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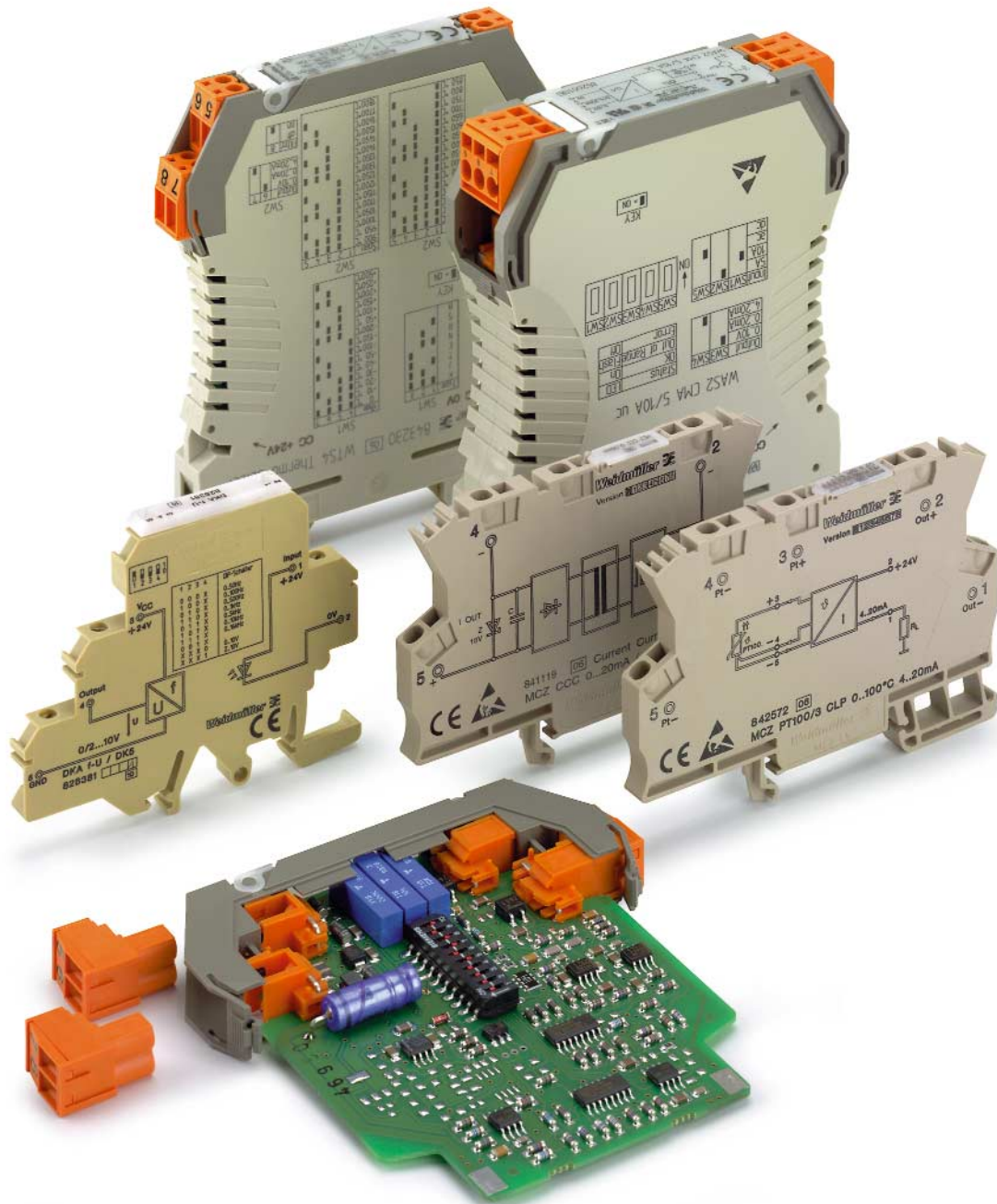

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Analogue Signal Processing

The problem

The real world can be measured in many ways, for example, via temperature, humidity, air pressure and so forth. The parameters of these different physical qualities change continuously. Elements that monitor statuses and changes in statuses of a given environment, must reflect these continual changes.

Within the framework of industrial monitoring tasks, the statuses of an environment are monitored by using sensors. These sensors should provide signals that enable connected evaluating and monitoring installations to draw detailed conclusions concerning the status of, for example, a production process. The sensor signals trace the continuous changes in the monitored range. The signals can be in analogue or digital form; which means in normal cases, an electrical voltage or current value is produced that corresponds proportionally to the monitored physical quantities. Increasing automation with the intention of achieving or maintaining certain predetermined statuses makes the processing of analogue values increasingly important. This is also true of fields beyond those where this has been necessary and standard for a long time, for example, processing technology in the chemical industry. Standard electrical signal values are the norm 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 has taken account the need for increasing automation with the processing of these analogue signals, and offers a wide range of products that are designed for 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 safe separation of, for example, sensor circuits of an evaluation circuit. This safe 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 separation and monitoring signals. The different designs in connection with the respective functions cover practically all applications in industrial measurement technology. With these new products, Weidmüller offers the possibility of taking into account the demands of modern automation technology with the inclusion of analogue signals. These products guarantee an elementary function between signals from the field and the further processing systems. The mechanical characteristics of these products correspond to those of the well-known Weidmüller products and are part of a continuous, ongoing concept. The signal conditioners can be combined together with other Weidmüller products.

They have been electrically and mechanically designed to ensure that only a minimum of wiring and maintenance costs are necessary.

The product program
contains the following functions:
- Current transformer
- Voltage transformer
- Thermocouple conditioners for resistance thermometers
- Frequency signal conditioner
- Potentiometer conditioner
- AC signal conditioner
- Bridge measurement conditioner
- Limit value monitoring modules
- AD/DA converter

These products are categorised according to functionality as pure signal conversion, 2-way-isolation, 3-way-isolation and as passive separation.

