input loop powered
- Galvanic isolation
- 1-, 2-channel versions
- Low power consumption
- Safety separation

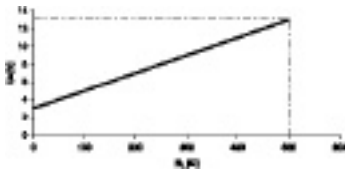
### Approvals:



### Schematic circuit diagram



### Working resistance diagram



Ordering data
Screw connection 1 channel
Tension clamp connection 1 channel
Screw connection 2 channel
Tension clamp connection 2 channel
Input/Output

### Technical data\* (per channel)

<b>Input signal</b>
Input voltage max.
Input current max.
Response current
Voltage drop
<b>Output signal</b>
Load resistance
Accuracy at $T_U=23\text{ }^\circ\text{C}$
Influence of load resistance
Temperature coefficient
Set time
Residual ripple
Chopper frequency

### General Data

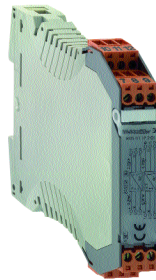
Operating temperature
Storage temperature
Dimensions L/H/W
Approvals

### Coordination of insulation according to EN 50178, 04/98 (safe separation)

Rated voltage
Rated surge voltage
Overvoltage category
Contamination class
Clearance and creepage distance
Isolation voltage, voltage strength
Input/output, channel / channel
Input/output to mounting rail
Standards/Specifications
EMC standards

\* $T_U = 23\text{ }^\circ\text{C}$  single module

**CCC LP ( 1 channel)**  
0(4) ... 20 mA / 0(4) ... 20 mA



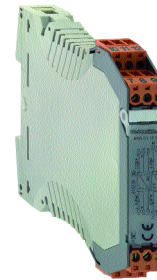
Type	Part No.
WAS5 CCC LP	8444950000
WAZ5 CCC LP	8444960000
Input/Output	0(4) ... 20 mA / 0(4) ... 20 mA

0 ... 20 mA (4 ... 20 mA)
18 V
50 mA
< 100 $\mu\text{A}$
approx. 3 V at $R_L = 0$
$I_{in} = 20\text{ mA}$
approx. 13 V at $R_L = 500$
at $I_{in} = 20\text{ mA}$
0 ... 20 mA (4 ... 20 mA)
500
< 0.1% from end value
< 0.1% from measurement value
per 100 load resistance
50 ppm / K from end value
4,5 ms at 500 working resistance
< 20 mV <sub>eff</sub>
approx. 170 kHz

-25 $^\circ\text{C}$ ... +70 $^\circ\text{C}$
-40 $^\circ\text{C}$ ... +80 $^\circ\text{C}$
92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)
CE, cULus, CSA, GL

300 V
6 kV
III
2
5.5 mm
4 kV <sub>eff</sub> / 1 s
4 kV <sub>eff</sub> / 1 min
EN 50178 (safe separation)
EN 50081, EN 50082, EN 55011

**CCC LP (2 channel)**  
0(4) ... 20 mA / 0(4) ... 20 mA



Type	Part No.
WAS5 CCC LP	8463580000
WAZ5 CCC LP	8463590000
Input/Output	0(4) ... 20 mA / 0(4) ... 20 mA

0 ... 20 mA (4 ... 20 mA)
18 V
50 mA
< 100 $\mu\text{A}$
approx. 3 V at $R_L = 0$
$I_{in} = 20\text{ mA}$
approx. 13 V at $R_L = 500$
at $I_{in} = 20\text{ mA}$
0 ... 20 mA (4 ... 20 mA)
500
< 0.1% from end value
< 0.1% from measurement value
per 100 load resistance
50 ppm / K from end value
4,5 ms at 500 working resistance
< 20 mV <sub>eff</sub>
approx. 170 kHz

-25 $^\circ\text{C}$ ... +70 $^\circ\text{C}$
-40 $^\circ\text{C}$ ... +80 $^\circ\text{C}$
92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)
CE, cULus, CSA, GL

300 V
6 kV
III
2
5.5 mm
4 kV <sub>eff</sub> / 1 s
4 kV <sub>eff</sub> / 1 min
EN 50178 (safe separation)
EN 50081, EN 50082, EN 55011

# DC/DC-Signal Conditioners 2-way-isolation

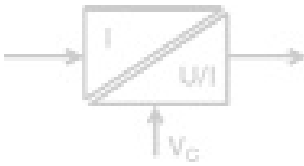
## WAVEANALOG DC/DC

- Voltage supply on output side
- 2-way-isolation
- Analog signal conditioning
- Galvanic isolation between input/output signal
- Input loop powered
- Cross-connectable voltage supply via cross-connectors

### Approvals:



Schematic circuit diagram



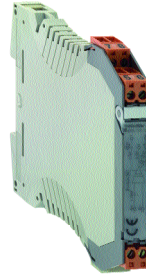
## CCC DC

4 ... 20 mA / 4 ... 20 mA



## CCC DC

4 ... 20 mA / 0 ... 20 mA



## CVC DC

4 ... 20 mA / 0 ... 10 V



### Ordering data

Screw connection	
Tension clamp connection	
Input/Output	

Type	Part No.
WAS4 CCC DC	8444980000
WAZ4 CCC DC	8444990000
4 ... 20 mA / 4...20 mA	

Type	Part No.
WAS4 CCC DC	8445010000
WAZ4 CCC DC	8445020000
4 ... 20 mA / 0 ... 20 mA	

Type	Part No.
WAS4 CVC DC	8445040000
WAZ4 CVC DC	8445050000
4 ... 20 mA / 0 ... 10V	

### Technical data\*

<b>Input signal</b>	4 ... 20 mA
Input voltage max.	7 V
Input current max	25 mA
<b>Output signal</b>	4 ... 20 mA
Load resistance	740 at 24 Vdc
Accuracy at Tu=23 °C	± 0.2% from end value
Temperature coefficient	250 ppm / K from end value
Response time	30 ms (typ. 20 ms)
Cut-off frequency (-3 dB)	15 Hz (typ. 20 Hz)

4 ... 20 mA	
7 V	
25 mA	
4 ... 20 mA	
740 at 24 Vdc	
± 0.2% from end value	
250 ppm / K from end value	
30 ms (typ. 20 ms)	
15 Hz (typ. 20 Hz)	

4 ... 20 mA	
7 V	
25 mA	
0 ... 20 mA	
740 at 24 Vdc	
± 0.2% from end value	
250 ppm / K from end value	
30 ms (typ. 20 ms)	
15 Hz (typ. 20 Hz)	

4 ... 20 mA	
7 V	
25 mA	
0 ... 10 V	
1 k	
± 0.2% from end value	
250 ppm / K from end value	
30 ms (typ. 20 ms)	
15 Hz (typ. 20 Hz)	

### General Data

Voltage supply	24 Vdc ±20% (19.2 ... 28.8 Vdc)
Power consumption	< 32 mA at I <sub>out</sub> = 20 mA
Current carrying capacity of cross-connection	2 A
Operating temperature	0 °C ... +55 °C (line up on DIN rail)
Storage temperature	-20 °C ... +85 °C
Dimensions L/H/W	92.4 / 112.5 / 12.5 mm (3.64 / 4.43 / 0.49 in.)
Approvals	CE, cULus, CSA

24 Vdc ±20% (19.2 ... 28.8 Vdc)	
< 32 mA at I <sub>out</sub> = 20 mA	
2 A	
0 °C ... +55 °C (line up on DIN rail)	
-20 °C ... +85 °C	
92.4 / 112.5 / 12.5 mm (3.64 / 4.43 / 0.49 in.)	
CE, cULus, CSA	

24 Vdc ±20% (19.2 ... 28.8 Vdc)	
< 32 mA at I <sub>out</sub> = 20 mA	
2 A	
0 °C ... +55 °C (line up on DIN rail)	
-20 °C ... +85 °C	
92.4 / 112.5 / 12.5 mm (3.64 / 4.43 / 0.49 in.)	
CE, cULus, CSA	

24 Vdc ±20% (19.2 ... 28.8 Vdc)	
< 20 mA at I <sub>out</sub> = 10 mA	
2 A	
0 °C ... +55 °C (line up on DIN rail)	
-20 °C ... +85 °C	
92.4 / 112.5 / 12.5 mm (3.64 / 4.43 / 0.49 in.)	
CE, cULus, CSA	

### Coordination of insulation according to EN 50178, 04/98

Rated voltage	300 V
Rated surge voltage	4 kV
Overvoltage category	III
Contamination class	2
Clearance and creepage distance	3 mm
Isolation voltage, voltage strength	
Input/output to mounting rail	4 kV <sub>eff</sub> / 1 min
Standards/Specifications	EN 50178
EMC standards	EN 50081, EN 50082, EN 55011

300 V	
4 kV	
III	
2	
3 mm	
4 kV <sub>eff</sub> / 1 min	
EN 50178	
EN 50081, EN 50082, EN 55011	

300 V	
4 kV	
III	
2	
3 mm	
4 kV <sub>eff</sub> / 1 min	
EN 50178	
EN 50081, EN 50082, EN 55011	

300 V	
4 kV	
III	
2	
3 mm	
4 kV <sub>eff</sub> / 1 min	
EN 50178	
EN 50081, EN 50082, EN 55011	

\*T<sub>U</sub> = 23 °C single module

# DC/DC-Signal Conditioners 2-way-isolation

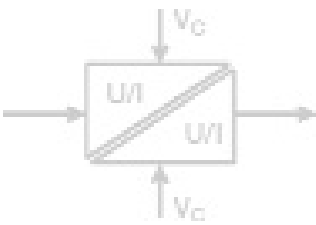
## WAVEANALOG DC/DC

- Voltage supply on both sides
- 2-way-isolation
- Analog signal conditioning
- Galvanic isolation between input/output signal
- Cross-connectable voltage supply via cross-connectors

### Approvals:

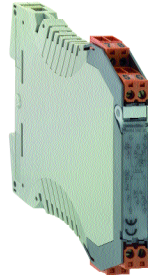


Schematic circuit diagram



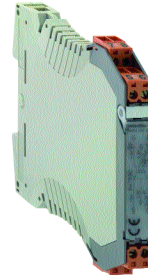
## CCC DC

0 ... 20 mA / 0 ... 20 mA



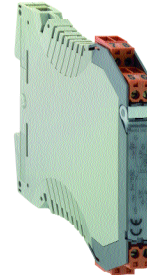
## CCC DC

0 ... 20 mA / 4 ... 20 mA



## CVC DC

0 ... 20 mA / 0 ... 10 V



### Ordering data

Screw connection	
Tension clamp connection	
Input/Output	

Type	Part No.
WAS4 CCC DC	8445070000
WAZ4 CCC DC	8445080000
0 ... 20 mA / 0 ... 20 mA	

Type	Part No.
WAS4 CCC DC	8446970000
WAZ4 CCC DC	8446990000
0 ... 20 mA / 4 ... 20 mA	

Type	Part No.
WAS4 CVC DC	8447020000
WAZ4 CVC DC	8447030000
0 ... 20 mA / 0 ... 10 V	

### Technical data\*

<b>Input signal</b>	0 ... 20 mA
Input current max.	25 mA
Input resistance	50
<b>Output signal</b>	0 ... 20 mA
Load resistance	740 at 24 Vdc
Accuracy at Tu=23 °C	± 0.2% from end value
Temperature coefficient	250 ppm / K from end value
Response time	30 ms (typ. 16 ms)
Cut-off frequency (-3 dB)	15 Hz (typ. 25 Hz)

0 ... 20 mA	
25 mA	
50	
0 ... 20 mA	
740 at 24 Vdc	
± 0.2% from end value	
250 ppm / K from end value	
30 ms (typ. 16 ms)	
15 Hz (typ. 25 Hz)	

0 ... 20 mA	
25 mA	
50	
4 ... 20 mA	
740 at 24 Vdc	
± 0.2% from end value	
250 ppm / K from end value	
30 ms (typ. 16 ms)	
15 Hz (typ. 25 Hz)	

0 ... 20 mA	
25 mA	
50	
0 ... 10 V	
1 k	
± 0.2% from end value	
250 ppm / K from end value	
30 ms (typ. 16 ms)	
15 Hz (typ. 25 Hz)	

### General Data

Voltage supply	24 Vdc ±20% (19.2 ... 28.8 Vdc)
Power consumption input	< 11 mA at I <sub>in</sub> = 20 mA
Power consumption output	< 32 mA at I <sub>out</sub> = 20 mA
Current carrying capacity of cross-connection	2 A
Operating temperature	0 °C ... +55 °C (line up on DIN rail)
Storage temperature	-20 °C ... +85 °C
Dimensions L/H/W	92.4 / 112.5 / 12.5 mm
Approvals	(3.64 / 4.43 / 0.49 in.) CE, cULus, CSA

24 Vdc ±20%	
(19.2 ... 28.8 Vdc)	
< 11 mA at I <sub>in</sub> = 20 mA	
< 32 mA at I <sub>out</sub> = 20 mA	
2 A	
0 °C ... +55 °C (line up on DIN rail)	
-20 °C ... +85 °C	
92.4 / 112.5 / 12.5 mm	
(3.64 / 4.43 / 0.49 in.)	
CE, cULus, CSA	

24 Vdc ±20%	
(19.2 ... 28.8 Vdc)	
< 11 mA at I <sub>in</sub> = 20 mA	
< 32 mA at I <sub>out</sub> = 20 mA	
2 A	
0 °C ... +55 °C (line up on DIN rail)	
-20 °C ... +85 °C	
92.4 / 112.5 / 12.5	
(3.64 / 4.43 / 0.49 in.)	
CE, cULus, CSA	

24 Vdc ±20%	
(19.2 ... 28.8 Vdc)	
< 11 mA at I <sub>in</sub> = 20 mA	
< 20 mA at I <sub>out</sub> = 10 V	
2 A	
0 °C ... +55 °C (line up on DIN rail)	
-20 °C ... +85 °C	
92.4 / 112.5 / 12.5	
(3.64 / 4.43 / 0.49 in.)	
CE, cULus, CSA	

### Coordination of insulation according to EN 50178, 04/98

Rated voltage	300 V
Rated surge voltage	4 kV
Overvoltage category	III
Contamination class	2
Clearance and creepage distance	3 mm
Isolation voltage, voltage strength	
Input/output to mounting rail	4 kV <sub>eff</sub> / 1 min
Standards/Specifications	EN 50178
EMC standards	EN 50081, EN 50082, EN 55011

300 V	
4 kV	
III	
2	
3 mm	
4 kV <sub>eff</sub> / 1 min	
EN 50178	
EN 50081, EN 50082, EN 55011	

300 V	
4 kV	
III	
2	
3 mm	
4 kV <sub>eff</sub> / 1 min	
EN 50178	
EN 50081, EN 50082, EN 55011	

300 V	
4 kV	
III	
2	
3 mm	
4 kV <sub>eff</sub> / 1 min	
EN 50178	
EN 50081, EN 50082, EN 55011	

\*T<sub>U</sub> = 23 °C single module

# DC/DC-Signal Conditioners 2-way-isolation

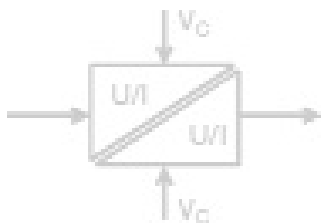
## WAVEANALOG DC/DC

- Voltage supply on both sides
- 2-way-isolation
- Analog signal conditioning
- Galvanic isolation between input/output signal
- Cross-connectable voltage supply via cross-connectors

### Approvals:

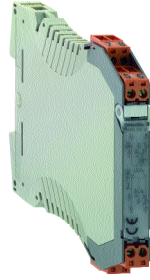


Schematic circuit diagram



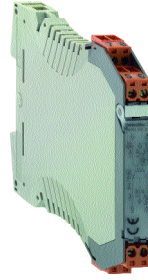
## VCC DC

0 ... 10 V / 0 ... 20 mA



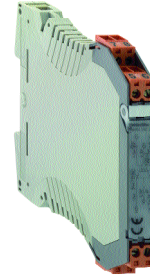
## VCC DC

0 ... 10 V / 4 ... 20 mA



## VVC DC

0 ... 10 V / 0 ... 10 V



### Ordering data

Screw connection  
Tension clamp connection  
Input/Output

Type Part No.  
WAS4 VCC DC **8447050000**  
WAZ4 VCC DC **8447080000**  
0 ... 10 V / 0 ... 20 mA

Type Part No.  
WAS4 VCC DC **8447100000**  
WAZ4 VCC DC **8447110000**  
0 ... 10 V / 4 ... 20 mA

Type Part No.  
WAS4 VVC DC **8447130000**  
WAZ4 VVC DC **8447140000**  
0 ... 10 V / 0 ... 10 V

### Technical data\*

#### Input signal

Input voltage max.  
Input resistance

#### Output signal

Load resistance

Accuracy at  $T_u=23^\circ\text{C}$

Temperature coefficient

Response time

Cut-off frequency (-3 dB)

0 ... 10 V  
15 V  
500 k  
0 ... 20 mA  
740 at 24 Vdc  
 $\pm 0.2\%$  from end value  
250 ppm / K from end value  
30 ms (typ. 25 ms)  
13 Hz (typ. 17 Hz)

0 ... 10 V  
15 V  
500 k  
4 ... 20 mA  
740 at 24 Vdc  
 $\pm 0.2\%$  from end value  
250 ppm / K from end value  
30 ms (typ. 25 ms)  
13 Hz (typ. 17 Hz)

0 ... 10 V  
15 V  
500 k  
0 ... 10 V  
1 k  
 $\pm 0.2\%$  from end value  
250 ppm / K from end value  
30 ms (typ. 25 ms)  
13 Hz (typ. 17 Hz)

### General Data

Voltage supply

Power consumption input

Power consumption output

Current carrying capacity of cross-connection

Operating temperature

Storage temperature

Dimensions L/H/W

Approvals

24 Vdc  $\pm 20\%$   
(19.2 ... 28.8 Vdc)  
< 11 mA at  $U_{in} = 10$  V  
< 32 mA at  $I_{out} = 20$  mA  
2 A  
0 °C...+55 °C (mounted on horizontal DIN rail)  
-20 °C ... +85 °C  
92.4 / 112.5 / 12.5 mm  
(3.64 / 4.43 / 0.49 in.)  
CE, cULus, CSA

24 Vdc  $\pm 20\%$   
(19.2 ... 28.8 Vdc)  
< 11 mA at  $U_{in} = 10$  V  
< 32 mA at  $I_{out} = 20$  mA  
2 A  
0 °C...+55 °C (mounted on horizontal DIN rail)  
-20 °C ... +85 °C  
92.4 / 112.5 / 12.5 mm  
(3.64 / 4.43 / 0.49 in.)  
CE, cULus, CSA

24 Vdc  $\pm 20\%$   
(19.2 ... 28.8 Vdc)  
< 11 mA at  $U_{in} = 10$  V  
< 20 mA at  $I_{out} = 10$  mA  
2 A  
0 °C...+55 °C (mounted on horizontal DIN rail)  
-20 °C ... +85 °C  
92.4 / 112.5 / 12.5 mm  
(3.64 / 4.43 / 0.49 in.)  
CE, cULus, CSA

### Coordination of insulation according to EN 50178, 04/98

Rated voltage

Rated surge voltage

Oversvoltage category

Contamination class

Clearance and creepage distance

Isolation voltage, voltage strength

Input/output to mounting rail

300 V  
4 kV  
III  
2  
3 mm  
4 kV<sub>eff</sub> / 1 min

300 V  
4 kV  
III  
2  
3 mm  
4 kV<sub>eff</sub> / 1 min

300 V  
4 kV  
III  
2  
3 mm  
4 kV<sub>eff</sub> / 1 min

Standards/Specifications

EMC standards

EN 50178  
EN 50081, EN 50082,  
EN 55011

EN 50178  
EN 50081, EN 50082,  
EN 55011

EN 50178  
EN 50081, EN 50082,  
EN 55011

# DC/DC-Signal Conditioners 3-way-isolation 10 Hz

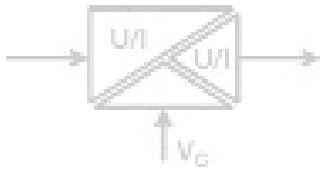
## WAVEANALOG DC/DC

- 3-way-isolation
- Analog signal conditioning
- Indication LED
- Cross-connectable voltage supply via cross-connectors

### Approvals:

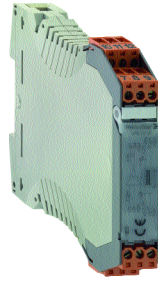


Schematic circuit diagram



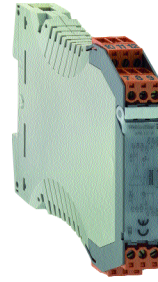
## CCC

0 ... 20 mA / 0 ... 20 mA



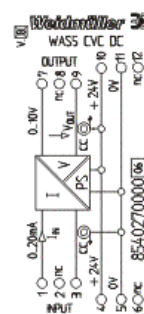
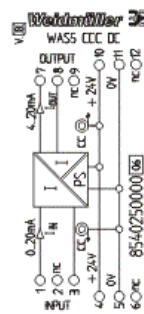
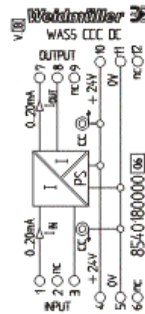
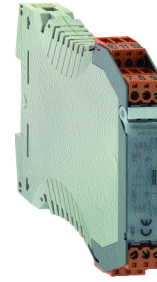
## CCC

0 ... 20 mA / 4 ... 20 mA



## CVC

0 ... 20 mA / 0 ... 10 V



### Ordering data

Screw connection	WAS5 CCC	8540180000*
Tension clamp connection	WAZ5 CCC	8540190000*
Input/Output	0 ... 20 mA / 0 ... 20 mA	

### Technical data\*\*

<b>Input signal</b>	0 ... 20 mA
Input current max.	25 mA
Input resistance	110
<b>Output signal</b>	0 ... 20 mA
Load resistance	600
Accuracy at Tu=23 °C	0.2%
Temperature coefficient	± 250 ppm / K
Response time	45 ms
Cut-off frequency (-3 dB)	10 Hz

### General Data

Voltage supply	24 Vdc ±25% (18 Vdc ... 24 Vdc ... 30 Vdc)
Power consumption	< 1.5 W at I <sub>out</sub> = 20 mA
Current carrying capacity of cross-connection	2 A
Operating temperature	0 °C...+55 °C (mounted on horizontal DIN rail)
Storage temperature	-20 °C ... +85 °C
Dimensions L/H/W	92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.49 in.)
Approvals	CE, cULus

### Coordination of insulation according to EN 50178, 04/98

Rated voltage	300 V
Rated surge voltage	4 kV
Overvoltage category	III
Contamination class	2
Clearance and creepage distance	3 mm
Coupling capacity	
Input / output to supply	1 nF
Isolation voltage, voltage strength	
Input/output to mounting rail	4 kV <sub>eff</sub> / 1 min
Standards/Specifications	EN 50178
EMC standards	EN 50081, EN 50082, EN 55011

Type	Part No.
WAS5 CCC	8540180000*
WAZ5 CCC	8540190000*
Input/Output	0 ... 20 mA / 0 ... 20 mA

Input signal	0 ... 20 mA
Input current max.	25 mA
Input resistance	110
Output signal	4 ... 20 mA
Load resistance	600
Accuracy at Tu=23 °C	0.2%
Temperature coefficient	± 250 ppm / K
Response time	45 ms
Cut-off frequency (-3 dB)	10 Hz

Voltage supply	24 Vdc ±25% (18 Vdc ... 24 Vdc ... 30 Vdc)
Power consumption	< 1.5 W at I <sub>out</sub> = 20 mA
Current carrying capacity of cross-connection	2 A
Operating temperature	0 °C...+55 °C (mounted on horizontal DIN rail)
Storage temperature	-20 °C ... +85 °C
Dimensions L/H/W	92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.49 in.)
Approvals	CE, cULus

Rated voltage	300 V
Rated surge voltage	4 kV
Overvoltage category	III
Contamination class	2
Clearance and creepage distance	3 mm
Coupling capacity	
Input / output to supply	1 nF
Isolation voltage, voltage strength	
Input/output to mounting rail	4 kV <sub>eff</sub> / 1 min
Standards/Specifications	EN 50178
EMC standards	EN 50081, EN 50082, EN 55011

Type	Part No.
WAS5 CCC	8540250000
WAZ5 CCC	8540260000
Input/Output	0 ... 20 mA / 4 ... 20 mA

Input signal	0 ... 20 mA
Input current max.	25 mA
Input resistance	110
Output signal	0 ... 10 V
Load resistance	1 k
Accuracy at Tu=23 °C	0.2%
Temperature coefficient	± 250 ppm / K
Response time	45 ms
Cut-off frequency (-3 dB)	10 Hz

Voltage supply	24 Vdc ±25% (18 Vdc ... 24 Vdc ... 30 Vdc)
Power consumption	< 1.5 W at I <sub>out</sub> = 20 mA
Current carrying capacity of cross-connection	2 A
Operating temperature	0 °C...+55 °C (mounted on horizontal DIN rail)
Storage temperature	-20 °C ... +85 °C
Dimensions L/H/W	92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.49 in.)
Approvals	CE, cULus

Rated voltage	300 V
Rated surge voltage	4 kV
Overvoltage category	III
Contamination class	2
Clearance and creepage distance	3 mm
Coupling capacity	
Input / output to supply	1 nF
Isolation voltage, voltage strength	
Input/output to mounting rail	4 kV <sub>eff</sub> / 1 min
Standards/Specifications	EN 50178
EMC standards	EN 50081, EN 50082, EN 55011

Type	Part No.
WAS5 CVC	8540270000
WAZ5 CVC	8540280000
Input/Output	0 ... 20 mA / 0 ... 10 V

Input signal	0 ... 20 mA
Input current max.	25 mA
Input resistance	110
Output signal	0 ... 10 V
Load resistance	1 k
Accuracy at Tu=23 °C	0.2%
Temperature coefficient	± 250 ppm / K
Response time	45 ms
Cut-off frequency (-3 dB)	10 Hz

Voltage supply	24 Vdc ±25% (18 Vdc ... 24 Vdc ... 30 Vdc)
Power consumption	< 1.3 W at I <sub>out</sub> = 5 mA
Current carrying capacity of cross-connection	2 A
Operating temperature	0 °C...+55 °C (mounted on horizontal DIN rail)
Storage temperature	-20 °C ... +85 °C
Dimensions L/H/W	92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.49 in.)
Approvals	CE, cULus

Rated voltage	300 V
Rated surge voltage	4 kV
Overvoltage category	III
Contamination class	2
Clearance and creepage distance	3 mm
Coupling capacity	
Input / output to supply	1 nF
Isolation voltage, voltage strength	
Input/output to mounting rail	4 kV <sub>eff</sub> / 1 min
Standards/Specifications	EN 50178
EMC standards	EN 50081, EN 50082, EN 55011

\*\* T<sub>U</sub> = 23 °C single module

\* Input/Output 4 ... 20 mA/4 ... 20 mA possible

# DC/DC-Signal Conditioners 3-way-isolation 10 Hz

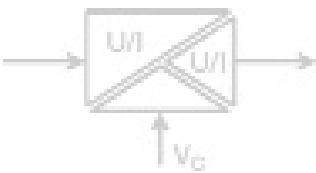
## WAVEANALOG DC/DC

- 3-way-isolation
- Analog signal conditioning
- Indication LED
- Cross-connectable voltage supply via cross-connectors

### Approvals:

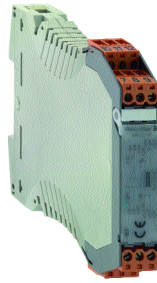


### Schematic circuit diagram



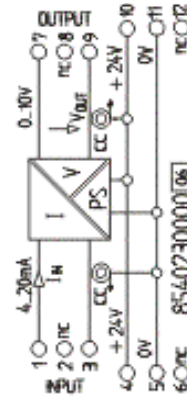
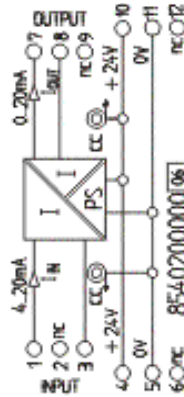
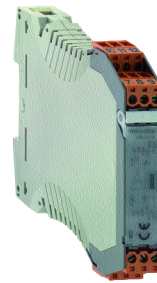
## CCC

4 ... 20 mA / 0 ... 20 mA



## CVC

4 ... 20 mA / 0 ... 10 V



Ordering data
Screw connection
Tension clamp connection
Input/Output

Technical data
<b>Input signal</b>
Input current max.
Input resistance
<b>Output signal</b>
Load resistance
Accuracy at $T_u=23\text{ }^\circ\text{C}$
Temperature coefficient
Response time
Cut-off frequency (-3 dB)

General Data*
Voltage supply
Power consumption
Current carrying capacity of cross-connection
Operating temperature
Storage temperature
Dimensions L/H/W
Approvals

Coordination of insulation according to EN 50178, 04/98
Rated voltage
Rated surge voltage
Overtension category
Contamination class
Clearance and creepage distance
Coupling capacity
Input / output to supply
Isolation voltage, voltage strength
Input/output to mounting rail

Standards/Specifications
EMC standards

\* $T_u = 23\text{ }^\circ\text{C}$  single module

Type	Part No.
WAS5 CCC	8540200000
WAZ5 CCC	8540210000
4 ... 20 mA / 0 ... 20 mA	

4 ... 20 mA
25 mA
110
0 ... 20 mA
600
0.2%
$\pm 250\text{ ppm / K}$
45 ms
10 Hz

24 Vdc $\pm 25\%$
(18 Vdc ... 24 Vdc ... 30 Vdc)
< 1.5 W at $I_{out} = 20\text{ mA}$
2 A
0 $^\circ\text{C}$ ... +55 $^\circ\text{C}$ (mounted on horizontal DIN rail)
-20 $^\circ\text{C}$ ... +85 $^\circ\text{C}$
92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)
CE, cULus

300 V
4 kV
III
2
3 mm
1 nF
4 kV <sub>eff</sub> / 1 min

EN 50178
EN 50081, EN 50082, EN 55011

Type	Part No.
WAS5 CVC	8540230000
WAZ5 CVC	8540240000
4 ... 20 mA / 0 ... 10 V	

4 ... 20 mA
25 mA
110
0 ... 10 V
1 k
0.2%
$\pm 250\text{ ppm / K}$
45 ms
10 Hz

24 Vdc $\pm 25\%$
(18 Vdc ... 24 Vdc ... 30 Vdc)
< 1.3 W at $I_{out} = 5\text{ mA}$
2 A
0 $^\circ\text{C}$ ... +55 $^\circ\text{C}$ (mounted on horizontal DIN rail)
-20 $^\circ\text{C}$ ... +85 $^\circ\text{C}$
92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)
CE, cULus

300 V
4 kV
III
2
3 mm
1 nF
4 kV <sub>eff</sub> / 1 min

EN 50178
EN 50081, EN 50082, EN 55011

# DC/DC-Signal Conditioners 3-way-isolation 10 Hz

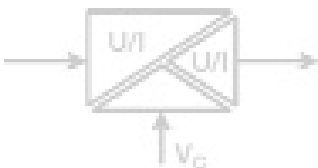
## WAVEANALOG DC/DC

- 3-way-isolation
- Analog signal conditioning
- Indication LED
- Cross-connectable voltage supply via cross-connectors

## Approvals:

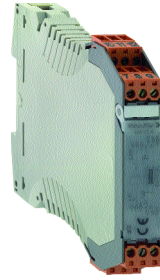


## Schematic circuit diagram



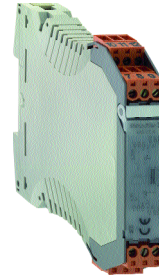
## VCC

0 ... 10 V / 0 ... 20 mA



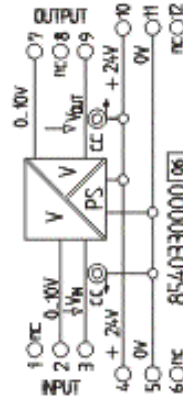
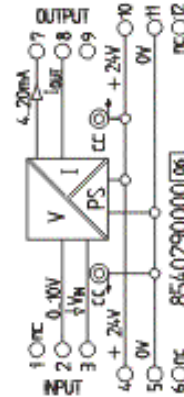
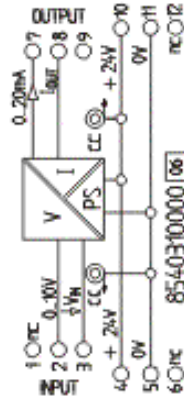
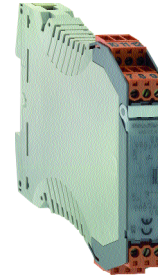
## VCC

0 ... 10 V / 4 ... 20 mA



## VVC

0 ... 10 V / 0 ... 10 V



## Ordering data

Screw connection	WAS5 VCC	8540310000
Tension clamp connection	WAZ5 VCC	8540320000
Input/Output	0 ... 10 V / 0 ... 20 mA	

## Technical data\*

<b>Input signal</b>	0 ... 10 V
Input voltage max.	15 V
Input resistance	typ. 100 k
<b>Output signal</b>	0 ... 20 mA
Load resistance	600
Accuracy at Tu=23 °C	0.2%
Temperature coefficient	± 250 ppm / K
Response time	45 ms
Cut-off frequency (-3 dB)	10 Hz

Type	Part No.
WAS5 VCC	8540310000
WAZ5 VCC	8540320000
0 ... 10 V / 0 ... 20 mA	

Type	Part No.
WAS5 VCC	8540290000
WAZ5 VCC	8540300000
0 ... 10 V / 4 ... 20 mA	

Type	Part No.
WAS5 VVC	8540330000
WAZ5 VVC	8540340000
0 ... 10 V / 0 ... 10 V	

## General Data

Voltage supply	24 Vdc ±25% (18 Vdc ... 24 Vdc ... 30 Vdc)
Power consumption	< 1.5 W at I <sub>out</sub> = 20 mA
Current carrying capacity of cross-connection	2 A
Operating temperature	0 °C ... +55 °C (mounted on horizontal DIN rail)
Storage temperature	-20 °C ... +85 °C
Dimensions L/H/W	92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)
Approvals	CE, cULus

24 Vdc ±25% (18 Vdc ... 24 Vdc ... 30 Vdc)	
< 1.5 W at I <sub>out</sub> = 20 mA	
2 A	
0 °C ... +55 °C (mounted on horizontal DIN rail)	
-20 °C ... +85 °C	
92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)	
CE, cULus	

24 Vdc ±25% (18 Vdc ... 24 Vdc ... 30 Vdc)	
< 1.5 W at I <sub>out</sub> = 20 mA	
2 A	
0 °C ... +55 °C (mounted on horizontal DIN rail)	
-20 °C ... +85 °C	
92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)	
CE, cULus	

24 Vdc ±25% (18 Vdc ... 24 Vdc ... 30 Vdc)	
< 1.3 W at I <sub>out</sub> = 5 mA	
2 A	
0 °C ... +55 °C (mounted on horizontal DIN rail)	
-20 °C ... +85 °C	
92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)	
CE, cULus	

## Coordination of insulation according to EN 50178, 04/98

Rated voltage	300 V
Rated surge voltage	4 kV
Overvoltage category	III
Contamination class	2
Clearance and creepage distance	3 mm
Coupling capacity	1 nF
Input / output to supply	1 nF
Isolation voltage, voltage strength	4 kV <sub>eff</sub> / 1 min
Input/output to mounting rail	4 kV <sub>eff</sub> / 1 min

300 V	
4 kV	
III	
2	
3 mm	
1 nF	
4 kV <sub>eff</sub> / 1 min	

300 V	
4 kV	
III	
2	
3 mm	
1 nF	
4 kV <sub>eff</sub> / 1 min	

300 V	
4 kV	
III	
2	
3 mm	
1 nF	
4 kV <sub>eff</sub> / 1 min	

## Standards/Specifications

EN 50178
EMC standards
EN 50081, EN 50082, EN 55011

EN 50178
EN 50081, EN 50082, EN 55011

EN 50178
EN 50081, EN 50082, EN 55011

EN 50178
EN 50081, EN 50082, EN 55011

\*T<sub>U</sub> = 23 °C single module

# DC/DC-Signal Conditioners 3-way-isolation 20 kHz

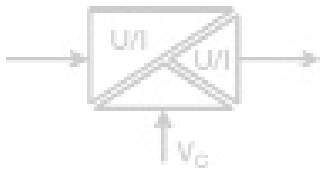
## WAVEANALOG DC/DC 20 kHz

- 3-way-isolation
- Transmission frequency 20 kHz
- Analog signal conditioning
- Cross-connectable voltage supply via cross-connectors

### Approvals:

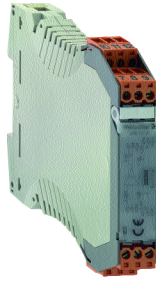


Schematic circuit diagram



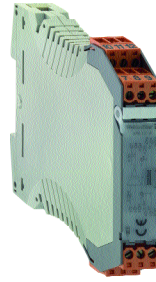
## CCC HF

0 ... 20 mA / 0 ... 20 mA



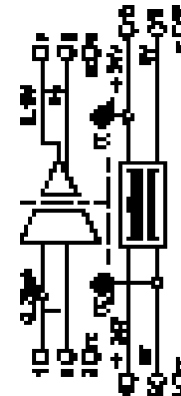
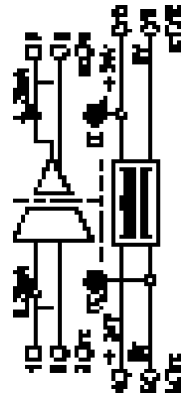
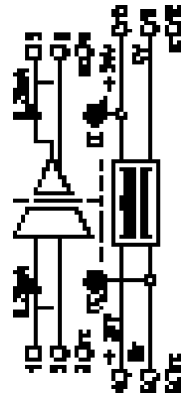
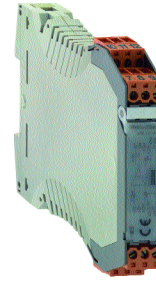
## CCC HF

0 ... 20 mA / 4 ... 20 mA



## CVC HF

0 ... 20 mA / 0 ... 10 V



Ordering data
Screw connection
Tension clamp connection
Input/Output

Technical data**
<b>Input signal</b>
Input current max.
Input resistance
<b>Output signal</b>
Load resistance
Accuracy at Tu=23 °C
Temperature coefficient
Response time
Cut-off frequency (-3 dB)

General Data
Voltage supply
Power consumption
Current carrying capacity of cross-connection
Operating temperature
Storage temperature
Dimensions L/H/W
Approvals

Coordination of insulation according to EN 50178, 04/98
Rated voltage
Rated surge voltage
Overvoltage category
Contamination class
Clearance and creepage distance
Coupling capacity
Input / output to supply
Isolation voltage, voltage strength
Input/output to mounting rail
Standards/Specifications
EMC standards

Type	Part No.
WAS5 CCC HF	8447160000*
WAZ5 CCC HF	8447170000*
0 ... 20 mA / 0 ... 20 mA	

0 ... 20 mA
50 mA
50
0 ... 20 mA
500
< 0.2% of full scale value
250 ppm / K of full scale value
40 µs (typ. 30 µs)
15 kHz (typ. 20 kHz)

24 Vdc ±25% (18 ... 30 Vdc)
< 1.5 W at I <sub>out</sub> = 20 mA
2 A
0 °C ... +55 °C
-20 °C ... +85 °C
92.4 / 112.5 / 17.5 mm
(3.64 / 4.43 / 0.69 in.)
CE, cULus, CSA

300 V
4 kV
III
2
3 mm
1 nF
4 kV <sub>eff</sub> / 1 min
EN 50178
EN 50081, EN 50082, EN 55011

Type	Part No.
WAS5 CCC HF	8447190000
WAZ5 CCC HF	8447200000
0 ... 20 mA / 4 ... 20 mA	

0 ... 20 mA
50 mA
50
4 ... 20 mA
500
< 0.2% of full scale value
250 ppm / K of full scale value
40 µs (typ. 30 µs)
15 kHz (typ. 20 kHz)

24 Vdc ±25% (18 ... 30 Vdc)
< 1.5 W at I <sub>out</sub> = 20 mA
2 A
0 °C ... +55 °C
-20 °C ... +85 °C
92.4 / 112.5 / 17.5 mm
(3.64 / 4.43 / 0.69 in.)
CE, cULus, CSA

300 V
4 kV
III
2
3 mm
1 nF
4 kV <sub>eff</sub> / 1 min
EN 50178
EN 50081, EN 50082, EN 55011

Type	Part No.
WAS5 CVC HF	8447220000
WAZ5 CVC HF	8447230000
0 ... 20 mA / 0 ... 10 V	

0 ... 20 mA
50 mA
50
0 ... 10 V
2 k
< 0.2% of full scale value
250 ppm / K of full scale value
40 µs (typ. 30 µs)
15 kHz (typ. 20 kHz)

24 Vdc ±25% (18 ... 30 Vdc)
< 1.3 W at I <sub>out</sub> = 5 mA
2 A
0 °C ... +55 °C
-20 °C ... +85 °C
92.4 / 112.5 / 17.5 mm
(3.64 / 4.43 / 0.69 in.)
CE, cULus, CSA

300 V
4 kV
III
2
3 mm
1 nF
4 kV <sub>eff</sub> / 1 min
EN 50178
EN 50081, EN 50082, EN 55011

\*\*T<sub>U</sub> = 23 °C single module

\* Input/output 4 ... 20 mA/4 ... 20 mA possible



# DC/DC-Signal Conditioners 3-way-isolation 20 kHz

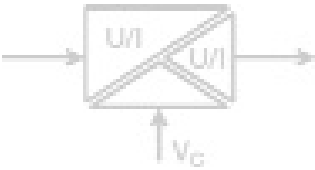
## WAVEANALOG DC/DC 20 kHz

- 3-way-isolation
- Transmission frequency 20 kHz
- Analog signal conditioning
- Cross-connectable voltage supply via cross-connectors

### Approvals:

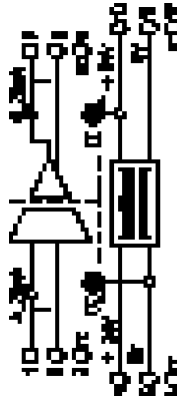
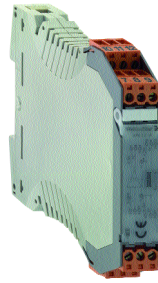


Schematic circuit diagram



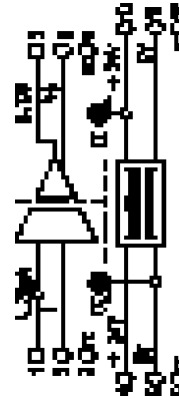
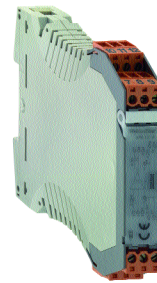
## CCC HF

4 ... 20 mA / 0 ... 20 mA



## CVC HF

4 ... 20 mA / 0 ... 10 V



### Ordering data

Screw connection	Type	Part No.
Tension clamp connection	WAS5 CCC HF	8447250000
Input/Output	WAZ5 CCC HF	8447260000
	4 ... 20 mA / 0 ... 20 mA	

### Technical data\*

<b>Input signal</b>	4 ... 20 mA
Input current max.	50 mA
Input resistance	50
<b>Output signal</b>	0 ... 20 mA
Load resistance	500
Accuracy at $T_U=23\text{ }^\circ\text{C}$	< 0.2% of full scale value
Temperature coefficient	250 ppm / K of full scale value
Response time	40 $\mu\text{s}$ (typ. 30 $\mu\text{s}$ )
Cut-off frequency (-3 dB)	15 kHz (typ. 20 kHz)

### General Data

Voltage supply	24 Vdc $\pm 25\%$ (18 ... 30 Vdc)
Power consumption	< 1.5 W at $I_{out} = 20\text{ mA}$
Current carrying capacity of cross-connection	2 A
Operating temperature	0 $^\circ\text{C}$ ... +55 $^\circ\text{C}$
Storage temperature	-20 $^\circ\text{C}$ ... +85 $^\circ\text{C}$
Dimensions L/H/W	92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)
Approvals	CE, cULus, CSA

### Coordination of insulation according to EN 50178, 04/98

Rated voltage	300 V
Rated surge voltage	4 kV
Overvoltage category	III
Contamination class	2
Clearance and creepage distance	3 mm
Coupling capacity	
Input / output to supply	1 nF
Isolation voltage, voltage strength	
Input/output to mounting rail	4 kVeff / 1 min
Standards/Specifications	EN 50178
EMC standards	EN 50081, EN 50082, EN 55011

\* $T_U = 23\text{ }^\circ\text{C}$  single module

### Ordering data

Screw connection	Type	Part No.
Tension clamp connection	WAS5 CVC HF	8447280000
Input/Output	WAZ5 CVC HF	8447290000
	4 ... 20 mA / 0 ... 10 V	

### Technical data\*

<b>Input signal</b>	4 ... 20 mA
Input current max.	50 mA
Input resistance	50
<b>Output signal</b>	0 ... 10 V
Load resistance	2 k
Accuracy at $T_U=23\text{ }^\circ\text{C}$	< 0.2% of full scale value
Temperature coefficient	250 ppm / K of full scale value
Response time	40 $\mu\text{s}$ (typ. 30 $\mu\text{s}$ )
Cut-off frequency (-3 dB)	15 kHz (typ. 20 kHz)

### General Data

Voltage supply	24 Vdc $\pm 25\%$ (18 ... 30 Vdc)
Power consumption	< 1.3 W at $I_{out} = 5\text{ mA}$
Current carrying capacity of cross-connection	2 A
Operating temperature	0 $^\circ\text{C}$ ... +55 $^\circ\text{C}$
Storage temperature	-20 $^\circ\text{C}$ ... +85 $^\circ\text{C}$
Dimensions L/H/W	92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)
Approvals	CE, cULus, CSA

Rated voltage	300 V
Rated surge voltage	4 kV
Overvoltage category	III
Contamination class	2
Clearance and creepage distance	3 mm
Coupling capacity	
Input / output to supply	1 nF
Isolation voltage, voltage strength	
Input/output to mounting rail	4 kVeff / 1 min
Standards/Specifications	EN 50178
EMC standards	EN 50081, EN 50082, EN 55011

# DC/DC-Signal Conditioners 3-way-isolation 20 kHz

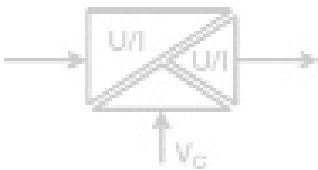
## WAVEANALOG DC/DC 20 kHz

- 3-way-isolation
- Transmission frequency 20 kHz
- Analog signal conditioning
- Cross-connectable voltage supply via cross-connectors

### Approvals:

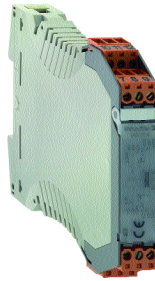


Schematic circuit diagram



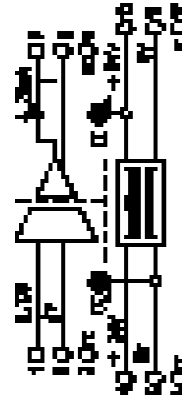
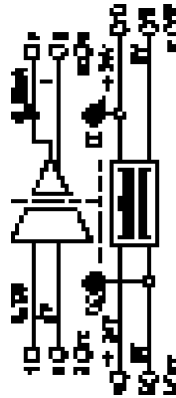
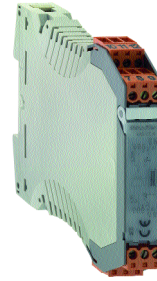
## VCC HF

0 ... 10 V / 0 ... 20 mA



## VCC HF

0 ... 10 V / 4 ... 20 mA



Ordering data
Screw connection
Tension clamp connection
Input/Output

Type	Part No.
WAS5 VCC HF	8447310000
WAZ5 VCC HF	8447320000
0 ... 10 V / 0 ... 20 mA	

Type	Part No.
WAS5 VCC HF	8447340000
WAZ5 VCC HF	8447350000
0 ... 10 V / 4 ... 20 mA	

Technical data*
<b>Input signal</b>
Input voltage max.
Input resistance
<b>Output signal</b>
Load resistance
Accuracy at Tu=23 °C
Temperature coefficient
Response time
Cut-off frequency (-3 dB)

0 ... 10 V
15 V
500 k
0 ... 20 mA
500
± 0.2% of full scale value
250 ppm / K of full scale value
40 µs (typ. 30 µs)
15 kHz (typ. 20 kHz)

0 ... 10 V
15 V
500 k
4 ... 20 mA
500
± 0.2% of full scale value
250 ppm / K of full scale value
40 µs (typ. 30 µs)
15 kHz (typ. 20 kHz)

General Data
Voltage supply
Power consumption
Current carrying capacity of cross-connection
Operating temperature
Storage temperature
Dimensions L/H/W
Approvals

24 Vdc ±25% (18 ... 30 Vdc)
< 1.5 W at I <sub>out</sub> = 20 mA
2 A
0 °C ... +55 °C
-20 °C ... +85 °C
92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)
CE, cULus, CSA

24 Vdc ±25% (18 ... 30 Vdc)
< 1.5 W at I <sub>out</sub> = 20 mA
2 A
0 °C ... +55 °C
-20 °C ... +85 °C
92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)
CE, cULus, CSA

Coordination of insulation according to EN 50178, 04/98
Rated voltage
Rated surge voltage
Overvoltage category
Contamination class
Clearance and creepage distance
Coupling capacity
Input / output to supply
Isolation voltage, voltage strength
Input/output to mounting rail

300 V
4 kV
III
2
3 mm
1 nF
4 kVeff / 1 min

300 V
4 kV
III
2
3 mm
1 nF
4 kVeff / 1 min

Standards/Specifications
EMC standards

EN 50178
EN 50081, EN 50082, EN 55011

EN 50178
EN 50081, EN 50082, EN 55011

\*T<sub>U</sub> = 23 °C single module

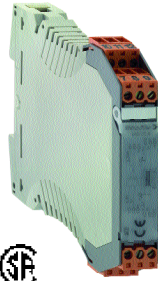
# DC/DC-Signal Conditioners 3-way-isolation 20 kHz

## WAVEANALOG DC/DC 20 kHz

- 3-way-isolation
- Transmission frequency 20 kHz
- Analog signal conditioning
- Cross-connectable voltage supply via cross-connectors

## VVC HF

0 ... 10 V / 0 ... 10 V



Approvals:



## VVC HF

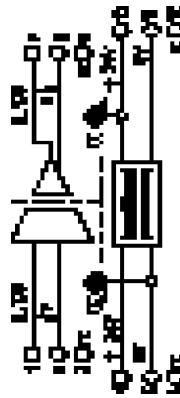
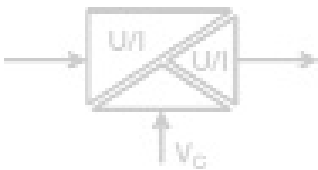
-10 ... +10 V / -10 ... +10 V



Approvals:



Schematic circuit diagram



Ordering data
Schraubanschluß
Zugfederanschluß
Input/Output

Type	Part No.
WAS5 VVC HF	8447370000
WAZ5 VVC HF	8447380000
0 ... 10 V / 0 ... 10 V	

Type	Part No.
WAS5 VVC HF	8561610000
WAZ5 VVC HF	8587000000
±10 V / ±10V	

Technical data*
<b>Input signal</b>
Input voltage max.
Input resistance
<b>Output signal</b>
Load resistance
Accuracy at Tu=23 °C
Temperature coefficient
Response time
Cut-off frequency (-3 dB)

0 ... 10 V
15 V
500 k
0 ... 10 V
2 k
± 0.2% of full scale value
250 ppm / K of full scale value
40 µs (typ. 30 µs)
15 kHz (typ. 20 kHz)

-10 ... + 10 V
± 15 V
500 k
-10 ... + 10 V
2 k
± 0.2% of measurement range
250 ppm / K of measurement range
40 µs (typ. 30 µs)
15 kHz (typ. 20 kHz)

General Data
Voltage supply
Power consumption
Current carrying capacity of cross-connection
Operating temperature
Storage temperature
Dimensions L/H/W
Approvals

24 Vdc ±25% (18 ... 30 Vdc)
< 1.3 W at I <sub>out</sub> = 5 mA
2 A
0 °C ... +55 °C
-20 °C ... +85 °C
92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)
CE, cULus, CSA

24 Vdc ±25% (18 ... 30 Vdc)
< 1.3 W at I <sub>out</sub> = 5 mA
2 A
0 °C ... +55 °C
-20 °C ... +85 °C
92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)
CE, cULus

Coordination of insulation according to EN 50178, 04/98
Rated voltage
Rated surge voltage
Overvoltage category
Contamination class
Clearance and creepage distance
Coupling capacity
Input / output to supply
Isolation voltage, voltage strength
Input/output to mounting rail

300 V
4 kV
III
2
3 mm
1 nF
4 kVeff / 1 min

300 V
4 kV
III
2
3 mm
1 nF
4 kVeff / 1 min

Standards/Specifications
EMC standards

EN 50178
EN 50081, EN 50082, EN 55011

EN 50178
EN 50081, EN 50082, EN 55011

\*T<sub>U</sub> = 23 °C single module

# ADVANTAGES ...

The **WAVEANALOG PRO** is a universal, isolating signal conditioner that converts current and voltage signals to standard signals in accordance with IEC 381. **WAVEANALOG PRO** settings are easily carried out via DIP switches; an additional calibration is no longer necessary, although possible, to enable adjustments to be made to the signal. The software "**WAVEtool**" is available to provide support when making the settings. **Wavetool** describes the necessary steps to configure the module once the required input and output ranges have been entered.