Analogue Signal Processing
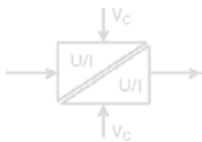
2-way-isolation separates the signals galvanically and decouples the measurement circuits. In so doing it eliminates potential differences caused by long cable lengths and common reference points. Furthermore, the galvanic isolation offers protection against destruction by overvoltage, and against inductive and capacitive interferences.
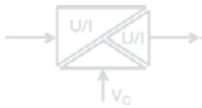
3-way-isolation also decouples the supply voltage from the input and output circuits, and enables the function with only one operating voltage.

The **passive isolator** offers a further elementary advantage; it needs no additional voltage supply. The supply to the modules ensues via the input circuit and is the transferred to the output. This current loop supply is distinguished by very low power consumption.

There are a large number of products available for measuring temperatures. RTD **PT100** signals, in 2-, 3- and 4-wire technology, are converted to standardised 0 – 20 mA, 4 – 20 mA and 0 – 10 V signals.
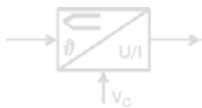
The modules which can be connected to commercially available **thermocouples** have cold junction compensation as standard. Furthermore, the modules amplify and linearize the voltage signals from the thermocouple. This guarantees an exact conditioning of analogue signals by eliminating sources of interference and errors.
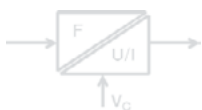
Frequency converters convert frequencies to standard analogue signals. This enables controllers connected in series to directly process impulse trains when making speed or rotational speed measurements.
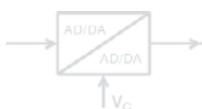
It is inconceivable to think about automation without **analogue-digital-analogue converters**. To bring together the aforementioned analogue form of describing the environment and the customary digital processing, within the framework of process monitoring, it is necessary to convert analogue signals into digital signals. Weidmüller offers modules for the following standard input and output signals: 0...20 mA, 4...20 mA and 0...10 V. 8-bit and 12-bit digital modules are available. All modules have an added input for making instantaneous measurements.

Current monitoring modules enable the monitoring of current values up to 60 A in alternating or direct voltages. Over range or under range values trip the switching output. Modules with analogue outputs enable the continuous monitoring of currents via connected controls.
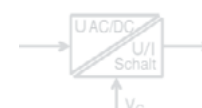
Voltage monitoring modules can be used to monitor direct and alternating voltages. Voltage fluctuations, resulting from switching operations or network overloads, can be reliably recognised and reported via the adjustable threshold function.

Modules for **monitoring of revolutions and torque** enable the control of cyclic movements on conveyor belts, ventilators and pumps. The output responds after a set amount of time, should the expected impulse not be received. The reliable potential-free relay contact, signalises the interference to the responsible component group.
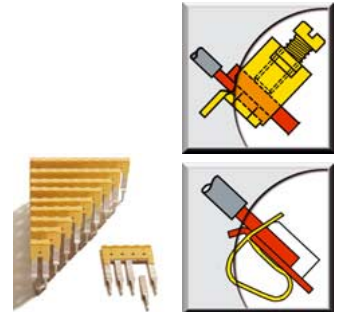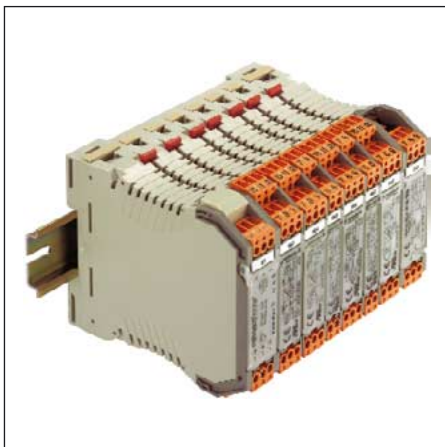
Mini Coupler / Mini Conditioner
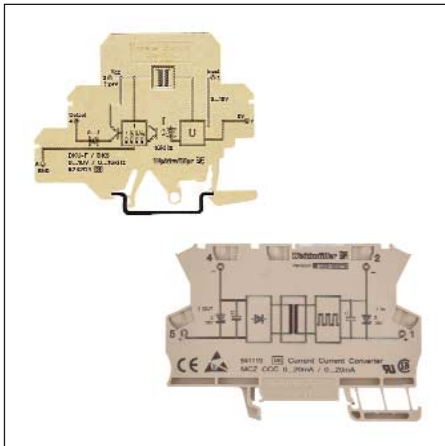
DK Mini Coupler / MCZ Mini Conditioner

- Extensive range of electronic functions in terminal format
- Pluggable cross-connections with mini conditioners
- Mini couplers with screw-in cross-connection combs
- Mini couplers with screw connections
- Mini conditioners with tension clamp connections

WAVESERIES

WAVEANALOG / WAVEANALOG PRO / WAVECONTROL

- Pluggable PCB for fast service when the configuration is changed
- Pluggable cross-connection in base socket housing to distribute the power supply, marking (CC) in the block diagram on the head plate
- Pluggable connections with optional screw or tension clamp connection
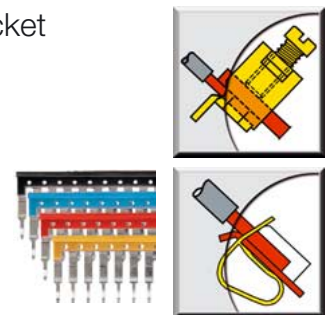
RS profiles
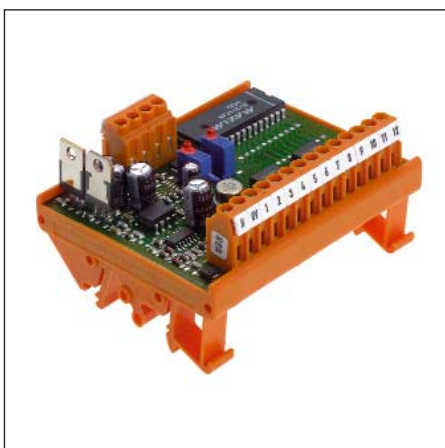
Analog-/Digital-Converters