The **WAVEANALOG PRO** is supplied with power via an internal, wide voltage-range power supply unit; thus increase the flexibility and use anywhere in the system.

Product features:

Wide voltage-range power supply unit from 20...253Vac/dc

Extremely slim design, 12.6 mm mounting width

Low power loss

Operates independent of mounting position

440 pre-programmed configurations

Input signals:  
voltage: 20mV...200Vdc,  
current: 1mA...50mA, uni and bipolar

Output signals:  
voltage : max.  $\pm 10V$ ;  
current : max.  $\pm 20 mA$

The offline configuration assistant "**WAVEtool**" supports the configuration and creates module-specific documentation

Operation indicator LED

Fine calibration via switchable potentiometers possible

Selectable transmission frequency between 10Hz and 10 kHz enables response time to be optimized

Further features  
**WAVEBOX**

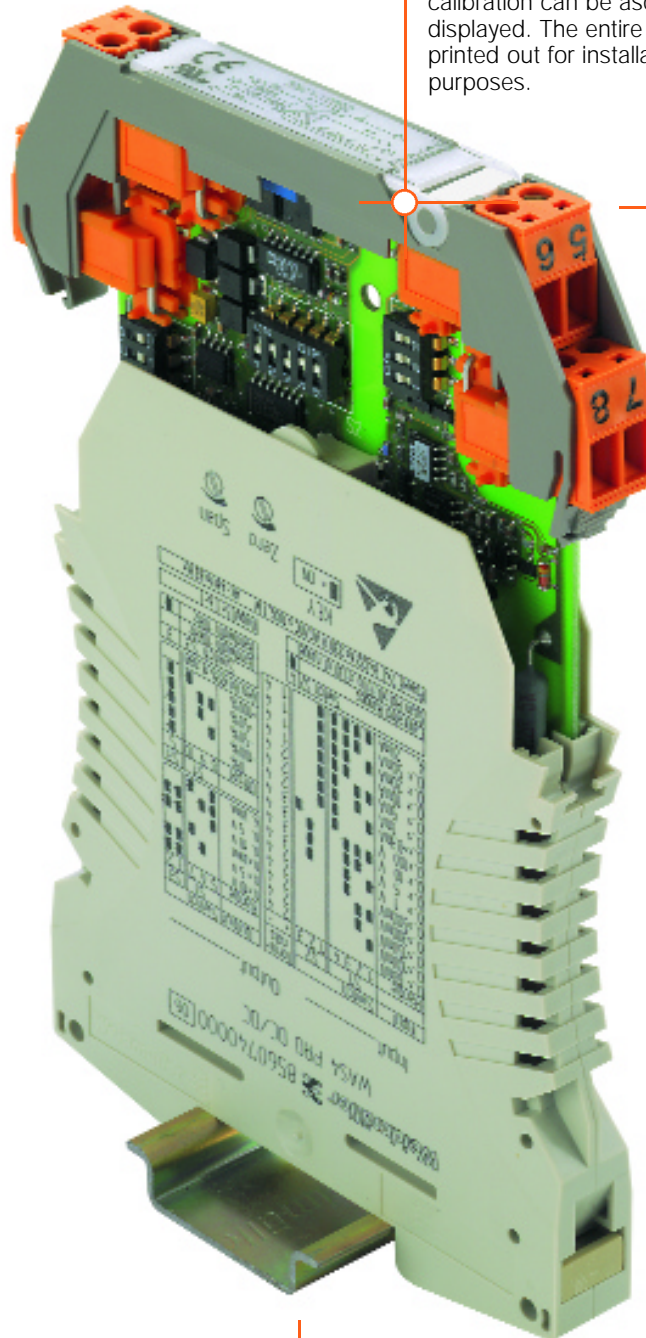
Approvals: 

Protective separation according to EN 50178

## WAVEtool

The service tool enables fast and uncomplicated configuration of the **WAVEANALOG PRO**. By simply entering the required input and output parameters, the program determines the correct switch settings and gives instructions for correctly connecting the module.

If required, the necessary values for a calibration can be ascertained and displayed. The entire process can be printed out for installation documentation purposes.

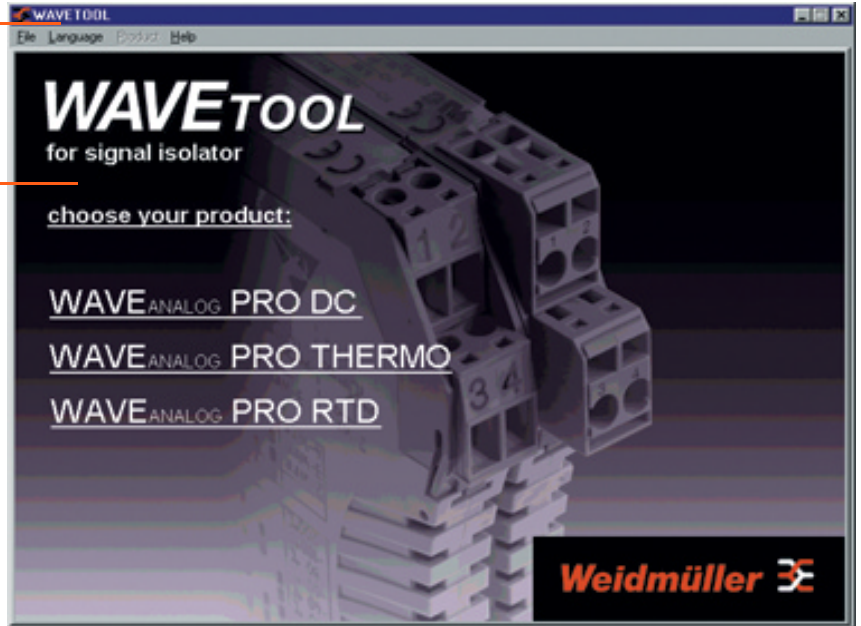


## Setting

440 pre-configured input and output settings can easily be selected via DIP switches. It is also possible to alter the transmission frequency via DIP switches. A further calibration is no longer necessary for the pre-programmed ranges.

**Download:**

[www.weidmuller.com](http://www.weidmuller.com)  
Products  
Downloads



**WAVE TOOL**  
for signal isolator **WAVE ANALOG PRO RTD**

**Notes:** Weidmüller Interface GmbH

**Brand:** Type: RTD100 4-wire  
Start value: 0°C / 32°F  
End value: 150°C / 302°F

**Output:** Output voltage: 0...10 V  
Response time: slow 2.5s  
Pre-calibration: off

**Settings:** Adjust switches

**Terminal 1:** RTD+ (Source)  
**Terminal 2:** Sense  
**Terminal 3:** RTD- (Source)  
**Terminal 4:** Sense

**Terminal 5:** Output 0...10 V  
**Terminal 6:** Gnd

**Terminal 10:** Power supply +18...30 V DC  
**Terminal 11:** Gnd

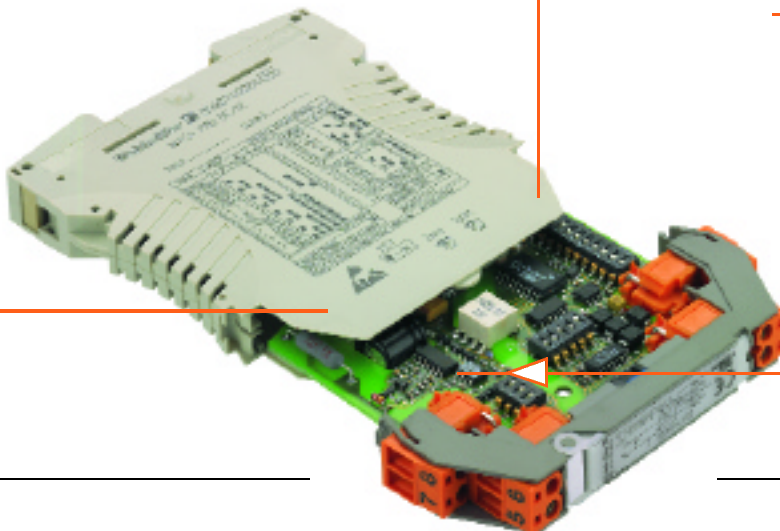
**Weidmüller**

**Wide-range power supply unit**

The wide-range power supply unit in the **WAVE ANALOG PRO DC/DC** makes it possible to use the module in all common voltage supply systems worldwide. The module can be operated with DC or AC voltages from 20 to 253 V. The AC voltages can be in the 48...62 Hz range.

**Switchable fine calibration**

To be able to set the module to suit applications with ranges other than the pre-programmed ranges, the **WAVE ANALOG PRO DC/DC** offers the option of switching in zero and span potentiometers via DIP switches. This allows the span to be adjusted by  $\pm 25\%$  of the measuring span of the selected output range and the zero to 0.3...3.33 x end value of the selected input range.



# DC/DC-Signal Conditioners - configurable

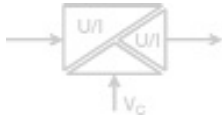
## WAVEANALOG PRO DC/DC

- Universally adjustable by DIP-switches
- Adjustment help via Internet
- 3-way-isolation
- Voltage supply from 20 - 230 V ac/dc
- Low power loss
- Adjustable transmission frequency
- Indication LED

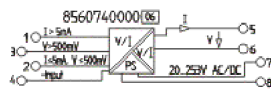
### Approvals:



### Schematic circuit diagram



## PRO DC/DC



### Ordering data

Screw connection

Tension clamp connection

Input/Output

### Technical data\*

#### Input (adjustable)

Voltage uni-/bipolar adjustable

Voltage calibrated ranges

Current uni-/bipolar adjustable

Current calibrated ranges

Input resistance

at current input range < 5 mA / > 5 mA

at voltage input

Input capacity

at current input

Voltage input range < 500 mV / > 500 mV

Overload capacity

at current input range < 5 mA / > 5 mA

at voltage input range < 500 mV / > 500 mV

#### Output (adjustable)

Voltage uni-/bipolar adjustable

Voltage calibrated ranges

Current uni-/bipolar adjustable

Current calibrated ranges

Offset

Load resistance

at output current

at output voltage

Offset

Residual ripple

Adjustment zero pot.

Adjustment span pot.

Gain error

Temperature coefficient

Cut-off frequency

### General Data

Voltage supply

Power consumption

Frequency range

Operating temperature

Storage temperature

Factory setting

Dimensions L/H/W

Weight

Approvals

### Coordination of insulation according to EN 50178, 04/98

Rated voltage

Rated surge voltage

Overvoltage category

Contamination class

Test voltage

Standards/specifications

EMC standards

Type

WAS4 PRO DC/DC

WAZ4 PRO DC/DC

configurable

Part No.

8560740000

8560750000

20 mV ... 200 V

0 ... ±60 mV, 0 ... ±100 mV, 0 ... ±150 mV, 0 ... ±300 mV,

0 ... ±500 mV, 0 ... ±1V, 0 ... ±5V, 0 ... ±10 V, 0 ... ±100 V

0.1 mA ... 100 mA

0 ... ±0.3 mA, 0 ... ±1 mA, 0 ... ±5 mA, 0 ... ±16 mA,

0 ... 20 mA, 0 ... 50 mA

approx. 100 / approx. 5

approx. 1 M

approx. 1 nF

approx. 1 nF / approx. 500 pF

< 75 mA / < 300 mA

max. < 20 mA / < 3 mA continuous current

0 ... 10 V

0 ... ±10 V, 2 ... 10 V, 0 ... ±5 V, 1 ... 5 V

0 ... 20 mV

0 ... ±20 mA, 4 ... 20 mA

-100%, -50%, 0%, 50%, 100% of measuring span of the chosen output range

< 12 V (600 at 20 mA)

< 10 mA (1 K at 10 V)

20 µA or 10 mV

< 10 mVeff

+25% measuring span of the chosen output range

0.33 ... 3.30 x end value of chosen input range

< 0.1% of full scale value

< 60 ppm/K of full scale value

> 10 kHz, < 10 Hz selectable

20 ... 230 V ac/dc ±10%

approx. 1 W

48 ... 62 Hz

-10 °C ... +70 °C

-40 °C ... +85 °C

0 ... 10 V / 0 ... 10 V 10 Hz

92.4 / 112.5 / 12.5 mm (3.64 / 4.43 / 0.49 in.)

approx. 100 g (0.22 lbs.)

CE, cULus, GL

600 V

5 kV, 1.2/50 us, acc. to IEC 255-4

III

2

4 Kveff input against output against auxiliary power

EN 50178

DIN EN 61326, EN 61326/A1, EN 50081-2, EN 61000-6-2

### Adjustment help WAVEtool

The service tool enables quick and uncomplicated configuration of WAVEANALOG PRO. Download from Internet: [www.weidmuller.com](http://www.weidmuller.com)

Products

Downloads (see page 29)

### Switch position/setting options

Input	S1	Switch							
		S2				S3			
Input range		1	2	3	4	1	2	3	4
0 ... ±60 mV		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
0 ... ±100 mV		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
0 ... ±150 mV		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
0 ... ±300 mV		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
0 ... ±500 mV		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
0 ... ±1 V		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
0 ... ±5 V		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
0 ... ±10 V		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
0 ... ±100 V		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
0 ... ±0.3 mA		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
0 ... ±1 mA		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
0 ... ±5 mA		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
0 ... ±10 mA		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
0 ... ±20 mA		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
0 ... ±50 mA		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4 ... ±20 mA*		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

\*Offset conversion not calibrated

Switch S2 4	
calibrated ranges	<input type="checkbox"/>
Span pot. activated: input range x 0.33 ... x 3.30	<input type="checkbox"/>

Output	Output range	Switch				
		S1		S3		
		5	6	7	1	2
0 ... ±10 V		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2 ... 10 V		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
0 ... ±5 V		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1 ... 5 V		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
0 ... ±20 mA		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 ... 20 mA		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Offset (in % of output voltage)	S1		S2
	8	9	10
0 %	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
-100 %	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
-50 %	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
+50 %	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
+100 %	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Zero pot. activated: additional ±25 %

Switch S3		3
Bandwidth 10 kHz		<input type="checkbox"/>
Bandwidth 10 Hz		<input checked="" type="checkbox"/>

Set range can be documented on side of housing.

■ = on

□ = off

\*T<sub>U</sub> = 23 °C single module

# DC/DC-Signal Conditioners - configurable

## MICROANALOG DC/DC select

- 3-way isolation between Input, output and supply voltage
- Calibrated selectable by DIP-switches
- Cross-connectable voltage supply via cross-connectors
- Low heat dissipation

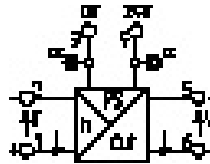
## DC/DC select



### Approvals:



Schematic circuit diagram



### Ordering data

Screw connection	
Tension clamp connection	

### Type Part No.

MAS DC/DC select	<b>8594810000</b>
MAZ DC/DC select	<b>8594840000</b>

### Technical data\*

<b>Input</b> (calibrated selectable)	0...10 V / 4...20 mA / 0...20 mA (factory setting)
Input resistance	
Input current (Voltage drop)	< 0.1 V at 20 mA
Input voltage	100 kOhm
Overload	
Input current	< 100 mA
Input voltage	max. 30 V, 3 mA
<b>Output</b> (selectable)	0...10 V / 4...20 mA / 0...20 mA (factory setting)
Load resistance	
Output current	500 Ohm
Output voltage	10 kOhm
Residual ripple	< 20 mV <sub>eff</sub>
Transmission error	< 0.5 % of full scale value
Temperature coefficient	< 150 ppm/K of full scale value
Cut-off frequency	> 100 Hz

### General Data

Supply voltage	24 Vdc (±15%)
Power consumption	approx. 0.6 W
Operating temperature	0...+55 °C
Storage temperature	-25 °C...+85 °C
Approvals	CE, cULus
Dimensions L/H/W	88 / 98 / 6.1 mm (3.46 / 3.86 / 0.24 in.)

### Coordination of insulation according to DIN EN50178, 04/98

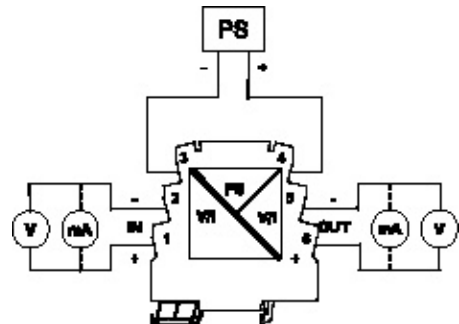
Rated voltage	50 V
Test voltage	500 V
Overvoltage category	II
Contamination class	2

\* Tu 20 °C

Input	Output	Switch							
		S1		S2					
		1	2	1	2	3	4	5	6
0 ... 20 mA	0 ... 20 mA	■	□	□	□	□	■	□	□
0 ... 20 mA	4 ... 20 mA	■	□	□	□	□	■	□	□
0 ... 20 mA	0 ... 10 V	■	□	□	□	□	■	□	■
4 ... 20 mA	0 ... 20 mA	■	□	■	■	■	■	□	□
4 ... 20 mA	4 ... 20 mA	■	□	□	□	□	■	□	□
4 ... 20 mA	0 ... 10 V	■	□	■	■	■	■	□	■
0 ... 10 V	0 ... 20 mA	□	□	□	□	□	□	□	□
0 ... 10 V	4 ... 20 mA	□	■	□	□	■	□	□	□
0 ... 10 V	0 ... 10 V	□	□	□	□	□	□	□	■

■ = on  
□ = off

### Connection



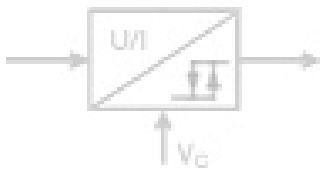
## DC Alarm Conditioners

The Setpoint Controller allows cost effective units to be built for monitoring analog signals. An upper and lower limit value, which covers the entire signal range, can be set by the user via 2 potentiometers. The respective statuses of the upper and lower limit value are indicated at the 2 digital outputs (upper limit value under/over flow; lower limit value under/over flow).

### Approvals:



### Schematic circuit diagram



### Ordering data

for TS 35

### Technical data

#### Voltage supply

Supply voltage

Supply current

#### Input

Input voltage

Input resistance

Voltage drop at full scale

max. input current

Cut-off frequency

#### Transmission behaviour

Threshold voltage ranges of  $U_{th}$

Setting of switching threshold

Hysteresis of switching threshold

Function of output 1

Function of output 2

Response time

#### Output

Output current per output

Voltage drop at output transistor

#### Insulation coordination/safe separation to EN 50178

Separation input / output

Dielectric strength I/O to mounting rail

Ambient temperature

Storage temperature

Conductor

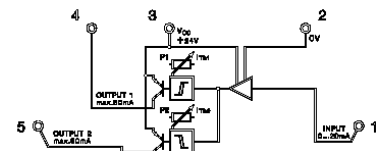
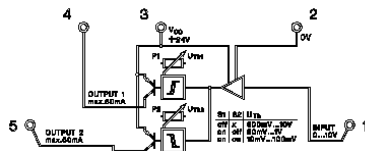
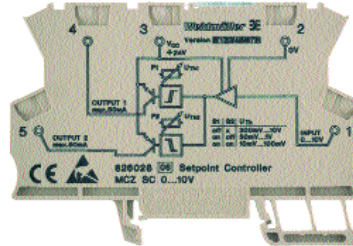
Conductor cross-section

Approvals

Overall width

## MCZ SC 0...10 Vdc

## MCZ SC 0...20 mA



Type	Part No.
MCZ SC 24 V/0...10V	8260280000

Type	Part No.
MCZ SC 24 V/0...20 mA	8227350000

Supply voltage	24 Vdc $\pm$ 20 %																
Supply current	15 mA																
Input voltage	0...10 V																
Input resistance	60 k																
Voltage drop at full scale																	
max. input current																	
Cut-off frequency	100 Hz																
Threshold voltage ranges of $U_{th}$	<table border="1"> <thead> <tr> <th></th> <th>S1</th> <th>S2</th> <th>Temperature coefficient <math>T_k</math></th> </tr> </thead> <tbody> <tr> <td>10...100 mV</td> <td>on</td> <td>on</td> <td>500 ppm max.</td> </tr> <tr> <td>0.03...1 V</td> <td>on</td> <td>off</td> <td>250 ppm max.</td> </tr> <tr> <td>0.3...10 V</td> <td>off</td> <td>x</td> <td>250 ppm max.</td> </tr> </tbody> </table>		S1	S2	Temperature coefficient $T_k$	10...100 mV	on	on	500 ppm max.	0.03...1 V	on	off	250 ppm max.	0.3...10 V	off	x	250 ppm max.
	S1	S2	Temperature coefficient $T_k$														
10...100 mV	on	on	500 ppm max.														
0.03...1 V	on	off	250 ppm max.														
0.3...10 V	off	x	250 ppm max.														
Setting of switching threshold	via 2 potentiometers (12 turns)																
Hysteresis of switching threshold	1 % of full scale value																
Function of output 1	active High for $U_{input} < U_{th1}$ (set via P1)																
Function of output 2	active High for $U_{input} > U_{th2}$ (set via P2)																
Response time	< 250 $\mu$ s (switch threshold at 90% of the max. input signal; $R_L$ 1 k $\Omega$ )																
Output	2 channel switching PNP																
Output current per output	max. 50 mA																
Voltage drop at output transistor	< 1.2 V at 50 mA																
Separation input / output	none																
Dielectric strength I/O to mounting rail	4 kVeff / 1 min																
Ambient temperature	0 $^{\circ}$ C...+50 $^{\circ}$ C																
Storage temperature	-25 $^{\circ}$ C...+60 $^{\circ}$ C																
Conductor	AWG 22...12																
Conductor cross-section	1.5 mm <sup>2</sup>																
Approvals	CE, cULus, CSA																
Overall width	6 mm (0.24 in.)																

Supply voltage	24 Vdc $\pm$ 20 %
Supply current	15 mA
Input voltage	0.5...20 mA
Input resistance	50
Voltage drop at full scale	1 V
max. input current	40 mA
Cut-off frequency	100 Hz
Temperature coefficient $T_k$	250 ppm max.
Setting of switching threshold	via 2 potentiometers (12 turns)
Hysteresis of switching threshold	1 % of full scale value
Function of output 1	active High for $I_{input} < I_{th1}$ (set via P1)
Function of output 2	active High for $I_{input} > I_{th2}$ (set via P2)
Response time	< 250 $\mu$ s (switch threshold at 90% of the max. input signal; $R_L$ 1 k $\Omega$ )
Output	2 channel switching PNP
Output current per output	max. 50 mA
Voltage drop at output transistor	< 1.2 V at 50 mA
Separation input / output	none
Dielectric strength I/O to mounting rail	4 kVeff / 1 min
Ambient temperature	0 $^{\circ}$ C...+50 $^{\circ}$ C
Storage temperature	-25 $^{\circ}$ C...+60 $^{\circ}$ C
Conductor	AWG 22...12
Conductor cross-section	1.5 mm <sup>2</sup>
Approvals	CE, cULus, CSA
Overall width	6 mm (0.24 in.)



# DC Alarm Conditioners

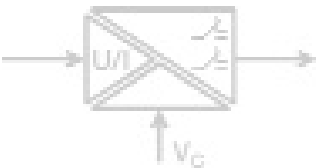
## WAVEANALOG DC/Alarm

- 3-way-isolation
- Low trip / high trip
- FAILSAFE / NON FAILSAFE
- 1 relay per setpoint 250V ac @ 3A

### Approvals:



### Schematic circuit diagram



### Ordering data

Screw connection

Tension clamp connection

### Technical data\*

#### Input

Input voltage

Input resistance

Input current

Input resistance

#### Output

Relay

Relay type

Contact material

Switching voltage

max. switching voltage

Permanent current ac

Switching load ac

Status indication

Mechanical lifetime (Switching cycles)

Electrical lifetime (Switching cycles at max. load)

Threshold

Hysteresis

Temperature coefficient

Repeatability

### Coordination of insulation according to EN 50178, 04/98

Rated voltage

Rated surge voltage

Overvoltage category

Contamination class

Clearance and creepage distance

Test voltage

### General Data

Supply voltage

Power consumption

Current carrying capacity of cross-connection

Operating temperature

Storage temperature

Standards/Specifications

EMC standards

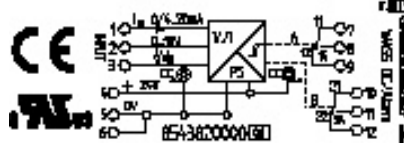
Dimensions L/H/W

Weight

Approvals

\* Tu 23 °C, single module

## DC/Alarm



### Type

WAS5 DC/Alarm

WAZ5 DC/Alarm

### Part No.

8543820000

8543880000

0...10 V

≥ 100 k

0/4...20 mA

≤ 110

1 relay per channel

1 change over (SPDT)

AgNi 90/10

253 Vac

253 Vac

3 A

750 VA

1 red LED per channel for alarm indication,

power on: green LED

15 x 10<sup>6</sup> operations

10<sup>5</sup>

1...90% (independent for channel 1 & 2)

1...10% (independent for channel 1 & 2)

≤ 500 ppm/K

max. ± 0.3 % from full scale value

10 V or 20m A

300 V

4 kV

III

2

3 mm

4 kV<sub>eff</sub>

18 Vdc...24 Vdc...30 Vdc

typ. 1 W both relay detected

2 A

0...+55 °C (mounted on horizontal DIN rail)

-20 °C...+85 °C

EN 50178

EN 50082-2, EN 50081-1, EN 50081-2 EN 55011

92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)

150 g (0.33 lbs.)