- Mounts onto TS 32 and TS 35 mounting rails
- Open, cost-saving design
- Variable housing width

Analogue Signal Processing

Selection Table of Functions

Function	Areas of application	Description	Versions	Page
DC signal conditioners	Signal conditioning, signal isolation, suppression of mass loops	DC input/fixed functions and configurable inputs and outputs	MCZ WAVEANALOG WAVEANALOG PRO	164 174-184 185
	Motor current limitation, pressure alarm, direct disconnection of connected modules, safety function	DC input/limit value monitoring	DK MCZ	172 173
PT100 signal conditioners	Temperature monitoring, noise rejection, electrical decoupling of visualization devices, suppression of mass loops, heating and cooling monitoring, overheating protection of motors	RTD input/fixed functions and configurable inputs and outputs	MCZ WAVEANALOG WAVEANALOG PRO	165 186-188 189
Thermocouple conditioners	Temperature monitoring, noise rejection, electrical decoupling of visualization devices, suppression of mass loops, heating and cooling monitoring, overheating protection of motors	Thermo input/fixed functions and configurable inputs and outputs	WAVEANALOG WAVEANALOG PRO	190 191
Frequency signal conditioners	Flow rate measurements, frequency converter monitoring, speed measurements, pulse processing	Input/fixed functions and configurable inputs and outputs	DK MCZ	167-168 166
AD/DA converters	Conditioning of voltage and current signals in 8-bit/12-bit digital form	8-bit AD/DA converter 12-bit AD/DA converter	RS	210-213
Current monitoring	Motor current monitoring, emergency lighting monitoring	AC input/measuring of sinusoidal and non sinusoidal signals up to 60A	DKI WAVECONTROL SMSI	172 196-199 200-203
Voltage monitoring	Under and overvoltage monitoring, operating status indication	One and three-phase overvoltage	SMSU	204-205
Motion and rotational speed monitoring	Downtime monitoring, conveyor-drive monitoring, monitoring of fans, pumps or pistons	PNP/NPN or NAMUR input/switching output	DKLW SMS	169 206
Namur switching amplifier	Switching amplifier	Namur input/switching output	EGV	207
Setpoint device	Testing measuring distances, defined input of analogue values	1 control input/+/-set value/ analogue output	EMA/SW24	208

Selection Table

Function	Input	Output	Galvanic isolation	Voltage supply	Setting	Module width/mm	Connection type	Cat. No.	Page
DC/DC	0…20mA	0…20mA	yes	Without auxiliary pwr. current loop supply from input	Fixed	6	Tens. clamp	**8411190000**	164
	0…20mA	0…20mA	yes	Without auxiliary pwr. current loop supply from input	Fixed	17.5	Screw/ tens. clamp	**8444950000/ 8444960000** (1-channel)	174
	0…20mA	0…20mA	yes	Without auxiliary pwr. current loop supply from input	Fixed	17.5	Screw/ tens. clamp	**8463580000/ 8463590000** (2-channel)	174
	0…20mA	0…20mA	2-way	19.2…28.8Vdc/ Voltage supply of both sides	Fixed	12.5	Screw/ tens. clamp	**8445070000/ 8445080000**	176
	0…20mA	0…20mA	yes	18…30Vdc	Fixed/10 Hz	17.5	Screw/ tens. clamp	**8540180000/ 8540190000**	178
	0…20mA	0…20mA	3-way	18…30Vdc	Fixed/20 kHz	17.5	Screw/ tens. clamp	**8447160000/ 8447170000**	181
	0…20mA	4…20mA	2-way	19.2…28.8Vdc/ Voltage supply of both sides	Fixed	12.5	Screw/ tens. clamp	**8446970000/ 8446990000**	176
	0…20mA	4…20mA	yes	18…30Vdc	Fixed/10 Hz	17.5	Screw/ tens. clamp	**8540250000/ 8540260000**	181
	0…20mA	4…20mA	3-way	18…30Vdc	Fixed/20 kHz	17.5	Screw/ tens. clamp	**8447190000/ 8447200000**	181
	0…20mA	0…10V	2-way	19.2…28.8Vdc/ Voltage supply of both sides	Fixed	12.5	Screw/ tens. clamp	**8447020000/ 8447030000**	176
	0…20mA	0…10V	yes	18…30Vdc	Fixed/10 Hz	17.5	Screw/ tens. clamp	**8540270000/ 8540280000**	178
	0…20mA	0…10V	3-way	18…30Vdc	Fixed/20 kHz	17.5	Screw/ tens. clamp	**8447220000/ 8447230000**	181
	4…20mA	0…20mA	2-way	19.2…28.8Vdc/ Voltage supply of output side	Fixed	12.5	Screw/ tens. clamp	**8444980000/ 8444990000**	175
	4…20mA	0…20mA	yes	18…30Vdc	Fixed/10 kHz	17.5	Screw/ tens. clamp	**8540200000/ 8540210000**	179
	4…20mA	0…20mA	3-way	18…30Vdc	Fixed/20 kHz	17.5	Screw/ tens. clamp	**8447250000/ 8447260000**	182
	4…20mA	4…20mA	2-way	19.2…28.8Vdc/ Voltage supply of output side	Fixed	12.5	Screw/ tens. clamp	**8445010000/ 8445020000**	175
	4…20mA	4…20mA	yes	18…30Vdc	Fixed/10 Hz	17.5	Screw/ tens. clamp	**8540180000/ 8540190000**	178
	4…20mA	4…20mA	3-way	18…30Vdc	Fixed/20 kHz	17.5	Screw/ tens. clamp	**8447160000/ 8447170000**	182
	4…20mA	0…10V	2-way	19.2…28.8Vdc/ Voltage supply of output side	Fixed	12.5	Screw/ tens. clamp	**8445040000/ 8445050000**	175
	4…20mA	0…10V	yes	18…30Vdc	Fixed/10 Hz	17.5	Screw/ tens. clamp	**8540230000/ 8540240000**	179
	4…20mA	0…10V	3-way	18…30Vdc	Fixed/20 kHz	17.5	Screw/ tens. clamp	**8447280000/ 8447290000**	182
	0…10V	0…20mA	2-way	19.2…28.8Vdc/ Voltage supply of both sides	Fixed	12.5	Screw/ tens. clamp	**8447050000/ 8447080000**	177
	0…10V	0…20mA	yes	18…30Vdc	Fixed/10 Hz	17.5	Screw/ tens. clamp	**8540310000/ 8540320000**	180
	0…10V	0…20mA	3-way	18…30Vdc	Fixed/20 kHz	17.5	Screw/ tens. clamp	**8447310000/ 8447320000**	183
	0…10V	4…20mA	2-way	19.2…28.8V/ Voltage supply of both sides	Fixed	12.5	Screw/ tens. clamp	**8447100000/ 8447110000**	177
	0…10V	4…20mA	yes	18…30Vdc	Fixed/10 Hz	17.5	Screw/ tens. clamp	**8540290000/ 8540300000**	180
	0…10V	4…20mA	3-way	18…30Vdc	Fixed/20 kHz	17.5	Screw/ tens. clamp	**8447340000/ 8447350000**	183
	0…10V	0…10V	2-way	19.2…28.8Vdc/ Voltage supply of both sides	Fixed	12.5	Screw/ tens. clamp	**8447130000/ 8447140000**	177

Selection Table

Function	Input	Output	Galvanic isolation	Voltage supply	Setting	Module width/mm	Connection type	Cat. No.	Page
	0…10V	0…10V	yes	18…30Vdc	Fixed/10 Hz	17.5	Screw/ tens. clamp	**8540330000/ 8540340000**	180
	0…10V	0…10V	3-way	18…30Vdc	Fixed/20 kHz	17.5	Screw/ tens. clamp	**8447370000/ 8447380000**	184
	Variable voltage and current (+/-20mV…+/-200V, +/-0.1mA…+/-100mA)	Variable voltage and current (-10V…+10V, -20mA…+20mA)	yes	20…253Vdc	DIP switch Potentiometer	12.5	Screw/ tens. clamp	**8560740000/ 8560750000**	185
	PT100/	(4)…20mA	no	19.2…28.8Vdc	DIP switch	12.5	Screw/ tens. clamp	**8432210000/ 8432220000**	186
RTD/DC	PT100/ 2-wire	0…10V	no	19.2…28.8Vdc	DIP switch Potentiometer	12.5	Screw/ tens. clamp	**8432180000/ 8432190000**	186
	PT100/ 2-wire	4…20mA	no	current loop supply in output	Fixed	6	Tens. clamp	**8425720000**	165
	PT100/ 3-wire	0(4)…20mA	no	19.2…28.8Vdc	DIP switch Potentiometer	12.5	Screw/ tens. clamp	**8432150000/ 8432160000**	187
	PT100/ 3-wire	0…10V	no	19.2…28.8Vdc	DIP switch Potentiometer	12.5	Screw/ tens. clamp	**8432090000/ 8432130000**	187
	PT100/0 4-wire	(4)…20mA	no	19.2…28.8Vdc	DIP switch Potentiometer	12.5	Screw/ tens. clamp	**8432270000/ 8432280000**	188
	PT100/ 4-wire	0…10V	no	19.2…28.8Vdc	DIP switch Potentiometer	12.5	Screw/ tens. clamp	**8432240000/ 8432250000**	188
	PT100/ 2-/3-/4-conduct. Ni100 Potentiometer: min. 0…100Ω max. 0…100kΩ R: 0…450Ω	0…10V 0…20mA 4…20mA	yes	18…30Vdc	DIP switch Potentiometer	17.5	Screw/ tens. clamp	**8560700000/ 8560710000**	189
Thermo/DC	K, J, T, E, N, R, S, B								
	Thermo K, J, T, E, N, R, S, B	0…10V 0…20mA 4…20mA	no	19.2…28.8Vdc	DIP switch	12.5	Screw/ tens. clamp	**8432300000/ 8432310000**	190
	Thermocouples K, J, T, E, N, R, S, B	0…10V 0…20mA 4…20mA	yes	18…30Vdc	DIP switch Potentiometer	17.5	Screw/ tens. clamp	**8560720000/ 8560730000**	191
Frequency/DC	0...50/100/500Hz 0...1/5/10/16kHz	0(4)…20mA	no	21.6…26.4Vdc	DIP switch	6	Screw	**8311870001**	168
	0...50/100/500Hz 0...1/5/10/16kHz	0(4)…20mA	no	21.6…26.4Vdc	DIP switch	6	Screw	**8311870001**	168
	0...50/100/500Hz 0...1/5/10/16kHz	0…10V	no	21.6…26.4Vdc	DIP switch	6	Screw	**8283810000**	168
	0…20mA	0...1/5/10/16kHz	no	21.6…26.4Vdc	DIP switch	6	Screw	**8258870000**	167
	0…20mA	0...1/5/10/16kHz	no	21.6…26.4Vdc	DIP switch	6	Tens. clamp	**8461480000**	166
	4…20mA	0...1/5/10/16kHz	no	current loop supply in input	DIP switch	6	Screw	**8081330000**	167
	4…20mA	0...1/5/10/16kHz	no	current loop supply in input	DIP switch	6	Tens. clamp	**8461490000**	166
	0…10V	0...1/5/10/16kHz	no	21.6…26.4Vdc	DIP switch	6	Screw	**8242040000**	167
	0…10V	0...1/5/10/16kHz	no	21.6…26.4Vdc	DIP switch	6	Tens. clamp	**8461470000**	166
Limit value monitoring	Variable, programmable	Switching output PNP	no	19.2…28.8Vdc	Fixed	12	Screw	**8248340000**	170-171
	0…20mA	Switching output PNP 2-channel	no	19.2…28.8Vdc	Potentiometer	6	Screw	**8031320000**	172
	0…20mA	Switching output PNP 2-channel	no	19.2…28.8Vdc	Potentiometer	6	Tens. clamp	**8227350000**	173
	0…10V	Switching output PNP 2-channel	no	19.2…28.8Vdc	DIP switch Potentiometer	6	Screw	**8019640000**	172
	0…10V	Switching output PNP 2-channel	no	19.2…28.8Vdc	DIP switch Potentiometer	6	Tens. clamp	**8260280000**	173
AD convert.	0…20mA	8-bit	no	19.2…28.8Vdc	Fixed	70	Screw	**1160561001**	210
	4…20mA	8-bit	no	19.2…28.8Vdc	Fixed	70	Screw	**1168561001**	210
	0…10V	8-bit	no	19.2…28.8Vdc	Fixed	70	Screw	**1160361001**	210
		8-bit	no	19.2…28.8Vdc	Fixed	70	Screw	**1122361001**	210
	0…20mA	12-bit	no	19.2…28.8Vdc	Fixed	70	Screw	**1168461001**	212
	4…20mA	12-bit	no	19.2…28.8Vdc	Fixed	70	Screw	**1169161001**	212
	0…10V	12-bit	no	19.2…28.8Vdc	Fixed	70	Screw	**1168361001**	212
		12-bit	no	19.2…28.8Vdc	Fixed	70	Screw	**1168261001**	212