CE, cULus

Function	SW 1			
	1	2	3	4
Channel A High Trip	■			
Channel A Low Trip	□			
Channel B High Trip		■		
Channel B Low Trip		□		
FAILSAFE, Channel 1 & 2			□	□
NON FAILSAFE, Channel 1 & 2			■	■

■ = on  
□ = off

NON FAILSAFE: The relay picks up when the alarm is triggered.  
FAILSAFE: The relay drops out when the alarm is triggered. An alarm is also triggered in the FAILSAFE mode, if for example, the operating voltage to the module fails.

Low trip: Alarm is triggered if the signal is undershoot the threshold.

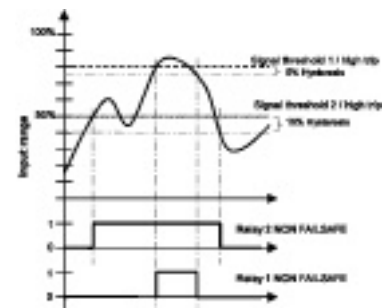
High trip: Alarm is triggered if the signal is overshoot the threshold.

Signal threshold: Adjustments of the signal threshold (1...90)% are made for channel 1 with the potentiometer P1, and separately for channel 2 via potentiometer P2.

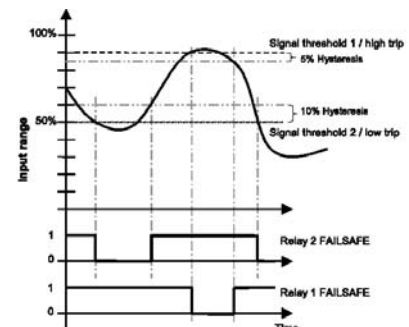
Hysteresis: Adjustments of the hysteresis (1...90)% are made for channel 1 with the potentiometer P3, and separately for channel 2 via potentiometer P4.

## WAVEANALOG DC/Alarm – Alarm indication

### Example 1



### Example 2



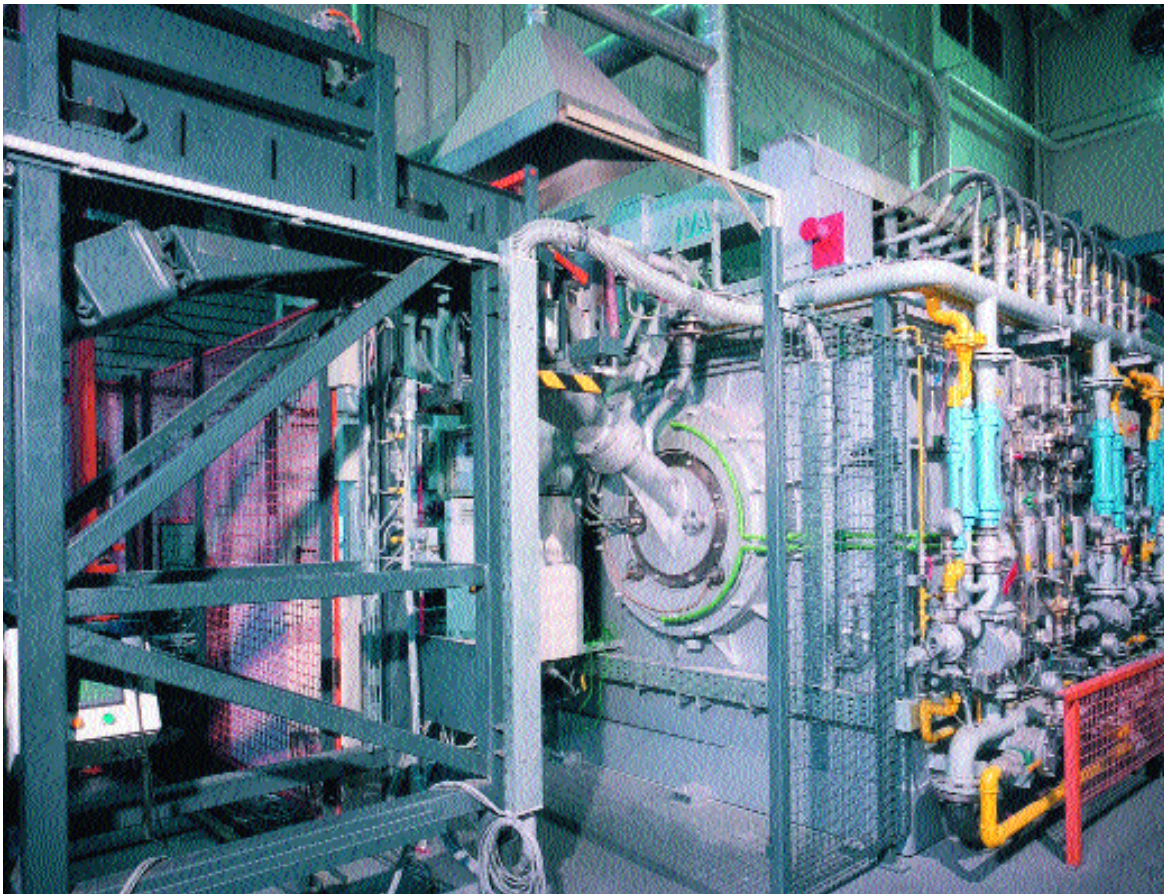
### Signal monitoring and temperature conversion

Reliable recording and monitoring of temperature is important in a number of industries. In industrial processes the point of measurement is very often some distance from the point of the measured value process, for example in the case of melting and annealing furnaces a central data processing system is required. Here the measured values are fed to regulators or recording units to guarantee optimum process control. Two measurement methods are predominantly used today to record temperature in the industrial field. First the **resistance thermometer** (e.g. PT 100), which makes use of the fact that the electrical resistance of an electrical conductor varies with temperature, a distinction being made between cold and hot conductors. For an exact temperature measurement the resistance value

must be recorded, linearized and converted to a temperature-proportional analog signal. Here a distinction is made between 2-, 3- and 4- wire temperature records. The applications of these different versions depend essentially on the distance between the measuring point and the place where the signals are further processed. Second, there are **thermocouples**. Here use is made of the effect that a voltage, which increases with temperature, is generated at the point of connection between two different metals. They have the distinct advantage over resistance thermometers that they have a higher upper temperature limit of up to several thousand degrees Celsius. A common area of application includes furnaces, measurements in charges, plastic injection moulding and aluminium die casting machines

with temperatures above approximately 250° Celsius. Here signal separating converters perform an important function. First they separate signals between the harsh industrial environment and the series-connected electronics to protect against destruction. They also eliminate potential differences caused by long distances. Second they convert small temperature recorder signals to standard signals to minimize measuring errors. The sensor-specific shortcomings, such as cold point and linearization errors, are also reduced to a minimum.

Figure: Hardening shop furnace



# PT100/2- /3-wire Signal Conditioners (Output loop powered)

## MCZ PT100/3 CLP

- for 2 and 3 wire sensors

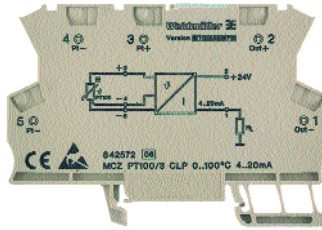
The temperature module converts measurement values from a PT 100 into analog measurement signals. The module supplies the sensor with power. The module is distinguished by its accuracy and linearity.

### Approvals:

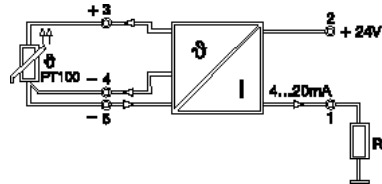


## MCZ PT100/3 CLP

0...100 °C / 0...120 °C / 0...150 °C / 0...200 °C / 0...300 °C  
 -50...+150 °C / -40...100 °C



### Schematic circuit diagram



### Ordering data

for TS 35

### Technical data

#### Input

Connection
Max. wire resistance
Leadwire resistance effect
Supply current

#### Output

Load resistance
Supply voltage
Residual ripple of supply voltage
Set time
Accuracy
Linearity
Temperature coefficient

Open circuit recognition

#### EMC

#### Approvals

Ambient temperature
Storage temperature
Conductor
Conductor cross-section
Overall width

\* Putting a bridge between Pins 4 and 5

### Type

Type	Part No.
MCZ PT100/3 CLP 0...100 °C	8425720000
MCZ PT100/3 CLP 0...120 °C	8483680000
MCZ PT100/3 CLP 0...150 °C	8604420000
MCZ PT100/3 CLP 0...200 °C	8473010000
MCZ PT100/3 CLP 0...300 °C	8473020000
MCZ PT100/3 CLP -50...+150 °C	8473000000
MCZ PT100/3 CLP -40...100 °C	8604430000

### PT 100 (according to IEC 751)

3- Conductor / 2- Conductor*
each 50
max. 0.006 °C/
0.8 mA
<b>4...20 mA**</b>
750 at 24 V
max: 30V/min: 9V+20mA x RL
max: 1.5 V at 100 Hz
10 ms
type. 0.2 % max. 0.5 % v. FSR
<0.1 % v. FSR
max. ±250 ppm/°C

yes

EMVG
EN 50081-1
EN 50082-2
CE, cULus, CSA

0 °C...+50 °C
-20 °C...+85 °C
AWG 22...12
1.5 mm <sup>2</sup>
6 mm (0.24 in.)

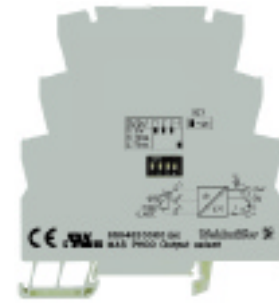
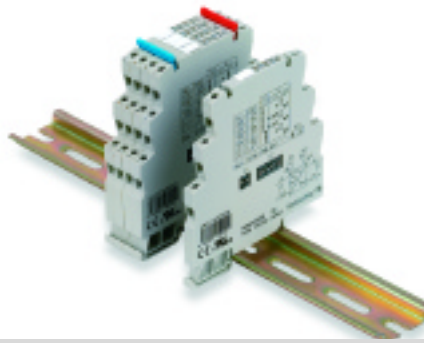
\*\* current loop supplied

# PT100/2- /3-wire Signal Conditioners

## MICROANALOG PT100 Output select

- 2-way isolation between input, output and supply voltage
- PT100 2-/3-wire
- Output calibrated selectable by DIP-switches

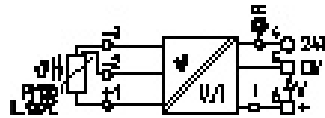
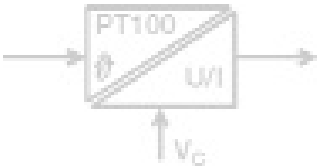
## PT100 Output select



### Approvals:



### Schematic circuit diagram



### Ordering data

Screw connection	
Tension clamp connection	

Type	Part No.
MAS PT100 Output select	8594820000
MAZ PT100 Output select	8594850000

### Technical data\*

Input (fix)	
Temperature range	0...100 °C
Sensor current	0.8 mA
Output (calibrated selectable)	0...10 V / 4...20 mA / 0...5V / 0...20mA (factory setting)
Load resistance	
Output current	< 400 Ohm @ providing 24Vdc
Output voltage	> 10 kOhm
Transmission error/accuracy	< 0.5 % of selected range
Temperature coefficient	< 250 ppm/K of selected range
Response time	< 0.7 sec.

PT 100 2-/3-Wire (2-Wire-Connection by putting bridge between 2 + 3)
---

### General Data

Voltage supply	24 Vdc (±10%)
Power consumption	approx. 0.6 W
Operating temperature	0...+55 °C
Storage temperature	-25 °C...+85 °C
Approvals	CE, cULus
Dimensions L/H/W	88 / 98 / 6.1 mm (3.46 / 3.86 / 0.24 in.)

24 Vdc (±10%)
approx. 0.6 W
0...+55 °C
-25 °C...+85 °C
CE, cULus
88 / 98 / 6.1 mm (3.46 / 3.86 / 0.24 in.)

### Coordination of insulation according to DIN EN50178, 04/98

Rated voltage	100 V
Test voltage	500 V
Overvoltage category	III
Contamination class	2

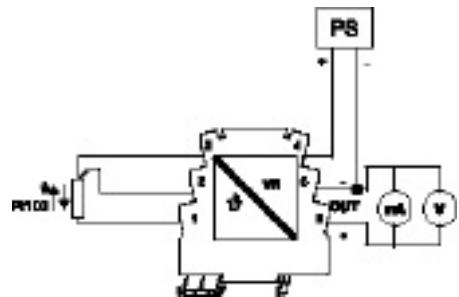
100 V
500 V
III
2

\* Tu 20 °C

Output	Switch			
	1	2	3	4
0 ... 10 V	■	■	■	□
0 ... 20 mA	□	□	□	□
4 ... 20 mA	□	□	□	■

■ = on  
□ = off

### Connection



# PT100/2-wire Signal Conditioners

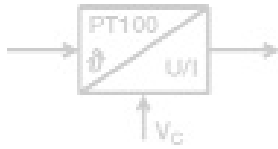
## WAVEANALOG PT100 select

- 2-wire technology
- Configurable temperature range  
-200 °C ... +800 °C
- Configurable output current range  
0 ... 20 mA / 4 ... 20 mA
- Cross-connectable voltage supply  
via cross-connectors

## Approvals:

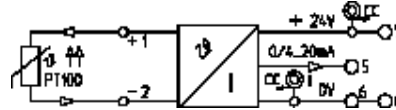
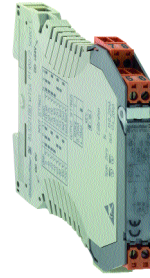


### Schematic circuit diagram



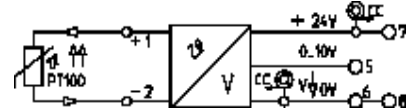
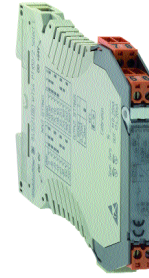
## PT100/2

0(4) ... 20 mA



## PT100/2

0 ... 10 V



### Ordering data

Screw connection
Tension clamp connection
Input/Output

### Type

WTS4 PT100/2 C	Part No. 8432210000*
WTZ4 PT100/2 C	8432220000*
PT100/2 / 0(4) ... 20 mA	

### Type

WTS4 PT100/2 V	Part No. 8432180000*
WTZ4 PT100/2 V	8432190000*
PT100/2 / 0 ... 10 V	

### Technical data\*\*\*

<b>Input signal</b>
Temperature range
Supply current
<b>Output signal</b>
Load resistance
Accuracy at Tu=23 °C
Temperature coefficient
Measurement range 200 K
100 K measurement range < 200 K
40 K measurement range < 100 K

### PT100/2- wire

-200 ... +800 °C
1.45 mA
0(4) ... 20 mA
500
± 0.5% of measurement range
200 ppm / °C (typ. 80 ppm / °C)
250 ppm / °C (typ. 100 ppm / °C)
500 ppm / °C

### PT100/2- wire

-200 ... +800 °C
1.45 mA
0 ... 10 V
1 k
± 0.5% of measurement range
200 ppm / °C (typ. 80 ppm / °C)
250 ppm / °C (typ. 100 ppm / °C)
500 ppm / °C

### General Data

Voltage supply
Power consumption
Current carrying capacity of cross-connection
Operating temperature
Storage temperature

24 Vdc ±20% (19.2 ... 28.8 Vdc)
< 48 mA at Iout = 20 mA
2 A
0 °C ... +55 °C
-20 °C ... +85 °C

24 Vdc ±20% (19.2 ... 28.8 Vdc)
< 38 mA at Iout = 10 mA
2 A
0 °C ... +55 °C
-20 °C ... +85 °C

### Standards/specifications

EMC standards
Dimensions L/H/W

EN 50178, IEC 751
EN 50081, EN 50082, EN 55011
92.4 / 112.5 / 12.5 mm (3.64 / 4.43 / 0.49 in.)

EN 50178, IEC 751
EN 50081, EN 50082, EN 55011
92.4 / 112.5 / 12.5 mm (3.64 / 4.43 / 0.49 in.)

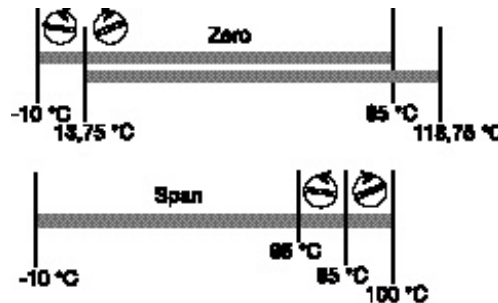
### Approvals

\* without balancing  
\*\*\* Tu = 23 °C single module

### Example for Zero and Span

#### Temperature adjustment:

Tmin	-10 °C
Span	75 ... 110 °C
Span	95 °C
Adjustment of Span	+ 25 %



### Switch position/setting options

Tmin	1	2	3	Span	4	5	6
0 °C	■	■	■	40 ... 50 °C	■	■	■
-10 °C	■	■	□	50 ... 75 °C	■	■	□
-20 °C	■	□	■	75 ... 110 °C	■	□	■
-40 °C	■	□	□	110 ... 165 °C	■	□	□
-60 °C	□	■	■	165 ... 245 °C	□	■	■
-80 °C	□	■	□	245 ... 360 °C	□	■	□
-100 °C	□	□	■	360 ... 540 °C	□	□	■
-200 °C	□	□	□	540 ... 800 °C	□	□	□

#### Output 1)

Range	7
0 ... 20 mA	□
4 ... 20 mA	■

1) only modules with current output

■ = on  
□ = off

### Preconfigured modules

	Input	Output		
		0 ... 20 mA	4 ... 20 mA	0 ... 10 V
<b>Screw connection</b>	0 ... 100 °C	8432210001	8432210011	8432180001
	special balancing	8432219999**	8432219999**	8432189999**
<b>Tension clamp connection</b>	0 ... 100 °C	8432220001	8432220011	8432190001
	special balancing	8432229999**	8432229999**	8432199999**

\*\*You must indicate the temperature range when ordering  
Please indicate additional output signal of current output

### Aids

- Voltage supply 24 Vdc, 50 mA
- Simulator for PT 100 or precision-resistance-decade
- Ampere-/voltmeter which can be calibrated to an accuracy of >0.1 % of the end value.

# PT100/3-wire Signal Conditioners

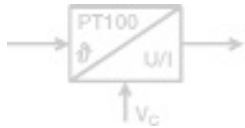
## WAVEANALOG PT100 select

- 3-wire technology
- Configurable temperature range  
-200 °C ... +800 °C
- Configurable output current range  
0 ... 20 mA / 4 ... 20 mA
- Cross-connectable voltage supply  
via cross-connectors

### Approvals:

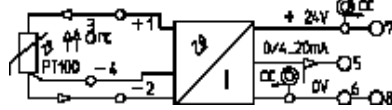
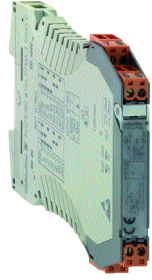


### Schematic circuit diagram



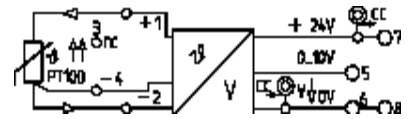
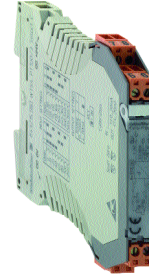
## PT100/3

0(4) ... 20 mA



## PT100/3

0 ... 10 V



### Ordering data

Screw connection	WTS4 PT100/3 C	8432150000*
Tension clamp connection	WTZ4 PT100/3 C	8432160000*
Input/Output	PT100/3 / 0(4) ... 20 mA	

### Technical data\*\*\*

<b>Input signal</b>	PT100/3- wire
Temperature range	-200 ... +800 °C
Supply current	1.45 mA
Conductor resistance	50
<b>Output signal</b>	0(4) ... 20 mA
Load resistance	500
Accuracy at Tu=23 °C	± 0.5% of measurement range
Temperature coefficient	
Measurement range	200 ppm / °C (typ. 80 ppm / °C)
100 K measurement range < 200 K	250 ppm / °C (typ. 100 ppm / °C)
40 K measurement range < 100 K	500 ppm / °C (typ. 200 ppm / °C)

Type	WTS4 PT100/3 C	Part No.	8432150000*
	WTZ4 PT100/3 C		8432160000*
	PT100/3 / 0(4) ... 20 mA		

Type	WTS4 PT100/3 V	Part No.	8432090000*
	WTZ4 PT100/3 V		8432130000*
	PT100/3 / 0 ... 10 V		

### General Data

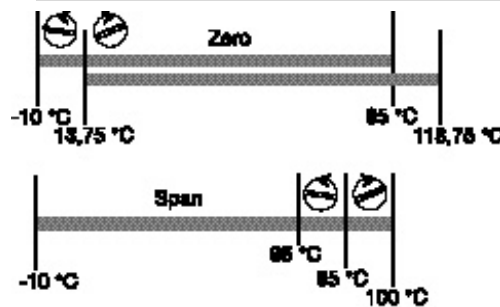
Voltage supply	24 Vdc ±20% (19.2 ... 28.8 Vdc)
Power consumption	< 48 mA at Iout = 20 mA
Current carrying capacity of cross-connection	2 A
Operating temperature	0 °C ... +55 °C
Storage temperature	-20 °C ... +85 °C
Standards/specifications	EN 50178, IEC 751
EMC standards	EN 50081, EN 50082, EN 55011
Dimensions L/H/W	92.4 / 112.5 / 12.5 mm (3.64 / 4.43 / 0.49 in.)
Approvals	CE, cULus, CSA

Voltage supply	24 Vdc ±20% (19.2 ... 28.8 Vdc)
Power consumption	< 38 mA at Iout = 10 mA
Current carrying capacity of cross-connection	2 A
Operating temperature	0 °C ... +55 °C
Storage temperature	-20 °C ... +85 °C
Standards/specifications	EN 50178, IEC 751
EMC standards	EN 50081, EN 50082, EN 55011
Dimensions L/H/W	92.4 / 112.5 / 12.5 mm (3.64 / 4.43 / 0.49 in.)
Approvals	CE, cULus, CSA

Voltage supply	24 Vdc ±20% (19.2 ... 28.8 Vdc)
Power consumption	< 38 mA at Iout = 10 mA
Current carrying capacity of cross-connection	2 A
Operating temperature	0 °C ... +55 °C
Storage temperature	-20 °C ... +85 °C
Standards/specifications	EN 50178, IEC 751
EMC standards	EN 50081, EN 50082, EN 55011
Dimensions L/H/W	92.4 / 112.5 / 12.5 mm (3.64 / 4.43 / 0.49 in.)
Approvals	CE, cULus, CSA

\* without balancing  
\*\*\* Tu = 23 °C single module

### Example for Zero and Span



### Temperature adjustment:

Tmin	-10 °C
Span	75 ... 110 °C

### Preconfigured modules

	Input	Output	4 ... 20 mA	0 ... 10 V
<b>Screw connection</b>	0 ... 100 °C	8432150001	8432150011	8432090001
	special balancing	8432159999**	8432159999**	8432099999**
<b>Tension clamp connection</b>	0 ... 100 °C	8432160001	8432160011	8432130001
	special balancing	8432169999**	8432169999**	8432139999**

\*\* You must indicate the temperature range when ordering  
Please indicate additional output signal of current output

Tmin	1	2	3	Span	4	5	6
0 °C	■	■	■	40 ... 50 °C	■	■	■
-10 °C	■	■	□	50 ... 75 °C	■	■	□
-20 °C	■	□	□	75 ... 110 °C	■	□	□
-40 °C	□	□	□	110 ... 165 °C	□	□	□
-60 °C	□	■	■	165 ... 245 °C	□	■	■
-80 °C	□	■	□	245 ... 360 °C	□	■	□
-100 °C	□	□	■	360 ... 540 °C	□	□	■
-200 °C	□	□	□	540 ... 800 °C	□	□	□

### Output<sup>1)</sup>

Range	7
0 ... 20 mA	□
4 ... 20 mA	■

<sup>1)</sup> only modules with current output

■ = on  
□ = off

### Aids

- Voltage supply 24 Vdc, 50 mA
- Simulator for PT 100 or precision-resistance-decade
- Ampere-/voltmeter which can be calibrated to an accuracy of >0.1 % of the end value.