Selection Table

Function	Input	Output	Galvanic isolation	Voltage supply	Setting	Module width/mm	Connection type	Cat. No.	Page
DA convert.	8-bit	0…20mA	no	19.2…28.8Vdc	Fixed	70	Screw	**1165860000**	211
	8-bit	4…20mA	no	19.2…28.8Vdc	Fixed	70	Screw	**1169260000**	211
	8-bit	0…10V	no	19.2…28.8Vdc	Fixed	70	Screw	**1160760000**	211
	8-bit		no	19.2…28.8Vdc	Fixed	70	Screw	**1123360000**	211
	12-bit	0…20mA	no	19.2…28.8Vdc	Fixed	70	Screw	**1166060000**	213
	12-bit	4…20mA	no	19.2…28.8Vdc	Fixed	70	Screw	**1165960000**	213
	12-bit	0…10V	no	19.2…28.8Vdc	Fixed	70	Screw	**1166160000**	213
	12-bit		no	19.2…28.8Vdc	Fixed	70	Screw	**1160860000**	213
Current monitoring	0…1/5/10 Aac	1)	2-way	21.6…26.4Vdc	DIP sw./P*	22.5	Screw	**8516560000**	196
	0…1/5/10 Aac	1)	2-way	21.6…26.4Vdc	DIP sw./P*	22.5	Tens. clamp	**8516570000**	196
	0…20/40/60 Aac	1)	2-way	21.6…26.4Vdc	DIP sw./P*	22.5	Screw	**8513340000**	196
	0…20/40/60 Aac	1)	2-way	21.6…26.4Vdc	DIP sw./P*	22.5	Tens. clamp	**8526600000**	196
	0…1/5/10 Aac	2)	2-way	21.6…26.4Vdc	DIP switch	22.5	Screw	**8523400000**	197
	0…1/5/10 Aac	2)	2-way	21.6…26.4Vdc	DIP sw./P*	22.5	Tens. clamp	**8523410000**	197
	0…1/5/10 Aac	3)	2-way	12…30Vdc	DIP sw./P*	22.5	Screw	**8528650000**	197
	0…1/5/10 Aac	3)	2-way	12…30Vdc	DIP sw./P*	22.5	Tens. clamp	**8528660000**	197
	0…5/10 Aac	4)	2-way	21.6…26.4Vdc	DIP sw./P*	22.5	Screw	**8526610000**	198
	0…5/10 Aac	4)	2-way	21.6…26.4Vdc	DIP sw./P*	22.5	Tens. clamp	**8526620000**	198
	0…20/25/30 Aac	4)	2-way	21.6…26.4Vdc	DIP sw./P*	22.5	Screw	**8545830000**	198
	0…20/25/30 Aac	4)	2-way	21.6…26.4Vdc	DIP sw./P*	22.5	Tens. clamp	**8545840000**	198
	0…20/40/60 Aac	4)	2-way	21.6…26.4Vdc	DIP sw./P*	22.5	Screw	**8513330000**	199
	0…20/40/60 Aac	4)	2-way	21.6…26.4Vdc	DIP sw./P*	22.5	Tens. clamp	**8526590000**	199
	0.1…2A	Switching output PNP	no	18…30Vdc	Fixed	6	Screw		
	1…50mAdc	Opto-coupler	yes	10…250Vdc	Op. point	22.5	Screw	**1157160000**	200
	40…250mAdc	Opto-coupler	yes	10…250Vdc	Op. point	22.5	Screw	**1156360000**	200
	40…250mAdc	Opto-coupler	yes	10…250Vdc	Op. point	22.5	Screw	**1156460000**	201
	0.2…2.2Aac	Opto-coupler	yes	10…250Vdc	Op. point	22.5	Screw	**1157360000**	201
	1…5Aac	21.6…26.4Vuc	yes	10…250Vdc	Fixed	22.5	Screw	**1112160000**	201
	1…5Aac	5…48Vdc	yes	10…250Vdc	Fixed	22.5	Screw	**8026930000**	201
	1…5Aac	LED	yes	10…250Vdc	Fixed	22.5	Screw	**1112060000**	201
	40…250mAdc	NO 1-channel	yes	10…250Vdc	Op. point	22.5	Screw	**1156660000**	202
	40…250mAdc	NO 1-channel	yes	10…250Vdc	Op. point	22.5	Screw	**1159960000**	202
	0.2…2.2Aac	NO 1-channel	yes	10…250Vdc	Op. point	22.5	Screw	**1156960000**	203
	1…5Aac	NO 1-channel	yes	10…250Vdc	Fixed	22.5	Screw	**1112260000**	203
Voltage monitoring	1-24Vdc	CO 1-channel	yes	21.6…26.4Vuc	Op. point	22.5	Screw	**0555060000**	205
	1-230Vuc	CO 1-channel	yes	207…253Vac	Op. point	22.5	Screw	**0555160000**	205
	18…24Vac	CO 1-channel	yes	18…27Vac	Op. point	22.5	Screw	**1156760000**	204
	36…48Vac	CO 1-channel	yes	36…53Vac	Op. point	22.5	Screw	**1157660000**	204
	83…110Vac	CO 1-channel	yes	83…121Vac	Op. point	22.5	Screw	**1157760000**	205
	165…220Vac	CO 1-channel	yes	165…253Vac	Op. point	22.5	Screw	**1157860000**	205
	200…260Vac	NO 1-channel	yes	200…299Vac	Op. point	22.5	Screw	**1160160000**	205
	3 phase 165…230Vac	NO 2-channel	yes	165…230Vac	Op. point	22.5	Screw	**1156560000**	205
	3 phase 165…230Vac	NO/NC	yes	165…230Vac	Op. point	22.5	Screw	**1178760000**	205
Rotational-motion and r.p.m. monitoring	P. / N. switching 24Vdc	CO 1-channel	no	195.5…241.5Vac	Potentiometer	22.5	Screw	**1110560000**	206
Namur switch amplifier	Namur	NO 1-channel	no	21.6…26.4Vdc	no	22.5	Screw	**1120360000**	207
	Namur	PNP/NPN	no	21.6…26.4Vdc	no	22.5	Screw	**1122460000**	207
Setpoint device	0…24V	10.5…+10.5V	yes	21.6…26.4Vdc	Potentiometer	22.5	Screw	**1172660000**	208