# PT100/2- /3- /4-wire Signal Conditioners

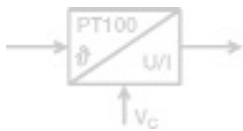
## WAVEANALOG PT100 select

- 2-, 3- and 4-wire technology
- Configurable temperature range  
-200 °C ... +800 °C
- Configurable output current range  
0 ... 20 mA / 4 ... 20 mA
- Cross-connectable voltage supply  
via cross-connectors

## Approvals:

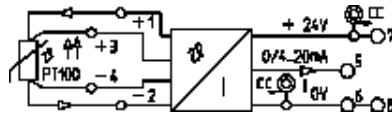
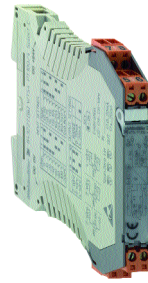


## Schematic circuit diagram



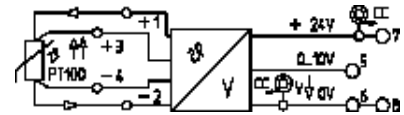
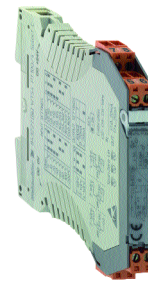
## PT100/4

0(4) ... 20 mA



## PT100/4

0 ... 10 V



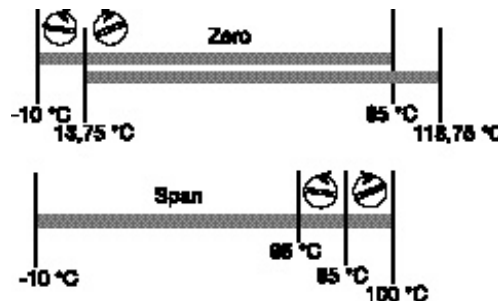
Ordering data	
Screw connection	
Tension clamp connection	
Input/Output	
Technical data***	
Input signal	
Temperature range	-200 ... +800 °C
Supply current	1.45 mA
Conductor resistance	50 (3- & 4-wire)
Output signal	
Load resistance	0(4) ... 20 mA 500
Accuracy at Tu=23 °C	
100 K measurement range < 600 K	± 0.1% of measurement range
Measurement range 100 K	± 0.1 K
Measurement range 600 K	± 0.2% of measurement range
Temperature coefficient	
Measurement range 200 K	200 ppm / °C (typ. 80 ppm / °C)
100 K measurement range < 200 K	225 ppm / °C (typ. 90 ppm / °C)
40 K measurement range < 100 K	450 ppm / °C (typ. 180 ppm / °C)
General Data	
Voltage supply	24 Vdc ±20% (19.2 ... 28.8 Vdc)
Power consumption	< 48 mA at Iout = 20 mA
Current carrying capacity of cross-connection	2 A
Operating temperature	0 °C ... +55 °C
Storage temperature	-20 °C ... +85 °C
Standards/specifications	EN 50178, IEC 751
EMC standards	EN 50081, EN 50082, EN 55011
Dimensions L/H/W	92.4 / 112.5 / 12.5 mm (3.64 / 4.43 / 0.49 in.)
Approvals	CE, cULus, CSA

Type	Part No.
WTS4 PT100/4 C	8432270000*
WTZ4 PT100/4 C	8432280000*
PT100/4 / 0(4) ... 20 mA	
PT100/4-wire	
Temperature range	-200 ... +800 °C
Supply current	1.45 mA
Conductor resistance	50 (3- & 4-wire)
Output signal	0(4) ... 20 mA
Load resistance	500
Accuracy at Tu=23 °C	
100 K measurement range < 600 K	± 0.1% of measurement range
Measurement range 100 K	± 0.1 K
Measurement range 600 K	± 0.2% of measurement range
Temperature coefficient	
Measurement range 200 K	200 ppm / °C (typ. 80 ppm / °C)
100 K measurement range < 200 K	225 ppm / °C (typ. 90 ppm / °C)
40 K measurement range < 100 K	450 ppm / °C (typ. 180 ppm / °C)
Voltage supply	24 Vdc ±20% (19.2 ... 28.8 Vdc)
Power consumption	< 48 mA at Iout = 20 mA
Current carrying capacity of cross-connection	2 A
Operating temperature	0 °C ... +55 °C
Storage temperature	-20 °C ... +85 °C
Standards/specifications	EN 50178, IEC 751
EMC standards	EN 50081, EN 50082, EN 55011
Dimensions L/H/W	92.4 / 112.5 / 12.5 mm (3.64 / 4.43 / 0.49 in.)
Approvals	CE, cULus, CSA

Type	Part No.
WTS4 PT100/4 V	432240000*
WTZ4 PT100/4 V	432250000*
PT100/4 / 0 ... 10 V	
PT100/4-wire	
Temperature range	-200 ... +800 °C
Supply current	1.45 mA
Conductor resistance	50 (3- & 4-wire)
Output signal	0 ... 10 V
Load resistance	1 k
Accuracy at Tu=23 °C	
100 K measurement range < 600 K	± 0.1% of measurement range
Measurement range 100 K	± 0.1 K
Measurement range 600 K	± 0.2% of measurement range
Temperature coefficient	
Measurement range 200 K	200 ppm / °C (typ. 80 ppm / °C)
100 K measurement range < 200 K	225 ppm / °C (typ. 90 ppm / °C)
40 K measurement range < 100 K	450 ppm / °C (typ. 180 ppm / °C)
Voltage supply	24 Vdc ±20% (19.2 ... 28.8 Vdc)
Power consumption	< 38 mA at Iout = 10 mA
Current carrying capacity of cross-connection	2 A
Operating temperature	0 °C ... +55 °C
Storage temperature	-20 °C ... +85 °C
Standards/specifications	EN 50178, IEC 751
EMC standards	EN 50081, EN 50082, EN 55011
Dimensions L/H/W	92.4 / 112.5 / 12.5 mm (3.64 / 4.43 / 0.49 in.)
Approvals	CE, cULus, CSA

## Example for Zero and Span

Temperature adjustment:	
Tmin	-10 °C
Span	75...110 °C
Span	95 °C
Adjustment of Span	+ 25 %



## Preconfigured modules

	Input	Output		
		0 ... 20 mA	4 ... 20 mA	0 ... 10 V
Screw connection	0 ... 100 °C	8432270001	8432270011	8432240001
	special balancing	8432279999**		8432249999**
Tension clamp connection	0 ... 100 °C	8432280001	8432280011	8432250001
	special balancing	8432289999**		8432259999**

\*\* Please indicate the temperature range and the sensor type (2-, 3- or 4-wire).

Please indicate additional output signal of current output

## Switch position/setting options

Tmin	1	2	3	Span	4	5	6
0 °C	■	■	■	40 ... 50 °C	■	■	■
-10 °C	■	■	□	50 ... 75 °C	■	■	□
-20 °C	■	□	□	75 ... 110 °C	■	□	■
-40 °C	■	□	□	110 ... 165 °C	■	□	□
-60 °C	□	■	■	165 ... 245 °C	□	■	■
-80 °C	□	■	■	245 ... 360 °C	□	■	■
-100 °C	□	□	■	360 ... 540 °C	□	□	■
-200 °C	□	□	□	540 ... 800 °C	□	□	□
Output <sup>1)</sup>				PT 100			
Range	7				8	9	10
0 ... 20 mA	□				2 - wire	■	■
4 ... 20 mA	■				3 - wire	■	■
					4 - wire	□	□

<sup>1)</sup> only modules with current output ■ = on □ = off

## Aids

- Voltage supply 24 Vdc, 50 mA
- Simulator for PT 100 or precision-resistance-decade
- Ampere-/voltmeter which can be calibrated to an accuracy of >0.1 % of the end value.

# RTD-Signal Conditioner (configurable)

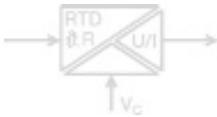
## WAVEANALOG PRO RTD

- Measurement from PT 100 (PRO RTD), measurement from PT 1000 (PRO RTD 1000) Ni 100, R, potentiometer
- Universally adjustable by DIP switches
- 3-way-isolation
- status LED
- Linearization
- Cross-connectable voltage supply via cross-connectors

### Approvals:

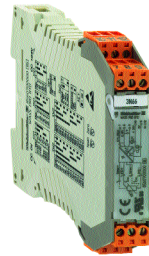


### Schematic circuit diagram



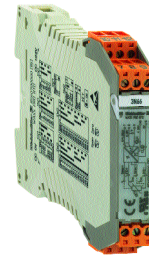
Ordering data	
Screw connection	
Tension clamp connection	
Input/Output	
Technical data*	
Input (adjustable)	
PT100/2-/3-/4-wire: -200°C to 850°C	
Ni100 : -60°C to +250°C	
Potentiometer: min: 0...100 / max: 0...100 k	
Resistance: 0 ... 450	
Output (adjustable)	
Output voltage	0...10 V
Offset voltage	max. 0.05 V
Load resistance	1 k
Output current	0/4 ... 20 mA
Offset current	max. 100 µA
Load resistance	600
Accuracy, slow/fast step response	
Step response (selectable by DIP-switches)	
RTD, R	
Potentiometer	
Temperature coefficient	measurement range 200 K
	100 K measurement range < 200 K
	40 K measurement range < 100 K
Max. wire resistance:	
Influence of wire resistances:	
Open circuit recognition:	
Range of man. fine adjustment (switchable)	
Status LED:	
General Data	
Supply voltage	18 Vdc ... 24 Vdc ... 30 Vdc
Power consumption	830 mW ... 880 mW ... 980mW @ I <sub>out</sub> = 20 mA
Current carrying capacity of cross-connection	2 A
Operating temperature	0...55°C
Storage temperature	-20...85°C
Factory setting	PT 100/3 0 ... 100 °C / 4 ... 20 mA
No manual fine adjustment: slow step response	
Dimensions L/H/W	92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)
Weight	approx. 100 g (0.22 lbs.)
Approvals	CE, cULus, GL
Coordination of insulation according to DIN EN 50178, 04/98	
Rated voltage	300 V
Rated surge voltage	4 kV
Overvoltage category	III
Contamination class	2
Clearance and creepage distance	3 mm
Test voltage	2 kVeff
Standards/specifications	EN 50178, IEC751
EMC standards	EN 50081, EN50082, EN55011
* T <sub>U</sub> = 23 °C single module	

## PRO RTD



Type	Part No.
WAS5 PRO RTD	<b>8560700000</b>
WAZ5 PRO RTD	<b>8560710000</b>
configurable	
PT100/2-/3-/4-wire: -200°C to 850°C	
Ni100 : -60°C to +250°C	
Potentiometer: min: 0...100 / max: 0...100 k	
Resistance: 0 ... 450	
0...10 V	
max. 0.05 V	
1 k	
0/4 ... 20 mA	
max. 100 µA	
600	
PT 100, Ni 100: 0.3% of measurement range 0.8%, Measurement range < 100 K / 0.3 K / 0.8 K	
Potentiometer: 0.2% from end value / 0.3%	
Resistance : 0.2% from end value / 0.3%	
type	fast slow
	< 1.2 s < 2.2 s
	< 500 ms < 1.1 s
200 ppm / °C	
250 ppm / °C	
400 ppm / °C	
50 for 3- and 4-wire	
max. + 0.25°C at 50 wire resistance	
Output signal > 10 V or > 20 mA, LED flashing	
± 5%, from ver. 1: 12.5%, potentiometer 12.5 %...25	
Module active: LED on / open circuit: LED flashing	
Error: LED off	
General Data	
Supply voltage	18 Vdc ... 24 Vdc ... 30 Vdc
Power consumption	830 mW ... 880 mW ... 980mW @ I <sub>out</sub> = 20 mA
Current carrying capacity of cross-connection	2 A
Operating temperature	0...55°C
Storage temperature	-20...85°C
Factory setting	PT 100/3 0 ... 100 °C / 4 ... 20 mA
No manual fine adjustment: slow step response	
Dimensions L/H/W	92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)
Weight	approx. 100 g (0.22 lbs.)
Approvals	CE, cULus, GL
Coordination of insulation according to DIN EN 50178, 04/98	
Rated voltage	300 V
Rated surge voltage	4 kV
Overvoltage category	III
Contamination class	2
Clearance and creepage distance	3 mm
Test voltage	2 kVeff
Standards/specifications	EN 50178, IEC751
EMC standards	EN 50081, EN50082, EN55011

## PRO RTD1000



Switch position/setting options (see next page)

Type	Part No.
WAS5 PRO RTD 1000	<b>8679490000</b>
on request	
PT1000/2-/3-/4-wire: 200°C to 850°C	
Ni1000: -60°C to + 250°C	
Potentiometer: min: 0...1 k / max: 0...100 k	
Resistance : 0 ... 4500	
0...10 V	
max. 0.05 V	
1 k	
0/4 ... 20 mA	
max. 100 µA	
600	
PT 100, Ni 100: 0.3 % of measurement range 0.8%, Measurement range < 100 K / 0.3 K / 0.8 K	
Potentiometer: 0.2% from end value / 0.3%	
Resistance : 0.2% from end value / 0.3%	
type	fast slow
	< 1.2 s < 2.2 s
	< 500 ms < 1.1 s
200 ppm / °C	
250 ppm / °C	
400 ppm / °C	
50 for 3- and 4-wire	
max. + 0.25°C at 50 wire resistance	
Output signal > 10 V or > 20 mA, LED flashing	
± 5%, ab Ver. 1: 12.5%, Potentiometer 12.5 %...25 %	
Module active: LED on / open circuit: LED flashing	
Error: LED off	
General Data	
Supply voltage	18 Vdc ... 24 Vdc ... 30 Vdc
Power consumption	830 mW ... 880 mW ... 980mW @ I <sub>out</sub> = 20 mA
Current carrying capacity of cross-connection	2 A
Operating temperature	0...55°C
Storage temperature	-20...85°C
Factory setting	PT 100/3 0 ... 100 °C / 4 ... 20 mA
No manual fine adjustment: slow step response	
Dimensions L/H/W	92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)
Weight	approx. 100 g (0.22 lbs.)
Approvals	CE, cULus, GL
Coordination of insulation according to DIN EN 50178, 04/98	
Rated voltage	300 V
Rated surge voltage	4 kV
Overvoltage category	III
Contamination class	2
Clearance and creepage distance	3 mm
Test voltage	2 kVeff
Standards/specifications	EN 50178, IEC751
EMC standards	EN 50081, EN50082, EN55011



# RTD-Signal Conditioner (configurable)

## WAVEANALOG PRO RTD

## WAVEANALOG PRO RTD 1000

### Switch position/setting options

Input	Switch 1		
	1	2	3
PT100 2-wire	■	■	■
PT100 3-wire	□	■	■
PT100 4-wire	■	□	■
R 2-wire	□	□	■
NI100 2-wire	■	■	□
NI100 3-wire	□	■	□
NI100 4-wire	■	□	□
Potentiometer	□	□	□

■ = on  
□ = off

### Switch position/setting options

Input	Switch 1		
	1	2	3
PT1000 2-wire	■	■	■
PT1000 3-wire	□	■	■
PT1000 4-wire	■	□	■
R 2-wire	□	□	■
NI1000 2-wire	■	■	□
NI1000 3-wire	□	■	□
NI1000 4-wire	■	□	□
Potentiometer	□	□	□

■ = on  
□ = off

Output	Switch 2	
	6	7
0...10V	■	□
0...20mA	□	□
4...20mA	□	■

Switching on the manual fine adjustment		S.1
man. adj..		8
off		□
on		■

Selection of step set time		S.2
Time of step response		8
slow		■
fast		□

q <sub>min</sub>	R <sub>min</sub>	Pot.min	Switch 1			
			4	5	6	7
0°C	0	0%	■	■	■	■
-10°C	10	10%	■	■	■	□
-20°C	20	20%	■	■	□	■
-25°C	20	25%	■	■	□	□
-30°C	30	30%	■	□	■	■
-40°C	40	40%	■	□	■	□
-50°C	50	50%	■	□	□	■
-60°C	60	60%	■	□	□	□
-70°C	70	70%	□	■	■	■
-80°C	80	80%	□	■	■	□
-90°C	90		□	■	□	■
-100°C	100		□	□	□	□
-150°C	150		□	□	■	■
-200°C	200		□	□	■	□
Special range			□	□	□	■

q <sub>min</sub>	R <sub>min</sub>	Pot.min	Switch 1			
			4	5	6	7
0°C	0	0%	■	■	■	■
-10°C	100	10%	■	■	■	□
-20°C	200	20%	■	■	□	■
-25°C	200	25%	■	■	□	□
-30°C	300	30%	■	□	■	■
-40°C	400	40%	■	□	■	□
-50°C	500	50%	■	□	□	■
-60°C	600	60%	■	□	□	□
-70°C	700	70%	□	■	■	■
-80°C	800	80%	□	■	■	□
-90°C	900		□	■	□	■
-100°C	1000		□	□	□	□
-150°C	1500		□	□	■	■
-200°C	2000		□	□	■	□
Special range			□	□	□	■

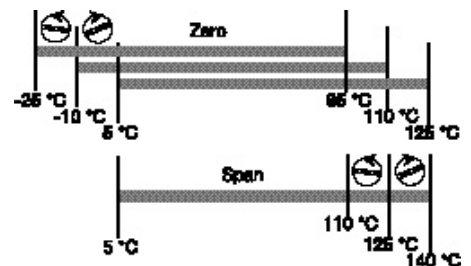
T	R	pot.	Switch 2				
			1	2	3	4	5
40K	20	20%	■	■	■	■	■
50K	25	25%	■	■	■	■	□
60K	30	30%	■	■	■	□	■
70K	35	35%	■	■	□	■	■
80K	40	40%	■	■	□	■	■
90K	45	45%	■	■	□	■	□
100K	50	50%	■	■	□	□	■
110K	55	55%	■	■	□	□	v
120K	60	60%	■	□	■	■	■
125K	62,5	62,5%	■	□	■	■	□
130K	65	65%	■	□	■	□	■
140K	70	70%	■	□	■	□	□
150K	75	75%	■	□	□	■	■
160K	80	80%	■	□	□	■	□
170K	85	85%	■	□	□	□	■
180K	90	90%	■	□	□	□	□
190K	95	95%	□	■	■	■	■
200K	100	100%	□	■	■	■	□
250K	125	---	□	■	■	■	■
300K	150	---	□	■	■	■	□
350K	175	---	□	■	□	■	■
400K	200	---	□	■	□	■	□
450K	225	---	□	■	□	□	■
500K	250	---	□	■	□	□	□
550K	275	---	□	□	■	■	■
600K	300	---	□	□	■	■	□
650K	325	---	□	□	■	□	■
700K	350	---	□	□	■	□	□
750K	375	---	□	□	□	■	■
800K	400	---	□	□	□	■	□
850K	425	---	□	□	□	□	■
900K	450	---	□	□	□	□	□

T	R	pot.	Switch 2				
			1	2	3	4	5
40K	200	20%	■	■	■	■	■
50K	250	25%	■	■	■	■	□
60K	300	30%	■	■	■	□	■
70K	350	35%	■	■	□	■	□
80K	400	40%	■	■	□	■	■
90K	450	45%	■	■	□	■	□
100K	500	50%	■	■	□	□	■
110K	550	55%	■	■	□	□	v
120K	600	60%	■	□	■	■	■
125K	625	62,5%	■	□	■	■	□
130K	650	65%	■	□	■	□	■
140K	700	70%	■	□	■	□	□
150K	750	75%	■	□	□	■	■
160K	800	80%	■	□	□	■	□
170K	850	85%	■	□	□	□	■
180K	900	90%	■	□	□	□	□
190K	950	95%	□	■	■	■	■
200K	1000	100%	□	■	■	■	□
250K	1250	---	□	■	■	■	■
300K	1500	---	□	■	■	■	□
350K	1750	---	□	■	□	■	■
400K	2000	---	□	■	□	■	□
450K	2250	---	□	■	□	□	■
500K	2500	---	□	■	□	□	□
550K	2750	---	□	□	■	■	■
600K	3000	---	□	□	■	■	□
650K	3250	---	□	□	■	□	■
700K	3500	---	□	□	■	□	□
750K	3750	---	□	□	□	■	■
800K	4000	---	□	□	□	■	□
850K	4250	---	□	□	□	□	■
900K	4500	---	□	□	□	□	□

### Example for Zero and Span

#### Temperature adjustment:

Output	4...20 mA
DIP-switch	-10 °C...+110 °C
Span	75...110 °C
Span	120 °C
Adjustment of Span	± 12.5 %



#### Adjustment help WAVEtool

This service tool enables quick and uncomplicated configuration of WAVEANALOG PRO.

Download from Internet:

[www.weidmuller.com](http://www.weidmuller.com)

Products

Downloads

(see page 29)

# RTD-Signal Conditioner for copper elements (configurable)

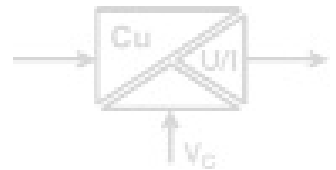
## WAVEANALOG PRO RTD Cu

- Universally adjustable by DIP-switches
- 3-way-isolation
- Status LED
- Linearization
- Cross-connectable voltage supply via cross-connectors

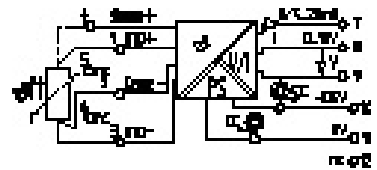
### Approvals:



### Schematic circuit diagram



## PRO RTD Cu



### Ordering data

Screw connection

Tension clamp connection

Input/Output

### Technical data\*

#### Input (adjustable)

#### Output (adjustable)

Output voltage

Offset voltage

Load resistance

Output current

Offset current

Load resistance

Accuracy, slow/fast step response

Step response (selectable by DIP-switches)

Temperature coefficient

max. wire resistance:

Influence of wire resistances:

Open circuit recognition:

Range of man. fine adjustment

Status LED:

### General Data

Supply voltage

Power consumption

Current carrying capacity of cross-connection

Operating temperature

Storage temperature

Factory setting

### Coordination of insulation according to DIN EN 50178, 04/98

Rated voltage

Rated surge voltage

Overvoltage category

Contamination class

Clearance and creepage distance

Test voltage

Standards/specifications

EMC standards

\* T<sub>U</sub> = 23 °C single module

### Type Part No.

WAS5 PRO RTD Cu 8638950000

WAZ5 PRO RTD Cu on request

configurable

Cu 10 -200...+260 °C

Cu 25 -200...+260 °C

Cu 50 -200...+260 °C

Cu 100 -200...+260 °C

0...10 V

max. 0.05 V

1 k

0/4 ... 20 mA

max. 100 µA

600

0.5 % of measurement range, resp. 0.5 K

1 % of measurement range, resp. 1 K

type fas slow

RTD Cu < 1.2 s < 2.3 s

250 ppm/K of measurement range for span 100 K

400 ppm/K of measurement range for 40 K span < 100 K

5 for Cu 10: 15 for Cu 25: 25 for Cu 50: 50 for Cu 100

max. + 0.25°C at max. wire resistance

Output signal > 10 V resp. > 20 mA, LED blinks

± 12.5%

Module active: LED lit / open circuit: LED blinks

Error: LED off

18 Vdc ... 24 Vdc ... 30 Vdc

880 mW ... 980 mW ... 1030 mW @ Output = 20 mA

2 A

0...55°C

-20...85°C

CU 10/3 0 ... 100 °C / 4 ... 20 mA; no filter;

No manual fine adjustment; slow step response

92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)

approx. 100 g (0.22 lbs.)

CE, cULus, GL

300 V

4 kV

III

2

3 mm

2 kVeff

EN 50178, IEC751

EN 50081, EN50082, EN55011

Connection	Switch 1	
	1	
3-wire	<input checked="" type="checkbox"/>	
4-wire	<input type="checkbox"/>	

Type	Switch 1	
	2	3
Cu 10	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Cu 25	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Cu 50	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Cu 100	<input type="checkbox"/>	<input type="checkbox"/>

q <sub>min</sub>	Switch 1			
	4	5	6	7
- 0 °C	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
-10 °C	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
-20 °C	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
-25 °C	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-30 °C	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
-40 °C	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
-50 °C	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
-60 °C	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-70 °C	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
-80 °C	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
-90 °C	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
-100 °C	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-150 °C	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
-200 °C	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Special range	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Span	Switch 2				
	1	2	3	4	5
40 K	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
50 K	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
60 K	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
70 K	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
80 K	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
90 K	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
100 K	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
110 K	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
120 K	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
125 K	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
130 K	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
140 K	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
150 K	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
160 K	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
170 K	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
180 K	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
190 K	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
200 K	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
210 K	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
220 K	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
230 K	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
240 K	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
250 K	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
260 K	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
270 K	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
280 K	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
290 K	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
300 K	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
350 K	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
400 K	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
450 K	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
460 K	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Output	Switch 2	
	6	7
0...10 V	<input checked="" type="checkbox"/>	<input type="checkbox"/>
0...20 mA	<input type="checkbox"/>	<input type="checkbox"/>
4...20 mA	<input type="checkbox"/>	<input checked="" type="checkbox"/>

man. adj.	Switch 1	
	8	
off	<input type="checkbox"/>	
on	<input checked="" type="checkbox"/>	

Time of step response	Switch 2	
	8	
slow	<input checked="" type="checkbox"/>	
fast	<input type="checkbox"/>	

■ = on  
□ = off

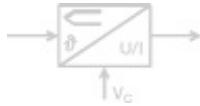
# Thermo-Signal Conditioners

## WAVEANALOG Thermo

- Thermocouples K, J, T, E, N, R, S, B configurable
- Temperature range -200 °C ... +1820 °C
- No adjustment necessary
- Cold junction compensation
- Configurable output signal
- Cross-connectable voltage supply via cross-connectors

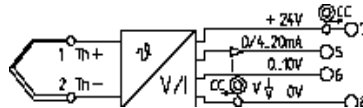
Approvals:  

### Schematic circuit diagram



## Thermo Select

°C / 0 ... 20 mA,  
4 ... 20 mA, 0 ... 10 V



### Ordering data

Screw connection

Tension clamp connection

Input/Output

### Technical data\*

#### Input signal

Types

#### Output signal

Load resistance

Output signal

Load resistance

Output signal

Load resistance

Accuracy at  $T_u = 23\text{ °C}$

Temperature coefficient

Response time without filter

Response time with Filter

### General Data

Voltage supply

Power consumption

Current carrying capacity of cross-connection

Open circuit recognition

Operating temperature

Storage temperature

Standards/specifications

EMC standards

Dimensions L/H/W

Approvals

\*  $T_u = 23\text{ °C}$  single module

Type

WTS4 Thermo Select 8432300000

WTZ4 Thermo Select 8432310000

°C / 0 ... 20 mA

°C / 4 ... 20 mA

°C / 0 ... 10 V

Thermocoupler acc. to IEC584 (fully insulated)

K -200 ... +1372 °C

J -200 ... +1200 °C

T -200 ... +400 °C

E -200 ... +1000 °C

N -200 ... +1300 °C

R -50 ... +1760 °C

S -50 ... +1760 °C

B +50 ... +1820 °C

0 ... 20 mA

500

4 ... 20 mA

500

0 ... 10 V

1 k

Typ K -200°C ... -150°C ± (5K + 0.1% of set range)

-150°C ... 1200°C ± (3K + 0.1% of set range)

1200°C ... 1372°C ± (4K + 0.1% of set range)

Typ J -200°C ... -150°C ± (4K + 0.1% of set range)

-150°C ... 1200°C ± (3K + 0.1% of set range)

Typ T -200°C ... -150°C ± (5K + 0.1% of set range)

-150°C ... 400°C ± (3K + 0.1% of set range)

Typ E -200°C ... -150°C ± (4K + 0.1% of set range)

-150°C ... 1000°C ± (3K + 0.1% of set range)

Typ N -200°C ... -150°C ± (6K + 0.1% of set range)

-150°C ... 1300°C ± (3K + 0.1% of set range)

Typ R -50°C ... 200°C ± (10K + 0.1% of set range)

200°C ... 1760°C ± (6K + 0.1% of set range)

Typ S -50°C ... 200°C ± (10K + 0.1% of set range)

200°C ... 1760°C ± (6K + 0.1% of set range)

Typ B 50°C ... 250°C ± (25K + 0.1% of set range)

250°C ... 500°C ± (10K + 0.1% of set range)

500°C ... 1820°C ± (6K + 0.1% of set range)

± (200 ppm v. span

+ 0.075 K) / K

1.1 s

6 s

24 Vdc ±20% (19.2 ... 28.8 Vdc)

< 38 mA at  $I_{out} = 20\text{ mA}$

2 A

LED blinks (output value: > 20 mA and > 10 V)

0 °C ... +55 °C

-20 °C ... +85 °C

EN 50178, IEC584

EN 50081, EN 50082, EN 55011

92.4 / 112.5 / 12.5 mm (3.64 / 4.43 / 0.49 in.)

CE, cULus, CSA

### Switch position/setting options

SW 1				SW 2					
Type	1	2	3	Span	1	2	3	4	5
K	■	■	■	100 °C	■	■	■	■	■
J	□	■	■	150 °C	■	■	■	■	□
T	■	□	■	200 °C	■	■	■	□	■
E	□	□	■	250 °C	■	■	■	□	□
N	■	■	□	300 °C	■	■	□	■	■
R	□	□	□	350 °C	■	■	□	■	□
S	■	□	□	400 °C	■	■	□	□	■
B	□	□	□	450 °C	■	■	□	□	□
				500 °C	■	□	□	□	□
				550 °C	■	□	■	□	□
				600 °C	■	□	□	□	■
				650 °C	■	□	■	□	□
				700 °C	■	□	□	■	■
				750 °C	■	□	□	□	□
				800 °C	■	□	□	□	■
				850 °C	■	□	□	□	□
				900 °C	□	□	■	■	■
				950 °C	□	□	□	■	□
				1000 °C	□	□	■	□	■
				1050 °C	□	■	■	□	□
				1100 °C	□	■	□	■	■
				1150 °C	□	□	□	■	□
				1200 °C	□	■	□	□	■
				1250 °C	□	□	■	□	□
				1300 °C	□	□	□	■	■
				1350 °C	□	□	■	■	□
				1400 °C	□	□	■	□	■
				1450 °C	□	□	■	□	□
				1500 °C	□	□	■	■	■
				1600 °C	□	□	□	■	□
				1700 °C	□	□	□	□	■
				1800 °C	□	□	□	□	□

SW 1				
Tmin	4	5	6	7
0 °C	■	■	■	■
-10 °C	■	■	■	□
-20 °C	■	■	□	□
-30 °C	■	■	□	□
-40 °C	■	□	■	■
-50 °C	■	□	□	□
-100 °C	■	□	□	□
-150 °C	■	□	□	□
-200 °C	□	■	■	■
+50 °C	□	■	■	□
+100 °C	□	■	□	□
+150 °C	□	■	□	□
+200 °C	□	□	■	■
+250 °C	□	□	□	■
+500 °C	□	□	□	■

SW 2		
Output	6	7
0 - 10 V	■	□
0 - 20 mA	□	□
4 - 20 mA	□	■

Filter	8
off	□
on	■

■ = on

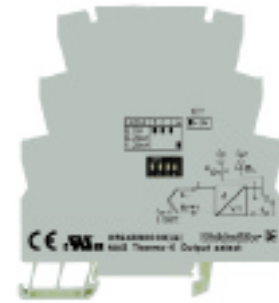
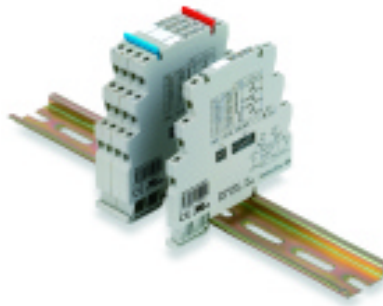
□ = off

# Thermo-Signal Conditioners

## MICROANALOG Thermo Output select

- 2-way isolation between input, output and supply voltage
- Cold junction compensation
- Linearity
- Output calibrated selectable by DIP-switches

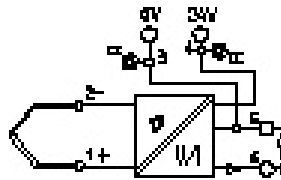
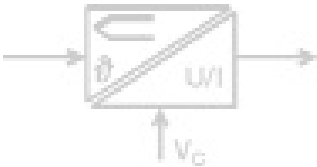
## Thermo-K Output select Thermo-J Output select



### Approvals:



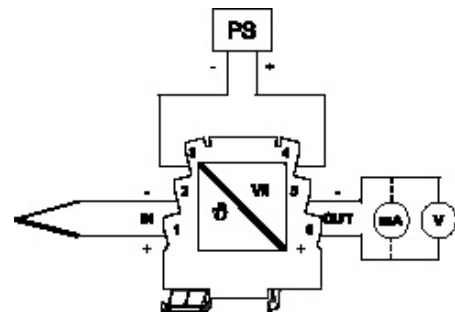
### Schematic circuit diagram



Output	Switch			
	1	2	3	4
0 ... 10 V	■	■	■	□
0 ... 20 mA	□	□	□	□
4 ... 20 mA	□	□	□	■

■ = on  
□ = off

### Connection



Ordering data
Screw connection
Tension clamp connection
Screw connection
Tension clamp connection

### Technical data\*

<b>Input (fix)</b>	
<b>Output (calibrated selectable)</b>	
Load resistance	
Output current	
Output voltage	
Residual ripple	
Accuracy (incl. Linearity and cold junction compensation)	
Thermoelemente Typ K, 0...1000 °C	
Thermoelemente Typ J, 0...700 °C	
Temperature coefficient	
Response time	

Type	Part No.
MAS Thermo-K Output select	8594830000
MAZ Thermo-K Output select	8594860000
MAS Thermo-J Output select	8615210000
MAZ Thermo-J Output select	8615240000

Thermocouple as in EN 60584-1	
Type K, 0...1000 °C	
Type J, 0...700 °C	
0...10V / 4...20mA / 0...5V / 0...20mA (factory setting)	
< 400 Ohm @ providing 24 Vdc	
> 10 kOhm	
< 20m V <sub>eff</sub>	
< 0.6 % of selected range	
< 0.7 % of selected range	
< 250 ppm/K of selected range	
< 0.7 sek	

### General Data

Voltage supply	24 Vdc (±10%)
Current carrying capacity of the connection between connections 3 and 5:	100 mA
Power consumption	approx. 0.6 W
Operating temperature	0...+55 °C
Storage temperature	-25 °C...+85 °C
Approvals	CE, cULus
Dimensions L/H/W	88 / 98 / 6.1 mm (3.46 / 3.86 / 0.24 in.)

### Coordination of insulation according to DIN EN50178, 04/98

Rated voltage	100 V
Test voltage	500 V
Overtoltage category	III
Contamination class	2

\* Tu 20 °C

# Thermo-Signal Conditioners - configurable

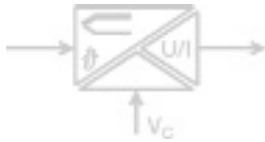
## WAVEANALOG PRO Thermo

- 3-way-isolation
- Thermocouples  
K, J, T, E, N, R, S, B configurable
- Temperature range  
-200 °C ... +1820 °C configurable
- No adjustment necessary
- Cold junction compensation
- Configurable output signal
- Cross-connectable voltage supply via cross-connectors

### Approvals:



### Schematic circuit diagram



### Ordering data

Screw connection  
Tension clamp connection  
Input/Output

### Technical data\*

#### Input (adjustable)

Accuracy at  $T_u = 23\text{ °C}$

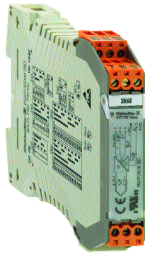
#### Output (adjustable)

Output voltage: 0...10 V  
Offset voltage: max. 0.05 V  
Load resistance: 1 K  
Output current: 0/4 ... 20 mA  
Offset current: max. 100 µA  
Load resistance: 600  
Step response: max. 1.4 s  
at connected filter function: max. 7.5 s  
max. wire resistance: 50 for 3- and 4-wire  
Open circuit recognition: Output signal > 10 V or > 20 mA, LED blinks  
Range of man. fine adjustment: ±5%  
Status LED: Module active: LED lights up / open circuit: LED blinks  
Error: LED off

### General Data

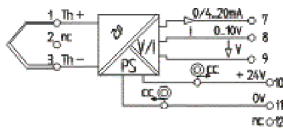
Supply voltage: 18 Vdc ... 24 Vdc ... 30 Vdc  
Power consumption: 800 mV ... 850 mW ... 950 mW @ I output = 20 mA  
Current carrying capacity of cross-connection: 2 A  
Operating temperature: 0 °C ... +55 °C  
Storage temperature: -20 ... +85 °C  
Standards/specifications: EN 50178, IEC751  
EMC standards: EN 50081, EN50082, EN55011  
Factory setting: Typ K 0 ... 1000 °C / 4 ... 20 mA; no filter;  
No manual fine adjustment  
Dimensions L/H/W: 92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)  
Weight: 100 g (0.22 lbs.)  
Approvals: CE, cULus, GL

## PRO Thermo



### Adjustment help WAVEtool

This service tool enables quick and uncomplicated configuration of WAVEANALOG PRO. Download from the Internet:  
[www.weidmuller.com](http://www.weidmuller.com)  
Products Downloads  
(see page 29)



Type	Part No.
WAS5 PRO Thermo	8560720000
WAZ5 PRO Thermo	8560730000
configurable	
Thermocouples acc. to EN 60584-1	
Type K, J, E, N, R, S, B via DIP switch selectable	
Typ K -200°C ... -150°C ± (5K + 0.1% of set range)	
-150°C ... 1200°C ± (3K + 0.1% of set range)	
1200°C ... 1372°C ± (4K + 0.1% of set range)	
Typ J -200°C ... -150°C ± (4K + 0.1% of set range)	
-150°C ... 1200°C ± (3K + 0.1% of set range)	
Typ T -200°C ... -150°C ± (5K + 0.1% of set range)	
-150°C ... 400°C ± (3K + 0.1% of set range)	
Typ E -200°C ... -150°C ± (4K + 0.1% of set range)	
-150°C ... 1000°C ± (3K + 0.1% of set range)	
Typ N -200°C ... -150°C ± (6K + 0.1% of set range)	
-150°C ... 1300°C ± (3K + 0.1% of set range)	
Typ R -50°C ... 200°C ± (10K + 0.1% of set range)	
200°C ... 1760°C ± (6K + 0.1% of set range)	
Typ S -50°C ... 200°C ± (10K + 0.1% of set range)	
200°C ... 1760°C ± (6K + 0.1% of set range)	
Typ B 50°C ... 250°C ± (25K + 0.1% of set range)	
250°C ... 500°C ± (10K + 0.1% of set range)	
500°C ... 1820°C ± (6K + 0.1% of set range)	

Span	1	2	3	4	5
100°C	■	■	■	■	■
150°C	■	■	■	■	■
200°C	■	■	■	■	■
250°C	■	■	■	■	■
300°C	■	■	■	■	■
350°C	■	■	■	■	■
400°C	■	■	■	■	■
450°C	■	■	■	■	■
500°C	■	■	■	■	■
550°C	■	■	■	■	■
600°C	■	■	■	■	■
650°C	■	■	■	■	■
700°C	■	■	■	■	■
750°C	■	■	■	■	■
800°C	■	■	■	■	■
850°C	■	■	■	■	■
900°C	■	■	■	■	■
950°C	■	■	■	■	■
1000°C	■	■	■	■	■
1050°C	■	■	■	■	■
1100°C	■	■	■	■	■
1150°C	■	■	■	■	■
1200°C	■	■	■	■	■
1250°C	■	■	■	■	■
1300°C	■	■	■	■	■
1350°C	■	■	■	■	■
1400°C	■	■	■	■	■
1450°C	■	■	■	■	■
1500°C	■	■	■	■	■
1600°C	■	■	■	■	■
1700°C	■	■	■	■	■
1800°C	■	■	■	■	■

Selection of thermocoupler	
Type	SW1
K	■ ■ ■ ■
J	□ □ □ □
T	■ □ □ □
E	□ □ □ □
N	■ □ □ □
R	□ □ □ □
S	■ □ □ □
B	□ □ □ □

Selection of minimum temperature	
$t_{min}$	SW1
0°C	■ ■ ■ ■
-10°C	■ ■ ■ ■
-20°C	■ ■ ■ ■
-30°C	■ ■ ■ ■
-40°C	■ □ □ □
-50°C	■ □ □ □
-100°C	■ □ □ □
-150°C	■ □ □ □
-200°C	□ □ □ □
+50°C	□ ■ ■ ■
+100°C	□ ■ ■ ■
+150°C	□ ■ ■ ■
+200°C	□ □ □ □
+250°C	□ □ □ □
500°C	□ □ □ □
Sonderbereich	□ □ □ □

Selection of temperature span	
Span	SW2
100°C	■ ■ ■ ■ ■
150°C	■ ■ ■ ■ ■
200°C	■ ■ ■ ■ ■
250°C	■ ■ ■ ■ ■
300°C	■ ■ ■ ■ ■
350°C	■ ■ ■ ■ ■
400°C	■ ■ ■ ■ ■
450°C	■ ■ ■ ■ ■
500°C	■ □ ■ ■ ■
550°C	■ □ ■ ■ ■
600°C	■ □ ■ ■ ■
650°C	■ □ ■ ■ ■
700°C	■ □ ■ ■ ■
750°C	■ □ ■ ■ ■
800°C	■ □ ■ ■ ■
850°C	■ □ ■ ■ ■
900°C	■ □ ■ ■ ■
950°C	□ ■ ■ ■ ■
1000°C	□ ■ ■ ■ ■
1050°C	□ ■ ■ ■ ■
1100°C	□ ■ ■ ■ ■
1150°C	□ ■ ■ ■ ■
1200°C	□ ■ ■ ■ ■
1250°C	□ ■ ■ ■ ■
1300°C	□ ■ ■ ■ ■
1350°C	□ ■ ■ ■ ■
1400°C	□ □ ■ ■ ■
1450°C	□ □ ■ ■ ■
1500°C	□ □ ■ ■ ■
1600°C	□ □ ■ ■ ■
1700°C	□ □ ■ ■ ■
1800°C	□ □ ■ ■ ■

Selection of output	
Output	SW2
0...10V	■ □
0...20mA	□ □
4...20mA	□ ■

Switching on the manual fine adjustment	
man. adjust.	SW1
off	□
on	■

Switching on the filter function	
Filter	SW2
off	□
on	■

■ = on  
□ = off

Coordination of insulation according to DIN EN 50178, 04/98	
Rated voltage	300 V
Rated surge voltage	4 kV
Overvoltage category	III
Contamination class	2
Clearance and creepage distance	3 mm
Test voltage	2 kVeff

# Frequency Signal Conditioners

## WAVEANALOG PRO Frequency

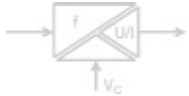
- 3-way-isolation
- Max. input frequency 100 kHz
- Input and output selectable by DIP-switches
- No adjustment required
- Special range programmable

Approvals:

## PRO Freq



### Schematic circuit diagram



### Ordering data

Screw connection  
Tension clamp connection

### Technical data\*

#### Input (adjustable)

Input frequency (selectable by DIP-switches)  
Input frequency (programmable)  
Resolution  
Accuracy of frequency measurement

#### Namur input according DIN 19234

Threshold  
Hysteresis  
**NPN input**  
Threshold  
Hysteresis  
Minimum pulse duration  
Minimum pulse separation

#### PNP output

Threshold  
Hysteresis  
Minimum pulse duration  
Minimum pulse separation  
Supply voltage for electrical sensor

#### Output

Current / voltage (selectable by DIP-switches)  
Output voltage  
Output offset voltage  
Load resistance  
Output current  
Output offset current  
Load resistance  
Accuracy  
Temperature coefficient  
Response time

#### Coordination of insulation according to DIN EN 50178, 04/98

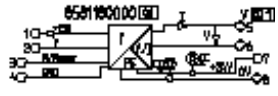
Rated voltage  
Rated surge voltage  
Overvoltage category  
Contamination class  
Clearance and creepage distance  
Test voltage

#### General Data

Supply voltage  
Power consumption  
Current carrying capacity of cross-connection  
Operating temperature  
Storage temperature  
Standards/specifications  
EMC standards  
Factory setting  
Dimensions L/H/W  
Weight  
Approvals

\* Tu 23°C, single module

### 8581190000



Type	Part No.
WAS4 PRO Freq	8581180000
WAZ4 PRO Freq	8581190000

- 3-wire initiator with PNP output  
- 3-wire initiator with PNP output and external power supply  
- 3-wire initiator with NPN output  
- 3-wire initiator with NPN output and external power supply  
- 2-wire initiator  
- Namur initiator  
- Push-pull output stage

0...15.9 kHz  
0...100 kHz  
0.1 MHz full scale, 5 ppm from measurement value  
max. 100 ppm full scale

approx. 1.7 mA  
approx. 0.2 mA  
max. input: + 30 V  
approx. 6.5 V  
approx. 0.2 V  
15 µs (5 µs push pull output stage)  
5 µs  
max. input: ± 30 V  
approx. 6.7 V  
approx. 0.5 V  
5 µs  
approx. 16 V @ max. 15 mA

0...10 V / 0...20 mA / 4...20 mA  
0...10 V  
max. 0.05 V  
1 k  
0/4...20 mA  
max. 100 µA  
600  
0.2 % of full scale  
max. 200 ppm/K of full scale  
360 ms + 2 x period of the input frequency  
**(safe separation)**

300 V  
6 kV  
III  
2  
5.5 mm  
1.2 KV<sub>gr</sub>

18 Vdc ... 24 Vdc ... 30 Vdc  
max. 1.6 W @ I<sub>out</sub>=20 mA  
2 A  
0...55 °C  
-20...85 °C  
EN 50178 (safe separation)  
EN 50081, EN 50082, EN 55011, EN 61000-6-2, EN 61326  
0...10 kHz / 4...20 mA  
92.4 / 112.5 / 1.5 mm (3.64 / 4.41 / 0.49 in.)  
100 g (0.22 lbs.)  
CE, cULus

### Selecting the operating mode

Operating mode	Switch 2	
	3	4
0...fmax	<input type="checkbox"/>	<input type="checkbox"/>
fmin...fmax	<input type="checkbox"/>	<input checked="" type="checkbox"/>
saving	<input type="checkbox"/>	<input type="checkbox"/>
fmin	<input checked="" type="checkbox"/>	<input type="checkbox"/>

f = (A+B) x C

Selecting the frequency					Selecting the frequency				
A	Switch 1				B	Switch 1			
	1	2	3	4		5	6	7	8
0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	0.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0.2	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0.3	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.4	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0.5	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0.6	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0.7	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
8	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.8	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	0.9	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>					
11	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
12	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
13	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>					
14	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
15	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					

C	Switch 2	
	1	2
x1	<input type="checkbox"/>	<input type="checkbox"/>
x10	<input type="checkbox"/>	<input checked="" type="checkbox"/>
x100	<input checked="" type="checkbox"/>	<input type="checkbox"/>
x1000	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

### Selecting the output

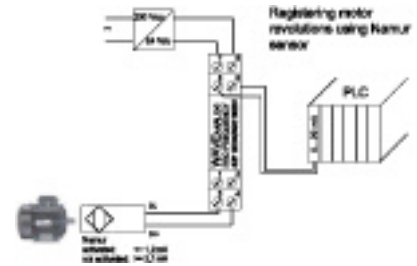
Output	Switch 2			
	5	6	7	8
0...10 V	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
0...20 mA	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4...20 mA	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0...5 V	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

### Special range (frequency generator is required)

Funktion	Switch 2			
	1	2	3	4
save min. frequency	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
save max. frequency	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
select special range	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

■ = on  
□ = off

### Application

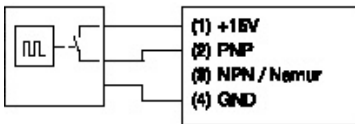


# Frequency Signal Conditioners

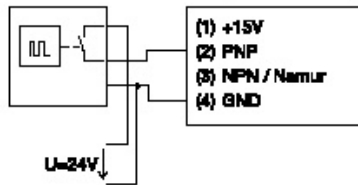
WAVEANALOG PRO Frequency

## Wiring diagram

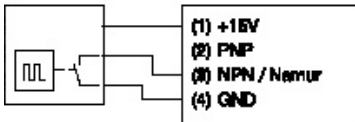
3-wire Initiator with PNP output



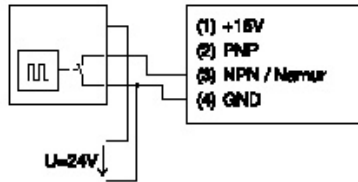
3-wire Initiator with PNP output and external power supply



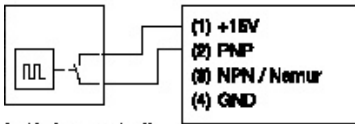
3-wire Initiator with NPN output



3-wire Initiator with NPN output and external power supply

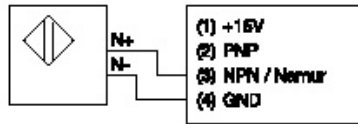


2-wire Initiator

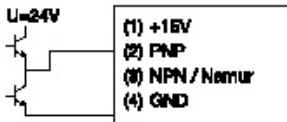


(residual current <1 mA)

Nemur Initiator



Push-pull output stage



## Adjustment help

Set the input range via the DIP switches (no frequency generator required):

2 cases are to be distinguished:

1. below measurement frequency = 0 Hz

- Select operating mode „0...fmax".  
S2.3 = 0 and S2.4 = 0
- Set upper measurement frequency via the DIP switches S1 and S2.1, S2.2 (see table)
- Ready!

2. lower measurement frequency 0 Hz

- First, the lower measurement frequency has to be saved.  
Select operating mode "save from fmin".  
S2.3 = 1 and S2.4 = 0  
Set upper measurement frequency via the DIP switches S1 and S2. (see table).  
Connect the module to the power supply to save the frequency.
- Select operating mode "fmin...fmax".  
S2.3 = 0 and S2.4 = 1
- Set upper measurement frequency via the DIP switches S1 and S2.1, S2.2 (see table)
- Ready!

### Setting the input range using a frequency generator:

- Select the switch setting for saving the minimum frequency:  
S2.1=0 ; S2.2=1; S2.3=1 and S2.4=1
- Apply minimum frequency to the module
- Connect the module to the power supply.
- The LED lights up when the input frequency is measured. The frequency has been saved when the LED goes out:  
the module can be disconnected from the power supply.
- Repeat the process with the maximum frequency:  
S2.1=1; S2.2=0; S2.3=1 and S2.4=1
- Select special range:  
S2.1=1; S2.2=1; S2.3=1 and S2.4=1

# DC-Frequency Signal Conditioners

- Tension clamp connection
- LED-Display
- Adjustable frequency output

The option of reading-in the analog signals from the field via counter inputs of the control is made possible by converting the analog signals in to frequencies. It is recommended that twisted and shielded 2-wire cables are used.