1) Switch output / 1 changeover contact
2) 0…10 V, 0 (4)…20 mA switchable
3) 4…20 mA / current loop supply
4) Switch output / 1 changeover contact
5) 0…10 V, 0 (4)…20 mA switchable

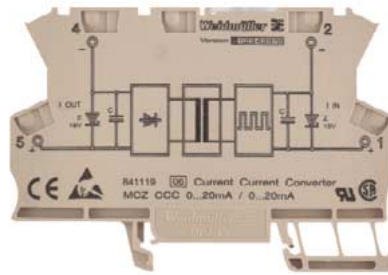DIP switch./P* = DIP switch / Potentiometer

Analogue Signal Processing

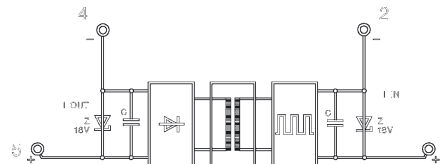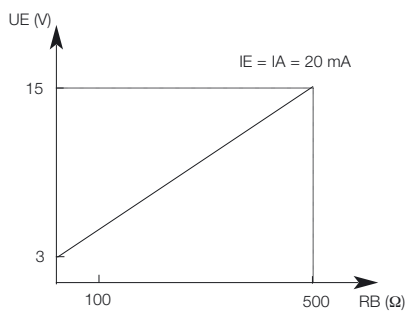# Passive Isolator

MCZ CCC 0…20 mA/0…20 mA

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 <100 µA.

Block diagram

Working resistance diagram

UE (V)

IE = IA = 20 mA

15

3

100   500   RB (Ω)

Ordering data	Type	Cat. No.
for TS 35	MCZ CCC 0…20 mA/0…20 mA	**8411190000**
	without power supply	

Technical data	
Input	**0…20 mA (max. 15 V)**
Response current	< 100 µA
Voltage drop	2.5…3 V (at 20 mA)
Max. overload capacity at input	50 mA, 15 V
Output	**0…20 mA (max. 10 V)**
Set time (T99)	approx. 5 ms at 500 Ω working resistance impedance
Residual ripple	< 10 mV$_{eff}$
Chopper frequency	approx. 200 kHz
Transmission error	< 0.1 % from end value, + 0.05 % from mean/100 Ω working resistance
Temperature effect	< 50 ppm/K from measurement value for working resistance 0 Ω
Voltage strength	
Input/output	510 V$_{eff}$
EMC	EMVG
	EN 50081-1
	EN 50082-2
Approvals	CE, UL, CSA
Ambient temperature	
- assembled without spacing	-25 °C…+40 °C
- assembled with 20 mm spacing	-25 °C…+50 °C
Storage temperature	-40 °C …+85 °C
Conductor	AWG 22…12
Conductor cross-section	1.5 mm^2
Overall width	6 mm
Dimensions and accessories see	Page 305