## Approvals:



### MCZ VFC

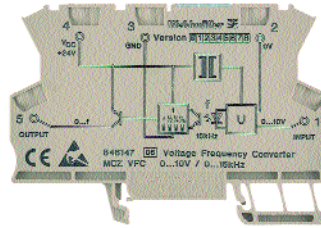
0...10 V

### MCZ CFC

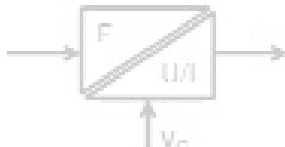
0...20 mA

### MCZ CFC

4...20 mA CLP



## Schematic circuit diagram/settings



### MCZ VFZ 0...10 V and MCZ CFC 0...20 mA

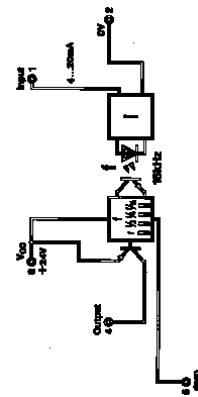
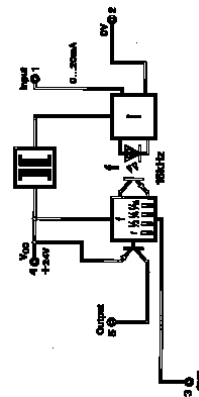
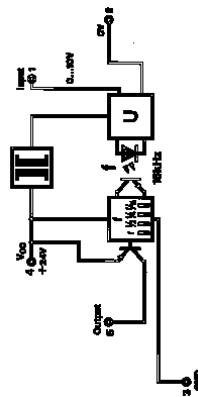
1	2	3	4	DIP switch
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0...16 kHz
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0...8 kHz
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0...4 kHz
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	0...1 kHz

### MCZ CFC 4...20 mA CLP

1	2	3	4	DIP switch
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3.2...16 kHz
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.6...8 kHz
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0.8...4 kHz
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	0.2...1 kHz

■ = on

□ = off



## Ordering data

for TS 35

Type	Part No.	Type	Part No.	Type	Part No.
MCZ VFC	8461470000	MCZ CFC	8461480000	MCZ CFC	8461490000

## Technical data

Input ranges	0...10 V	0...20 mA	4...20 mA LP*
Overload limits, input	30 V	50 mA	50 mA
Input resistance	100 k	50	
Voltage drop, Input		1 V at 20 mA	5.8...6.4 at 20 mA
Output			
Output frequency, end value	1 kHz, 4 kHz, 8 kHz, 16 kHz	1 kHz, 4 kHz, 8 kHz, 16 kHz	1 kHz, 4 kHz, 8 kHz, 16 kHz
Frequency adjustment	DIL switch	DIL switch	DIL switch
Readjustment range	±10 %, internal	±10 %, internal	±10 %, internal
Output level	PNP, Ub- 0.7 V	PNP, Ub- 0.7 V	PNP, Ub- 0.7 V
Output current	max. 20 mA	max. 20 mA	max. 20 mA
Display	LED, pulsing	LED, pulsing	LED, pulsing
Supply voltage	24 Vdc ±10 %	24 Vdc ±10 %	24 Vdc ±20 %
Power consumption	14 mA, without load	14 mA without load	14 mA without load
Making current limit	200 mA	200 mA	
Polarisation protection	yes	yes	yes
Accuracy	0.2 % v. FSR	0.2 % v. FSR	0.15 % v. FSR
Temperature coefficient	< 250 ppm/°C	< 250 ppm/°C	< 250 ppm/°C
<b>Coordination of insulation according to EN 50178</b>			
Voltage strength input/output	1 kVdc	1 kVdc	
Rated voltage	100 V	100 V	150 V
Rated surge voltage	1.5 kV	1.5 kV	2.5 kV
Overvoltage category	III	III	III
Voltage strength I/O to mounting rail	4 kV <sub>eff</sub> / 1 min	4 kV <sub>eff</sub> / 1 min	4 kV <sub>eff</sub> / 1 min
Operating temperature	0 °C...+50 °C	0 °C...+50 °C	0 °C...+50 °C
Storage temperature	-25 °C...+85 °C	-25 °C...+85 °C	-25 °C...+85 °C
Overall width	6 mm (0.24 in.)	6 mm (0.24 in.)	6 mm (0.24 in.)
Conductor cross-section	1.5 mm <sup>2</sup>	1.5 mm <sup>2</sup>	1.5 mm <sup>2</sup>

\* without DC/DC converter input supply via current loop



# Bridge Signal Conditioners

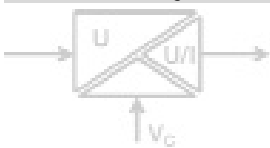
## WAVEANALOG PRO Bridge

- 3-way-isolation
- Input and output selectable by DIP-Switches
- No adjustment required
- Inverted output signals possible

### Approvals:



#### Schematic circuit diagram



Ordering data	
Screw connection	
Tension clamp connection	
Technical data*	
Input	
Input voltage (selectable by DIP-Switches)	
Input resistance	
Output	
Output voltage (selectable by DIP-Switches)	
Load resistance (Voltage output)	
Output current (selectable by DIP-Switches)	
Load resistance (Current output)	
Wire break detection	
Status indication	
Accuracy	
Temperature coefficient	
Response time	
Bridge supply voltage	

Coordination of insulation according to EN 50178, 04/98	
Rated voltage	300
Rated surge voltage	2 kV
Overvoltage category	III
Contamination class	2
Clearance and creepage distance	3 mm
Test voltage	2 kV <sub>eff</sub>

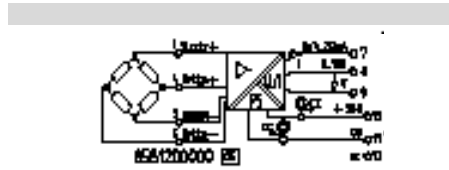
General Data	
Supply voltage	18 Vdc ... 24 Vdc ... 30 Vdc
Power consumption	max. 1.6 W @I <sub>out</sub> =20 mA
Current carrying capacity of cross-connection	2 A
Operating temperature	0...55 °C
Storage temperature	-20...85 °C
Standards/specifications	EN 50178
EMC standards	EN 61000-6-2, EN 50081-2
Factory setting	-500 mV...+500 mV / 0...10 V / + 10 V / standard
Dimensions L/H/W	92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)
Weight	100 g (0.22 lbs.)
Approvals	CE, cULus

\* Tu 23 °C, single module

#### Example for bridge supply voltage

Temperature adjustment:	
Input voltage	0...10 mA
Output	0...10 V
Bridge supply voltage	+4.8...10.2 V
Bridge excitation	1 mV/V (Declaration from manufacturer)

## PRO Bridge



Type	Part No.
WAS5 PRO Bridge	858120000
WAZ5 PRO Bridge	858121000

0...10 mV, 0...20 mV, 0...50 mV, 0...100 mV, 0...200 mV, 0...500 mV, -10...10 mV, -20...20 mV, -50...50 mV, -100...100 mV, -200...200 mV, -500...500 mV	
> 1 M	
0...5 V, 5...0 V, 10...0 V, 0...10 V	
≥ 1 k	
0...20 mA, 20...0 mA, 4...20 mA, 20...4 mA	
≤ 600	
Output: 0 V or. 0/4 mA	
Power on: LED green	
0.3 % of full scale	
± 250 ppm/K of full scale	
typ. < 200 ms	
+10 V, +5 V, 4.8...10.2 V man. adjustment and offset possible	

Rated voltage	300
Rated surge voltage	2 kV
Overvoltage category	III
Contamination class	2
Clearance and creepage distance	3 mm
Test voltage	2 kV <sub>eff</sub>

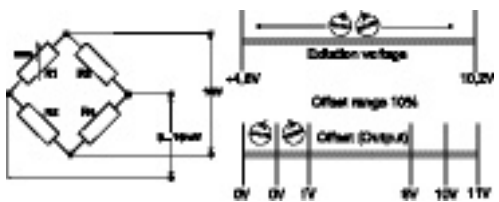
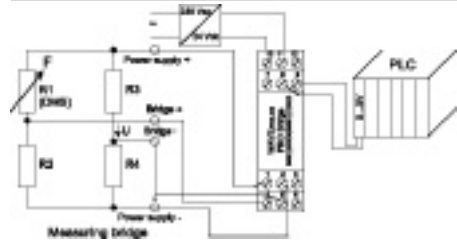
General Data	
Supply voltage	18 Vdc ... 24 Vdc ... 30 Vdc
Power consumption	max. 1.6 W @I <sub>out</sub> =20 mA
Current carrying capacity of cross-connection	2 A
Operating temperature	0...55 °C
Storage temperature	-20...85 °C
Standards/specifications	EN 50178
EMC standards	EN 61000-6-2, EN 50081-2
Factory setting	-500 mV...+500 mV / 0...10 V / + 10 V / standard
Dimensions L/H/W	92.4 / 112.5 / 17.5 mm (3.64 / 4.43 / 0.69 in.)
Weight	100 g (0.22 lbs.)
Approvals	CE, cULus

Input voltage	SW 1									
	1	2	3	4	5	6	7	8	9	10
0...10 mV										
0...20 mV										
0...50 mV										
0...100 mV										
0...200 mV										
0...500 mV										
-10 mV...10 mV										
-20 mV...20 mV										
-50 mV...50 mV										
-100 mV...100 mV										
-200 mV...200 mV										
-500 mV...500 mV										
output										
0...+10 V										
0...+5 V										
0...20 mA										
4...20 mA										
Bridge supply voltage										
+10V										
+5V										
+4.8...+10.2V adjustable										
+4.8...+10.2V adjustable man. adjustment and offset possible										
Transmission method										
standard output signal										
inverse output signal										

■ = on  
□ = off

Status LED	
LED on	normal operating
LED off	Error
LED blinks slow	measurement range undershoot U <sub>in</sub> < U <sub>max</sub> + 10%
LED blinks fast	measurement range undershoot U <sub>in</sub> < U <sub>max</sub> - 10 %

#### Application



# Interface Converter RS232 / RS485/422 and RS232 / TTY

## WAVEDATA

- 3-way-isolation
- RS232/RS485/422 = max. transmission rate 115.2 kBit/s
- RS232/TTY = max. transmission rate 19.2 kBit/s
- RS232 connection by SUB-D 9
- RS485/422 shield connection by KLBÜ
- TTY shield connection by KLBÜ
- DTE or DCE connection selectable

## Approvals:



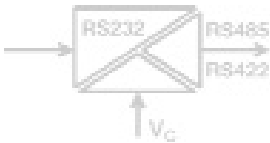
## WDS2 RS232/RS485/422



## WDS2 RS232/TTY



### Schematic circuit diagram



### Ordering data

Screw connection

### Technical data\*

#### RS232 Interface

Connection  
DTE/DCE connection

#### RS422/RS485 interface

##### RS422 interface

Connection  
Shield point  
Terminal resistance  
Transmission length

##### RS485 interface

Connection  
Shield point  
Terminal resistance  
Transmission length

Maximum transmission rate  
Bit distortion  
Bit delay

### Coordination of insulation according to DIN EN50178, 04/98

Rated voltage  
Rated surge voltage  
Overvoltage category  
Contamination class  
Clearance and creepage distance  
Test voltage

### General Data

Supply voltage  
Power consumption  
Current carrying capacity of cross-connection  
Operating temperature  
Storage temperature  
Standards/Specifications  
EMC standards  
Dimensions L/H/W  
Weight  
Approvals

\* Tu 23 °C, single module

### Type

WDS2 RS232/RS485/422

### Part No.

861570000

SUB-D 9 (connector)  
selectable by DIP-switches  
  
selectable by DIP-switches

BLZ Screw connection clamp  
KLBÜ 4-6 Z/1  
by DIP-switches  
max. 1200 m

BLZ Screw connection clamp  
KLBÜ 4-6 Z/1  
by DIP-switches  
max. 1200 m

115.2 kBit/s  
< 1.5 %  
3 µs

300

4 kV

III

2

3 mm

1.2 KV<sub>eff</sub>

18 Vdc ... **24 Vdc** ... 30 Vdc

max. 1.6 W @ I<sub>out</sub> = 20 mA

2 A

0...55 °C

-20...85 °C

EN 50178

EN 50081, EN 50082, EN 55011, EN 610000, EN 61326

92.4 / 112.5 / 22.5 mm (3.64 / 4.43 / 0.88 in.)

150 g (0.33 lbs.)

CE, cULus

### Type

WDS2 RS232/TTY

### Part No.

861569000

SUB-D 9 (connector)  
selectable by DIP-switches

BLZ Screw connection clamp  
KLBÜ 4-6 Z/1

max. 1000 m

19.2 kBit/s  
< 1.5 %  
3 µs

300

4 kV

III

2

3 mm

1.2 KV<sub>eff</sub>

18 Vdc ... **24 Vdc** ... 30 Vdc

max. 1.6 W @ I<sub>out</sub> = 20 mA

2 A

0...55 °C

-20...85 °C

EN 50178

EN 50081, EN 50082, EN 55011, EN 610000, EN 61326

92.4 / 112.5 / 22.5 mm (3.64 / 4.43 / 0.88 in.)

150 g (0.33 lbs.)

CE, cULus

## Current monitoring

Monitoring flows of currents enables a constant control of individual devices and installation components. Discrepancies or disruptions arising in the electrical circuit can easily be evaluated as breakdowns. Targeted rectifying procedures can be taken. The **WAVECONTROL** range of products convert sinusoidal/non-sinusoidal AC/DC currents up to 60 A to standard analog signals. The measurement processes are based on 2 basic principles. One principle is alternating currents up to 10 A ac and 50/60 Hz are measured using the **transformer process**. The module is looped directly into the measurement circuit. A **Hall-effect** element comes in to operation at 10 A ac/dc.

The potential-free wire is inserted through the module, allowing currents up to 60 A ac/dc to be measured. Quite often, there are high-frequency parts of signals on the wire to be measured. In order to be able to take these parts of the signals into consideration, so-called **TRMS converters (TRUE Root Mean Square)** are connected to the Hall sensors. This enables measurements up to 2 kHz, independent of the shape of the curve. Standard signals (0...20, 4...20 mA, 4...20 A current loop supply, 0...10 V) or a switch output are on offer.

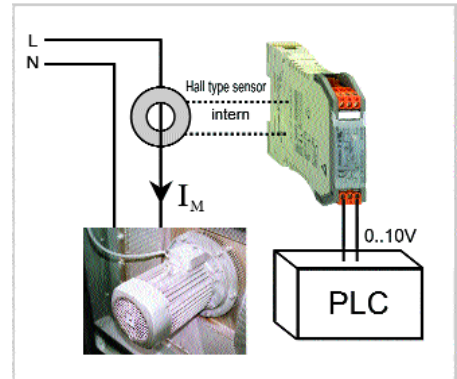
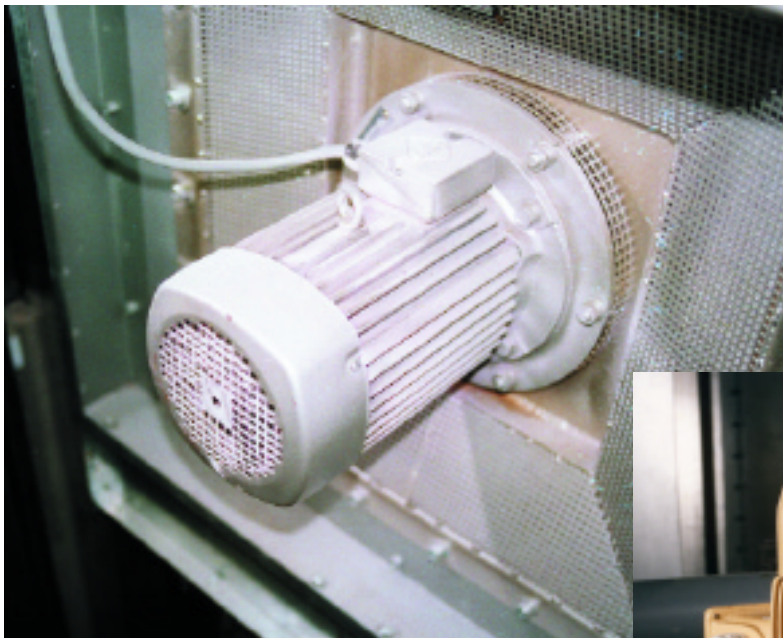
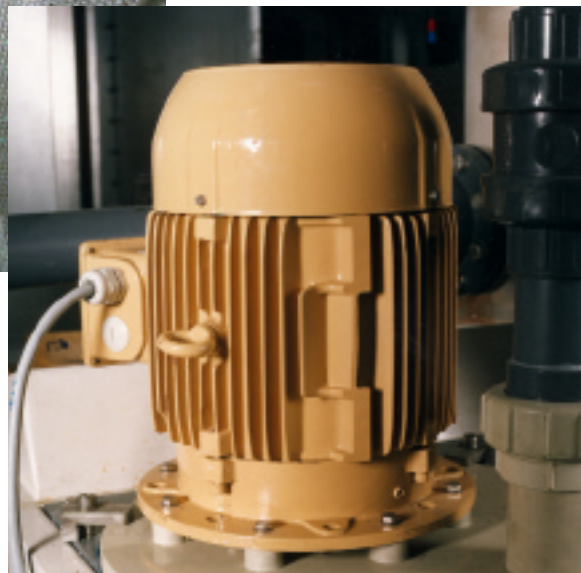


Fig.: Monitoring motor currents



Monitoring a motor in a cooling system



Monitoring a pump in a sewage treatment plant

# Current Monitoring

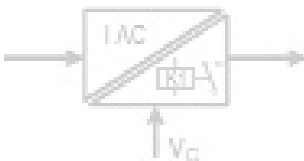
## WAVECONTROL

- Current ranges adjustable by DIP switch
- Cross-connectable voltage supply via cross-connectors
- Selectable hysteresis
- Selectable working and closed-circuit current principle

## Approvals:



### Schematic circuit diagram



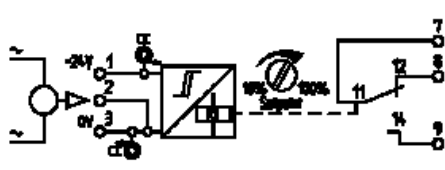
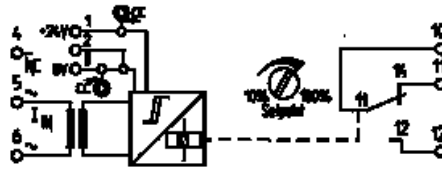
## WAS2 CMR WAZ2 CMR

1/5/10 A ac  
selectable with  
relay output



## WAS2 CMR WAZ2 CMR

20/40/60A ac  
selectable with  
relay output



### Ordering data

Screw connection

Tension clamp connection

### Technical data\*

#### Input

Input current

Input frequency

Pass through diameter

Measuring principle

Connection type

Measurement circuit voltage

Maximum measuring circuit

#### Output

Contact set

Minimum switching voltage

Maximum switching voltage

Continuous current AC

Continuous current DC

Maximum switching current

Minimum switching current

Status LED

Threshold

Hysteresis

Temperature coefficient

Response time (10 ... 90%)

Working/closed-circuit current principle

### Coordination of insulation according to DIN EN 50178, 04/98

Rated voltage

Rated surge voltage

Oversvoltage category

Contamination class

Clearance and creepage distance

Test voltage

### General Data

Supply

Supply voltage

Power consumption at rated voltage

Reverse polarity protection

Current carrying capacity of the cross-connection

Operating temperature

Storage/transport

Factory setting

Dimensions L/H/W

Weight

Approvals

\* T<sub>U</sub> = 23 °C single module

### Type Part No.

WAS2 CMR 1/5/10A ac 8516560000

WAZ2 CMR 1/5/10A ac 8516570000

### Type Part No.

WAS2 CMR 20/40/60A ac 8513340000

WAZ2 CMR 20/40/60A ac 8526600000

1A ac/5A ac/10A ac selectable (without additional adjustment)

50Hz/60Hz

transformer coupled

screw or tension clamp connection

250Vac

100A for 1s

1 changeover contact

6 Vdc/6 Vac

60 Vdc/250 Vac

3 A

0.7 A

7 A

100 mA

green LED

10 % ... 100 % adjustable via front potentiometer

approx. 5 % or approx. 10 % selectable from set threshold

800 ppm/K

typ. 700 ms

selectable

300 V

4 KV

III

2

3 mm

4 kV eff

20A ac/40A ac/60A ac selectable (without additional adjustment)

50Hz/60Hz

8mm

Contact-free current monitoring using Hall sensor

Push-through connection

400Vac, higher voltages dependent on wire insulation

dependent on wire cross-section

1 changeover contact

6 Vdc/6 Vac

60 Vdc/250 Vac

3 A

0.7 A

7 A

100 mA

green LED

10 % ... 100 % adjustable via front potentiometer

approx. 5 % or approx. 10 % selectable from set threshold

250 ppm/K

typ. 700 ms

selectable

300 V

4 KV

III

2

3 mm

4 kV eff

21.6 Vdc...24 Vdc...26.4 Vdc

23 mA (relay not switched)

47 mA (relay switched)

yes

2 A

0 ... 50°C

-20 ... +70°C

Input range :40A ac; hysteresis 10% working current principle

92.4 /112.4 / 22.5 mm ( 3.64 / 4.43 / 0.88 in.)

150g (0.33 lbs.)

CE, cULus

# Current Monitoring

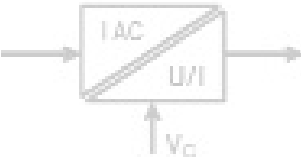
## WAVECONTROL

- Input and output range adjustable by DIP switch
- No calibration required
- Cross-connectable voltage supply via cross-connectors

## Approvals:

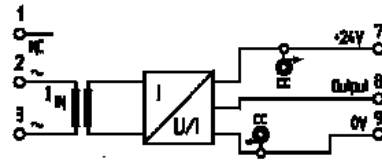


### Schematic circuit diagram



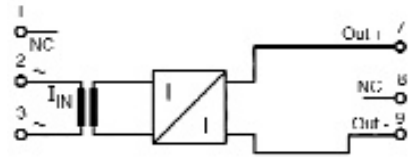
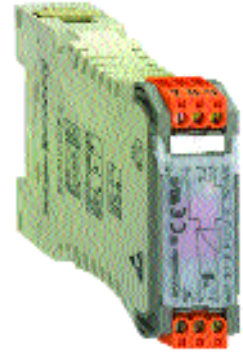
## WAS1 CMA WAZ1 CMA

1/5/10A ac  
selectable with  
analog output  
0...20 mA /  
4...20 mA  
0...10 V



## WAS1 LP CMA WAZ1 LP CMA

1/5/10 A ac  
selectable with  
analog output  
4...20 mA  
loop powered



### Ordering data

Screw connection

Tension clamp connection

### Technical data\*

	Type	Part No.	Type	Part No.
Input current	1 A ac/5 A ac/10 A ac selectable (without additional adjustment)	8523400000	1A ac/5A ac/10A ac selectable (without additional adjustment)	8528650000
Input frequency	50 Hz/60 Hz		50 Hz/60 Hz	
Accuracy	0.5 % FSR		0.5 % FSR	
Measuring principle	transformer coupled		transformer coupled	
Connection type	Screw or tension clamp connection		Screw or tension clamp connection	
Measurement circuit voltage	250 Vac		250 Vac	
Maximum measuring circuit	100 A for 1s		100 A for 1s	
Output				
Current/voltage selectable	0 ... 10 V 0 ... 20 mA 4 ... 20 mA		4 ... 20mA current loop supply	
Output voltage	0 ... 10 V			
Offset voltage	max. 0.05 V			
Load resistance	1 K			
Output signal limit	approx. 13 V and. 24 mA		approx. 24 mA	
Output current	0/4 ... 20 mA		4 ... 20 mA	
Offset current	max. 100 µA		max. 100 µA	
Load resistance	600		550 (at 24 V) $RL = (V_{cc} - 13V) / 20 \text{ mA}$	
Status LED	green LED ON-> OK; blinks -> signal out of range; OFF -> Error		green LED ON-> OK; blinks -> signal out of range; OFF -> Error	
Temperature coefficient	200 ppm/K		200 ppm/K	
Response time (10 ... 90%)	typ. 700 ms		typ. 700 ms	
<b>Coordination of insulation according to DIN EN 50178, 04/98</b> (safe separation)				
Rated voltage	300V		300V	
Rated surge voltage	6KV		6KV	
Overtoltage category	III		III	
Contamination class	2		2	
Clearance and creepage distance	5.5 mm		5.5 mm	
Test voltage	4kV eff		4kV eff	
<b>General Data</b>				
Supply				
Supply voltage	21.6 Vdc...24 Vdc...26.4 Vdc		13 Vdc ... 30 Vdc	
Power consumption at rated voltage	40 mA at $I_{out} = 20 \text{ mA}$			
Reverse polarity protection	yes		yes	
Operating temperature	0 ... 50 °C		0 ... 50 °C	
Storage/transport	-20 ... +70 °C		-20 ... +70 °C	
Factory setting	0 ... 5 Aac; 4 ... 20 mA		0 ... 5 Aac; 4 ... 20 mA	
Dimensions L/H/W	72 / 92.4 / 22.5 mm (2.83 / 3.64 / 0.88 in.)		72 / 92.4 / 22.5 mm (2.83 / 3.64 / 0.88 in.)	
Weight	150 g (0.33 lbs.)		150 g (0.33 lbs.)	
Approvals	CE, cULus		CE, cULus	

\*  $T_U = 23 \text{ °C}$  single module

# Current Monitoring

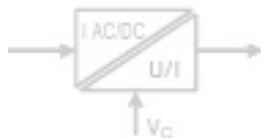
## WAVECONTROL

- Input and output range adjustable by DIP switch
- No calibration required
- True TRMS value measurements
- Hall sensor measurement method

## Approvals:



### Schematic circuit diagram



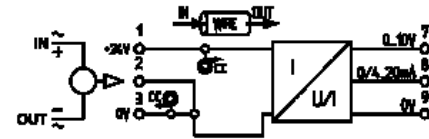
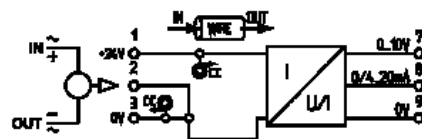
## WAS2 CMA WAZ2 CMA

5/10A ac/dc  
selectable with  
analog output  
0 ... 20 mA/  
4 ... 20 mA/  
0 ... 10 V



## WAS2 CMA WAZ2 CMA

20/25/30A ac/dc  
selectable with  
analog output  
0 ... 20 mA/  
4 ... 20 mA/  
0 ... 10 V



Ordering data	
Screw connection	
Tension clamp connection	
Technical data*	
Input	
Input current	5 A uc/10 A uc selectable (without additional adjustment)
Input frequency	0 Hz - 2 kHz (True RMS to DC Converter)
Accuracy	1% (0 Hz - 1 kHz) Crest factor 3 FSR 2% (0 Hz - 2 kHz) Crest factor 5 FSR
Measuring principle	
Connection type	Contact-free current monitoring using Hall sensor
Pass through diameter	8 mm
Measurement circuit voltage	400 Vac, higher voltages dependent on wire insulation
Maximum measuring circuit	dependent on wire cross-section
Output	
Current/voltage selectable	0 ... 10 V 0 ... 20 mA 4 ... 20 mA
Output voltage	0 ... 10 V
Offset voltage	max. 0.08 V
Load resistance	1 K
Output signal limit	approx. 13 V and. 24 mA
Output current	0/4 ... 20 mA
Offset current	max. 150 µA
Load resistance	600
Status LED	green LED
Temperature coefficient	ON-> OK; blinks -> signal out of range; OFF -> Error
Response time (10 ... 90%)	650 ppm/K typ. 700 ms
Coordination of insulation according to DIN EN 50178, 04/98 (safe separation)	
Rated voltage	300 V
Rated surge voltage	6 KV
Overvoltage category	III
Contamination class	2
Clearance and creepage distance	5.5 mm
Test voltage	4 kV eff
General Data	
Supply	
Supply voltage	21.6 Vdc...24 Vdc...26.4 Vdc
Power consumption at rated voltage	50 mA at I <sub>out</sub> = 20 mA
Reverse polarity protection	yes
Operating temperature range	0 ... 50 °C
Storage/transport	-20 ... +70 °C
Factory setting	0 ... 5A uc; 4 ... 20 mA
Dimensions L/H/W	92.4 / 112.4 / 22.5 mm (3.63 / 4.42 / 0.88 in.)
Weight	150g (0.33 in.)
Approvals	CE, cULus

\* T<sub>U</sub> = 23 °C single module

Type	Part No.
WAS2 CMA 5/10A uc	8526610000
WAZ2 CMA 5/10A uc	8526620000
Type	
WAS2 CMA 20/25/30A uc	8545830000
WAZ2 CMA 20/25/30A uc	8545840000
Type	
20/25/30 A uc selectable (without additional adjustment)	
Input frequency	0 Hz - 2 kHz (True RMS to DC Converter)
Accuracy	1% (0 Hz - 1 kHz) Crest factor 3 FSR 2% (0 Hz - 2 kHz) Crest factor 5 FSR
Measuring principle	
Connection type	Contact-free current monitoring using Hall sensor
Pass through diameter	8 mm
Measurement circuit voltage	400 Vac, higher voltages dependent on wire insulation
Maximum measuring circuit	dependent on wire cross-section
Output	
Current/voltage selectable	0 ... 10 V 0 ... 20 mA 4 ... 20 mA
Output voltage	0 ... 10 V
Offset voltage	max. 0.08 V
Load resistance	1 K
Output signal limit	approx. 13 V and. 24 mA
Output current	0/4 ... 20 mA
Offset current	max. 150 µA
Load resistance	600
Status LED	green LED
Temperature coefficient	ON-> OK; blinks -> signal out of range; OFF -> Error
Response time (10 ... 90%)	650 ppm/K typ. 700 ms
Coordination of insulation according to DIN EN 50178, 04/98 (safe separation)	
Rated voltage	300 V
Rated surge voltage	6 KV
Overvoltage category	III
Contamination class	2
Clearance and creepage distance	5.5 mm
Test voltage	4 kV eff
General Data	
Supply	
Supply voltage	21.6 Vdc...24 Vdc...26.4 Vdc
Power consumption at rated voltage	50 mA at I <sub>out</sub> = 20 mA
Reverse polarity protection	yes
Operating temperature range	0 ... 50 °C
Storage/transport	-20 ... +70 °C
Factory setting	0 ... 25 A uc; 4 ... 20mA
Dimensions L/H/W	92.4 / 112.4 / 22.5 mm (3.63 / 4.42 / 0.88 in.)
Weight	150g (0.33 in.)
Approvals	CE, cULus

Type	Part No.
WAS2 CMA 20/25/30A uc	8545830000
WAZ2 CMA 20/25/30A uc	8545840000
Type	
20/25/30 A uc selectable (without additional adjustment)	
Input frequency	0 Hz - 2 kHz (True RMS to DC Converter)
Accuracy	1% (0 Hz - 1 kHz) Crest factor 3 FSR 2% (0 Hz - 2 kHz) Crest factor 5 FSR
Measuring principle	
Connection type	Contact-free current monitoring using Hall sensor
Pass through diameter	8 mm
Measurement circuit voltage	400 Vac, higher voltages dependent on wire insulation
Maximum measuring circuit	dependent on wire cross-section
Output	
Current/voltage selectable	0 ... 10 V 0 ... 20 mA 4 ... 20 mA
Output voltage	0 ... 10 V
Offset voltage	max. 0.08 V
Load resistance	1 K
Output signal limit	approx. 13 V and. 24 mA
Output current	0/4 ... 20 mA
Offset current	max. 150 µA
Load resistance	600
Status LED	green LED
Temperature coefficient	ON-> OK; blinks -> signal out of range; OFF -> Error
Response time (10 ... 90%)	650 ppm/K typ. 700 ms
Coordination of insulation according to DIN EN 50178, 04/98 (safe separation)	
Rated voltage	300 V
Rated surge voltage	6 KV
Overvoltage category	III
Contamination class	2
Clearance and creepage distance	5.5 mm
Test voltage	4 kV eff
General Data	
Supply	
Supply voltage	21.6 Vdc...24 Vdc...26.4 Vdc
Power consumption at rated voltage	50 mA at I <sub>out</sub> = 20 mA
Reverse polarity protection	yes
Operating temperature range	0 ... 50 °C
Storage/transport	-20 ... +70 °C
Factory setting	0 ... 25 A uc; 4 ... 20mA
Dimensions L/H/W	92.4 / 112.4 / 22.5 mm (3.63 / 4.42 / 0.88 in.)
Weight	150g (0.33 in.)
Approvals	CE, cULus

# Current Monitoring

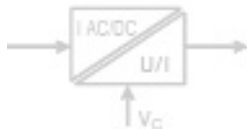
## WAVECONTROL

- Input and output range adjustable by DIP switch
- No calibration required
- Cross-connectable voltage supply via cross-connectors
- True TRMS value measurements
- Hall sensor measurement method

## Approvals:

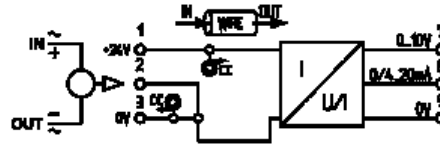


### Schematic circuit diagram



## WAS2 CMA WAZ2 CMA

40/50/60A ac/dc  
selectable with  
analog output  
0 ... 20 mA/  
4 ... 20 mA/  
0 ... 10 V



Ordering data	Type	Part No.
Screw connection	WAS2 CMA 40/50/60A uc	8513330000
Tension clamp connection	WAZ2 CMA 40/50/60A uc	8526590000
Technical data*		
<b>Input</b>	40/50/60A uc selectable (without additional adjustment)	
Input current	0 Hz - 2 kHz (True RMS to DC Converter)	
Input frequency	1% (0Hz - 1KHz) Crest factor 3 FSR	
Accuracy	2% (0Hz - 2KHz) Crest factor 5 FSR	
Measuring principle	Contact-free current monitoring using Hall sensor	
Connection type	Push-through connection (Please notice push through direction by DC measurement)	
Pass through diameter	8 mm	
Measurement circuit voltage	400 Vac, higher voltages dependent on wire insulation	
Maximum measuring circuit	dependent on wire cross-section	
<b>Output</b>		
Current/voltage selectable	0 ... 10 V 0 ... 20 mA 4 ... 20 mA	
Output voltage	0 ... 10V	
Offset voltage	max. 0.08 V	
Load resistance	1 k	
Output signal limit	approx. 13 V and. 24 mA	
Output current	0/4 ... 20 mA	
Offset current	max. 150 µA	
Load resistance	600	
Status LED	green LED ON-> OK; blinks -> signal out of range; OFF -> Error	
Temperature coefficient	650 ppm/K	
Response time (10 ... 90%)	type 700 ms	
Coordination of insulation according to DIN EN 50178, 04/98		
(safe separation)	300 V	
Rated voltage	6 KV	
Rated surge voltage	III	
Overvoltage category	2	
Contamination class	5.5 mm	
Clearance and creepage distance	4 kV eff	
Test voltage		
General Data		
Supply	21.6 Vdc...24 Vdc...26.4 Vdc	
Supply voltage	50 mA at I <sub>out</sub> = 20 mA	
Power consumption at rated voltage	yes	
Reverse polarity protection		
Operating temperature range	0 ... 50°C	
Storage/transport	-20 ... +70°C	
Factory setting	0 ... 50 A uc; 4 ... 20 mA	
Dimensions L/H/W	92.4 / 112.4 / 22.5 mm (3.63 / 4.42 / 0.88 in.)	
Weight	150 g (0.33 in.)	
Approvals	CE, cULus	

\* T<sub>U</sub> = 23 °C single module

# Voltage monitoring with analog output

## WAVECONTROL

- 3-way-isolation
- Max. measuring voltage 450 Vac<sub>eff</sub>
- Output range selection by DIP-Switches
- No adjustment required

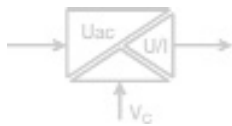
## VMA Vac



### Approvals:



### Schematic circuit diagram



### Ordering data

Screw connection	WAS2 VMA Vac
Tension clamp connection	WAZ2 VMA Vac

Type	Part No.
WAS2 VMA Vac	8581220000
WAZ2 VMA Vac	8581230000

### Technical data\*

#### Input

Input voltage / input impedance	
Input frequency	
Accuracy	
Maximum overvoltage (short term)	

Connection 1: 0 V GND
Connection 2: 0...30 Vac / 30 k
Connection 3: 0...70 Vac / 70 k
Connection 4: 0...130 Vac / 130 k
Connection 5: 0...250 Vac / 250 k
Connection 6: 0...450 Vac / 450 k
40 Hz...400 Hz wave
1.3 % (40 Hz...60 Hz) typ. 1 %
2.0 % (70 Hz...400 Hz) typ. 1.5 %
45 Vac with 0...30 Vac
100 Vac from 0...100 Vac
180 Vac from 0...180 Vac
270 Vac from 0...250 Vac
475 Vac from 0...450 Vac

#### Output

Current-/voltage output (by DIP-Switches)	
Output voltage	
Output offset voltage	
Load resistance	
Output current	
Output offset current	
Load resistance	
Status indication	
Temperature coefficient	
Response time (0...90%)	

0...10 V
0...20 mA
4...20 mA
0...10 V
max. 0.02 V
1 k
0/4...20 mA
max. 40 µA
600
LED green
250 ppm/K
300 ms

### Coordination of insulation according to DIN EN 50178, 04/98

Rated voltage	
Rated surge voltage	
Overvoltage category	
Contamination class	
Clearance and creepage distance	
Test voltage	

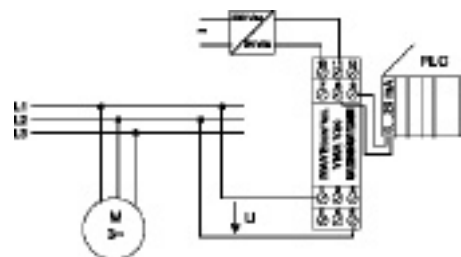
Supply / Output	Input / Output Supply / Input
300 V	600 V
4 kV	6 kV
III	III
2	2
3 mm	5.5 mm
3 kV <sub>eff</sub>	4 kV <sub>eff</sub>

### General Data

Supply voltage	18 Vdc ... 24 Vdc ... 30 Vdc
Rated current consumption	40 mA...30 mA...24 mA (I <sub>out</sub> = 20 mA)
Polarization protection	yes
Cross connection above	+24 V, max. current: 2 A
Cross connection below	0 V max. current: 2 A
Operating temperature	0...50 °C
Storage temperature	-20...+70 °C
Factory setting	0...10 V / 0...20 mA
Dimensions L/H/W	92.4 / 112.4 / 22.5 mm (3.64 / 4.42 / 0.88 in.)
Weight	200 g
Approvals	CE, cULus

\* Tu 23°C, single module

### Application





## Power supplies

### WAVEPOWER

The WAVEPOWER power supply is specially designed for use with WAVESERIES Analog signal conditioners. The modules could be supplied by using the pluggable cross connection, which reduces the installation time. Especially in decentralized Automation systems the required place will be reduced.

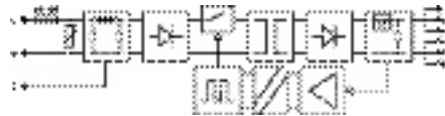
### CP-SNT 12W



### Approvals:



### Diagramm/Schematic circuit diagram



– secondary through plug-in jumpers ZOV cross-connectable to other WAVE-modules

### Ordering data

Ordering data		Type	Part No.
Output voltage/max. current		CP-SNT 12 W	9918840024
Input voltage		85 Vac, 120 Vdc	
	Minimum	115-230 Vac $\pm$ 10%, 50/60 Hz	
	Typical	265 Vac, 300 Vdc	
	Maximum	260 mA RMS $\pm$ 20%	
Input current	at 115 Vac	180 mA RMS $\pm$ 20%	
(Average values for references only)		125 mA $\pm$ 20%	
	at 230 Vac	65 mA $\pm$ 20%	
	at 125 Vdc	2 A slow fuse (internal)	
	at 250 Vdc	Varistor	
Input protection	Fuse	100 kHz PWM	
	Overvoltage protection	80%	
Switching frequency		0.1% RMS	
Efficiency at maximum load		0.6%	
Maximum ripple		0.2% 85 Vac - 265 Vac on	
Regulation	Load (10-100% load)	Overcurrent shutdown with automatic restart plus thermal shutdown	
	at input voltage	8,000 $\mu$ F	
Overload protection		30 ms	
Maximum capacity at output		80 ms	
Hold time	at 115 Vac	-40 $^{\circ}$ C...+85 $^{\circ}$ C	
(Maximum output current following input loss)	at 230 Vac	-20 $^{\circ}$ C...+50 $^{\circ}$ C max. full rated load	
Storage temperature		Derating: 33% at 60 $^{\circ}$ C	
Operating temperature		20 - 85% RH non-condensing	
Humidity	Operating temperature	20 - 90% RH	
	Storage temperature	3 kV RMS	
Galvanic isolation	Input-output	4 kV RMS	
	Input/output to mounting rail	1.5 kV RMS	
	Input to earth	500 V RMS	
	Output to earth	26-12 AWG (0.1-4.0 mm <sup>2</sup> )	
Wire size		90 / 18 / 112.5 mm (3.54 / 0.71 / 4.43 in.)	
Dimensions L/H/W		110 g (0.24 in.)	
Weight		TS 35	
Mounts on mounting rail			

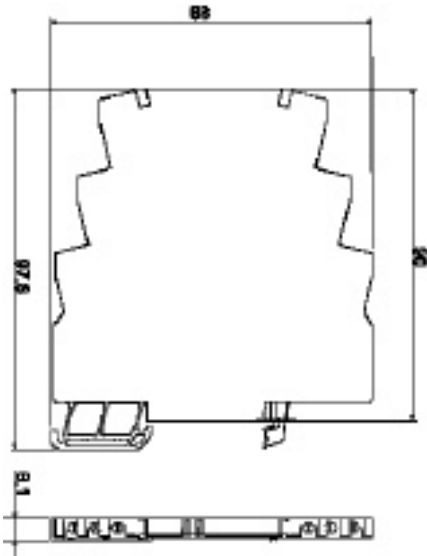
### Approvals/certifications

CE, cULus, CSA

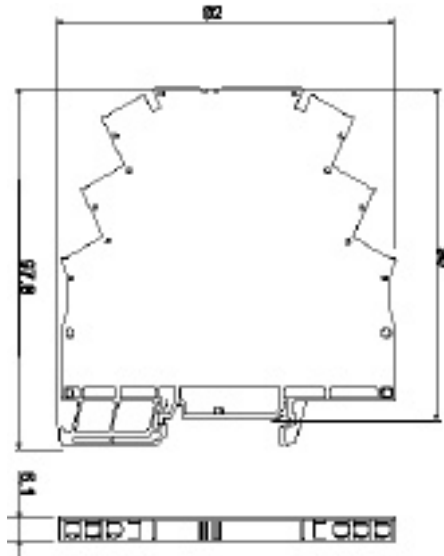
## Dimensions and accessories

### MICROANALOG

#### Screw connection



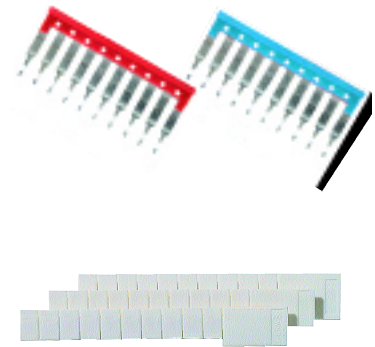
#### Tension clamp connection



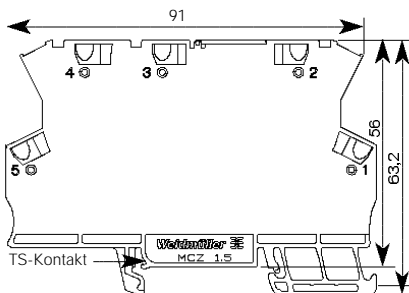
#### Accessories

Cross-connection, 2-pole, red
Cross-connection, 3-pole, red
Cross-connection, 4-pole, red
Cross-connection, 10-pole, red
Cross-connection, 41-pole, red
Cross-connection, 2-pole, blue
Cross-connection, 3-pole, blue
Cross-connection, 4-pole, blue
Cross-connection, 10-pole, blue
Cross-connection, 41-pole, blue
Terminal marker

Type	Part No.
ZOV 4N/2 red	1793950000
ZOV 4N/3 red	1793980000
ZOV 4N/4 red	1794010000
ZOV 4N/10 red	1794040000
ZOV 4N/41 red	1794070000
ZOV 4N/2 blue	1793960000
ZOV 4N/3 blue	1793990000
ZOV 4N/4 blue	1794020000
ZOV 4N/10 blue	1794050000
ZOV 4N/41 blue	1794080000
WS10/6	1060960000



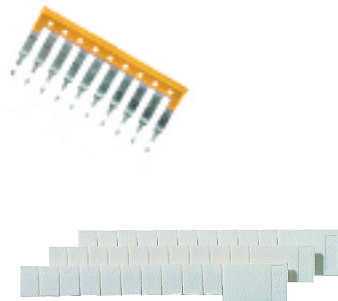
### MCZ



#### Accessories

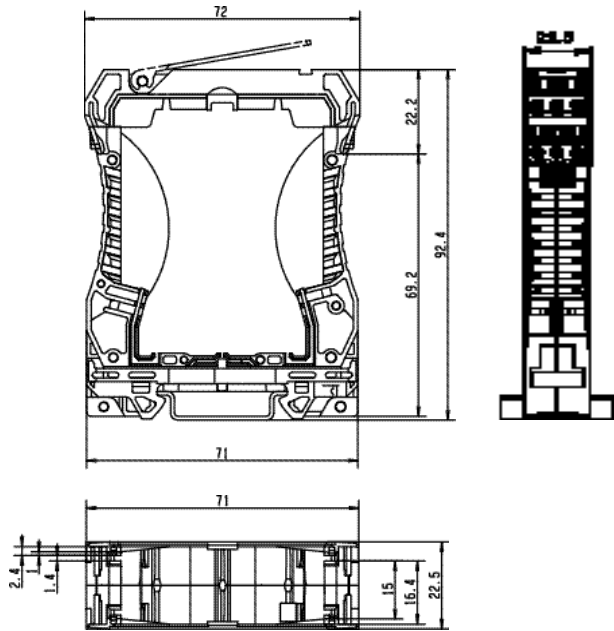
Cross-connection, 2-pole, yellow
Cross-connection, 3-pole, yellow
Cross-connection, 4-pole, yellow
Cross-connection, 5-pole, yellow
Cross-connection, 6-pole, yellow
Cross-connection, 7-pole, yellow
Cross-connection, 8-pole, yellow
Cross-connection, 9-pole, yellow
Cross-connection, 10-pole, yellow
Terminal marker

Type	Part No.
ZOV 4N/2 yellow	1608950000
ZOV 4N/3 yellow	1608960000
ZOV 4N/4 yellow	1608970000
ZOV 4N/5 yellow	1608980000
ZOV 4N/6 yellow	1608990000
ZOV 4N/7 yellow	1609000000
ZOV 4N/8 yellow	1609010000
ZOV 4N/9 yellow	1609020000
ZOV 4N/10 yellow	1609030000
WS10/6	1060960000

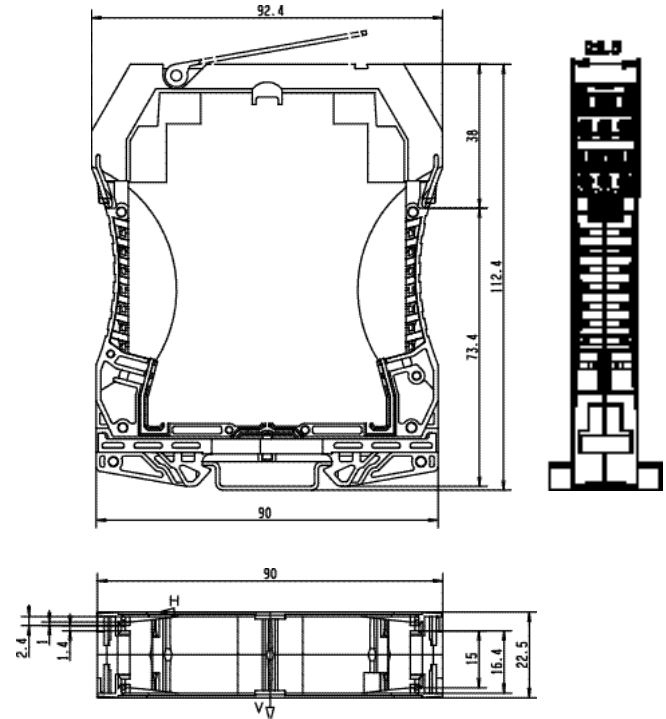


## Dimensions and accessories

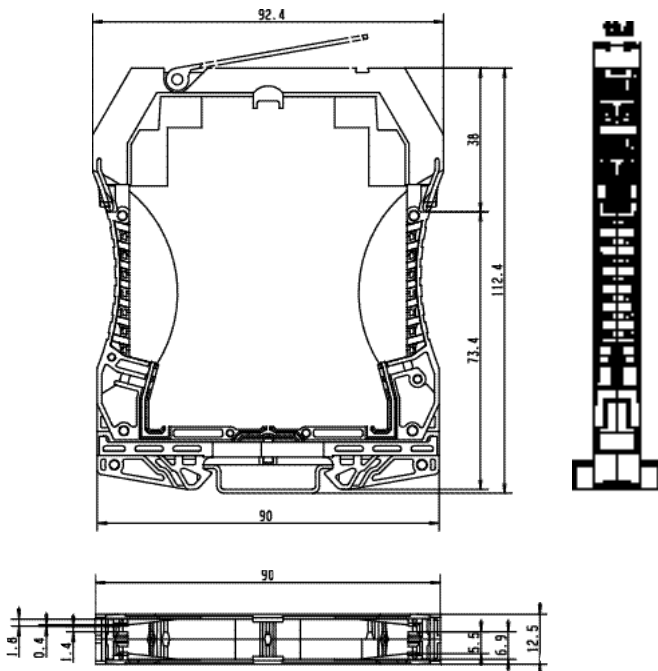
### WAVEBOX S 22.5



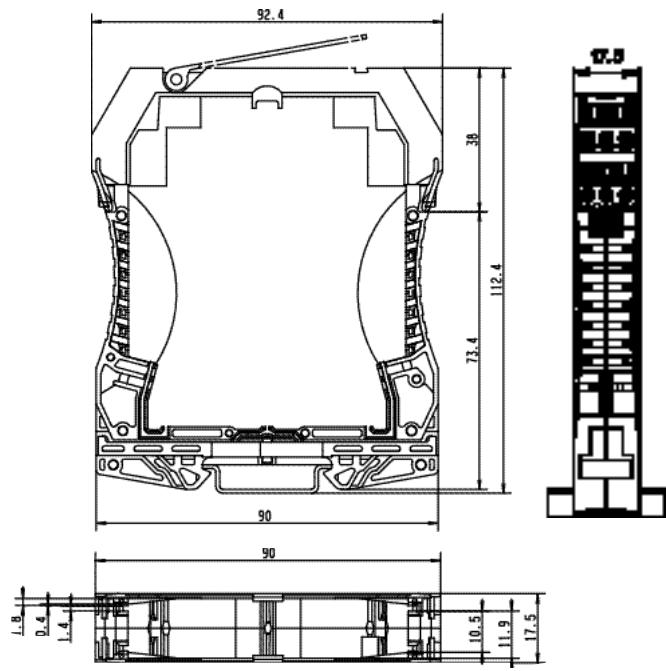
### WAVEBOX L 22.5



### WAVEBOX 12.5



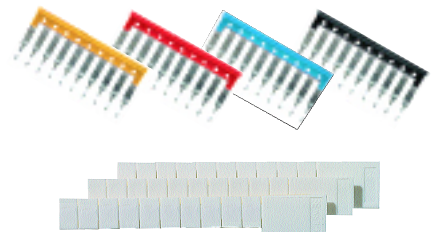
### WAVEBOX 17.5



### Dimensions in mm

Accessories	Type	Part No.
Cross-connection ZQV 2.5N/2 black	ZQV 2.5N/2 black	1718080000
Cross-connection ZQV 2.5N/2 red	ZQV 2.5N/2 red	1717900000
Cross-connection ZQV 2.5N/2 blue	ZQV 2.5N/2 blue	1717990000
Cross-connection ZQV 2.5N/2 yellow	ZQV 2.5N/2 yellow	1693800000

Terminal marker		
WS 10/5 Multicard for Plotter print	WS10/5	1061160000
WS 10/5 Blank	WS10/5 neutral	1060860000



Argentina	Malaysia
Australia	Mexico
Austria	Morocco
Bahrain	Netherlands
Belarus	New Zealand
Belgium	Nicaragua
Brazil	Norway
Bulgaria	Oman
Canada	Pakistan
Chile	Panama
China	Peru
Colombia	Philippines
Costa Rica	Poland
Croatia	Portugal
Czech Republic	Qatar
Denmark	Romania
Egypt	Russia
El Salvador	Saudi Arabia
Estonia	Singapore
Finland	Slovakia
France	Slovenia
Germany	South Africa
Greece	South Korea
Guatemala	Spain
Honduras	Sweden
Hong Kong	Switzerland
Hungary	Syria
India	Taiwan
Indonesia	Thailand
Iran	Turkey
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Israel	United Arab Emirates
Italy	United Kingdom
Japan	USA
Jordan	Vietnam
Kuwait	Yemen
Lebanon	Yugoslavia
Luxembourg	



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