RTD Thermocouple Conditioners

• for 2 and 3 wire sensors

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

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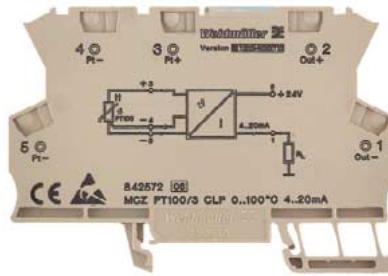
Block diagram
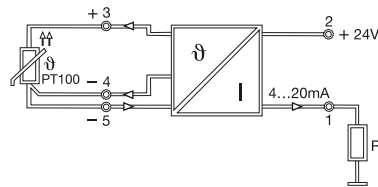
Ordering data

for TS 35

Type		Cat. 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**

Technical data

Input	PT 100 (according to IEC 751)
Connection	3-wire / 2-wire*
Max. wire resistance	each 50 Ω
Leadwire resistance effect	max. 0.006 °C/Ω
Supply current	0.8 mA

Output	4…20 mA**
Load	750 Ω at 24 V
Supply voltage	max: 30V/min: 9V+20mA x R_L
Residual ripple of supply voltage	max: 1.5 V at 100 Hz
Set time	10 ms
Accuracy	Type. 0.2 % max. 0.5 % v. FSR
Linearity	<0.1 % v. FSR
Temperature coefficient	max. ±250 ppm/°C
Open circuit recognition	yes

EMC	EMVG
	EN 50081-1
	EN 50082-2
Approvals	CE, UL, CSA
Ambient temperature	0 °C…+50 °C
Storage temperature	-20 °C…+85 °C
Conductor	AWG 22…12
Conductor cross-section	1.5 mm²
Overall width	6 mm

* Putting a bridge between Pins 4 and 5

** current loop supplied

Dimensions and accessories see | Page 305

Frequency Signal Conditioners

- Tension clamp connection
- LED-Display
- Adjustable frequency output
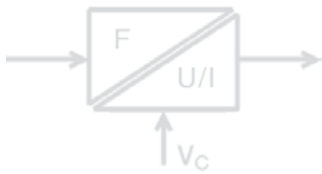
The option of reading-in the analogue signals from the field via counter inputs of the control is made possible by converting the analogue signals in to frequencies. It is recommended that twisted and shielded 2-wire cables are used.

	MCZ VFC	**MCZ CFC**	**MCZ CFC**
	0…10 V	0…20 mA	4…20 mA CLP
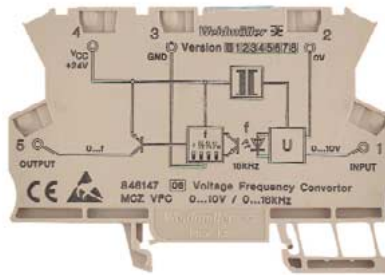
Block diagram/settings

MCZ VFZ 0…10 V and MCZ CFC 0…20 mA

1	2	3	4	DIP switch
1	0	0	0	0…16 kHz
0	1	0	0	0…8 kHz
0	0	1	0	0…4 kHz
0	0	0	1	0…1 kHz

MCZ CFC 4…20 mA CLP

1	2	3	4	DIP switch
1	0	0	0	3.2…16 kHz
0	1	0	0	1.6…8 kHz
0	0	1	0	0.8…4 kHz
0	0	0	1	0.2…1 kHz

Ordering data

		Type	Cat. No.	Type	Cat. No.	Type	Cat. No.
for TS 35	w	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 kΩ	50 Ω	
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, w/o load	14 mA w/o load	14 mA w/o 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
Coordination of insulation according to EN 50178			
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_eff/ 1 min	4 kV_eff/ 1 min	4 kV_eff/ 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	6 mm	6 mm
Conductor cross-section	1.5 mm^2	1.5 mm^2	1.5 mm^2
Dimensions and accessories see	Page 305	Page 305	Page 305

* without DC/DC converter
input supply vie current loop

Frequency Signal Conditioners

- Screw connection
- LED-Display
- Adjustable frequency output
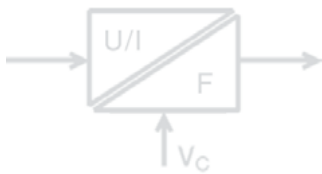
For EMC reasons, frequency processing modules must be used in conjunction with shielded cables. This measure prevents interference of analogue and frequency signals by other signal cables and vice versa.
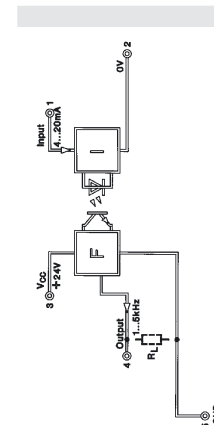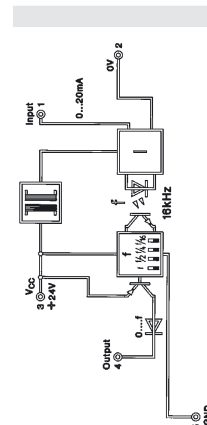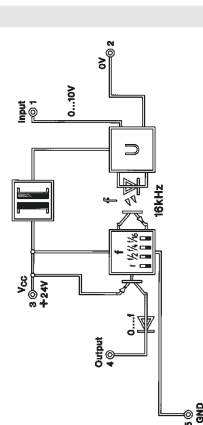
	DKA U/f	DKA I/f	DKA I/f*
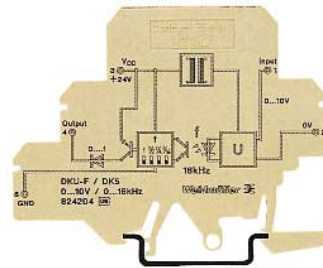
Block diagram/settings

DKA U/f and DKA I/f

1	2	3	4	DIP switch
1	0	0	0	0…16 kHz
0	1	0	0	0…8 kHz
0	0	1	0	0…4 kHz
0	0	0	1	0…1 kHz

| **Ordering data**	Type	Cat. No.	Type	Cat. No.	Type	Cat. No.
for TS 32	Y					
for TS 35	W					
with combi foot TS 32/TS 35	DKA U/f	**8242040000**	DKA I/f	**8258870000**	DKA I/f *	**8081330000**
Technical data						
Input ranges	0…10 V		0…20 mA		4…20 mA	
Overload limits, input	100 V		50 mA		50 mA	
Input resistance	100 kΩ		50 Ω		max. 320 Ω at 20 mA	
Voltage drop, input			1 V at 20 mA		max. 6.4 V at 20 mA	
Output						
Output frequency, end value	1 kHz, 4 kHz, 8 kHz, 16 kHz		1 kHz, 4 kHz, 8 kHz, 16 kHz		5 kHz (1…5 kHz)	
Frequency adjustment	DIL switch		DIL switch			
Readjustment range	±10 %, internal		±10 %, internal			
Output level	PNP, Ub- 0.7 V		PNP, Ub- 0.8 V		Ub- 3 V	
Output current	max. 20 mA		max. 20 mA		max. 20 mA	
Display	LED, pulsing		LED, pulsing			
Decoupling diode	present		present		present	
Supply voltage	24 Vdc ±10 %		24 Vdc ±10 %		19.2…28.8 Vdc	
Power consumption	14 mA, w/o load		14 mA w/o load		<13 mA w/o 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	
	<250 ppm/°C		<250 ppm/°C		<250 ppm/°C 2	
Coordination of insulation to DIN VDE 0160, Draft 11/94						
Voltage strength input/output	1 kVdc		1 kVdc		4 kV$_{eff}$	
Rated voltage					150 V	
Rated surge voltage					2.5 kV	
Overvoltage category					III	
Voltage strength to mounting rail	4 kV$_{eff}$		4 kV$_{eff}$		4 kV$_{eff}$	
Operating temperature	0 °C…+50 °C		0 °C…+50 °C		0 °C…+50 °C	
Storage temperature	-25 °C…+60 °C		-25 °C…+60 °C		-25 °C…+60 °C	
Overall width	6 mm		6 mm		6 mm	
Conductor cross-section	0.5…4 mm^2		0.5…4 mm^2		0.5…4 mm^2	
Accessories	Type	Cat. No.	Type	Cat. No.	Type	Cat. No.
End plate	AP DK5	**8268870000**	AP DK5	**8268870000**	AP DK5	**8268870000**
Dimensions and accessories see	Page 305		Page 305		Page 305	

* without DC/DC converter
Input current loop supplied

Frequency Signal Conditioners

- Screw connection
- LED-Display
- Adjustable frequency output
- multiplex capable
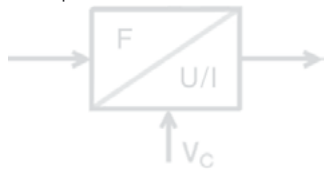
DKA f/U **DKA f/I**

For EMC reasons, frequency processing modules must be used in conjunction with shielded cables. This measure prevents interference of analogue and frequency signals by other signal cables and vice versa.
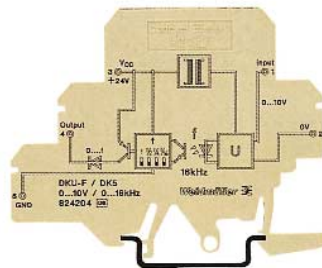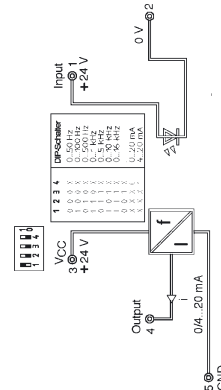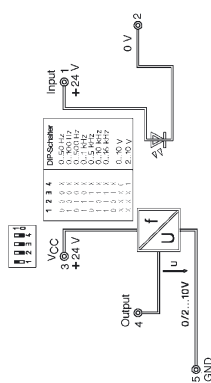
Block diagram/settings

1	2	3	4	DIP switch
0	0	0	X	0…50 Hz
1	0	0	X	0…100 Hz
0	1	0	X	0…500 Hz
1	1	0	X	0…1 kHz
0	1	1	X	0…5 kHz
1	0	1	X	0…10 kHz
1	1	1	X	0…16 kHz
0	0	1	X	Customer specific
X	X	X	0	0…20 mA / 0…10 V
X	X	X	1	4…20 mA / 2…10 V

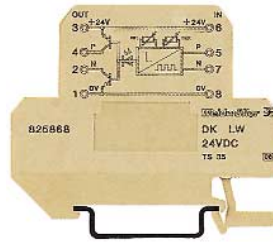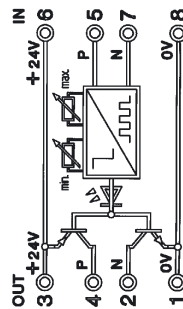| Ordering data		Type	Cat. No.	Type	Cat. No.
for TS 32	Y				
for TS 35	W				
with combi foot TS 32/TS 35		DKA f/U	**8283810001**	DKA f/I	**8311870001**
Technical data					
Input ranges		0…50/100/500 Hz		0…50/100/500 Hz	
		0…1/5/10/16 kHz		0…1/5/10/16 kHz	
Overload limits, input					
Input resistance		10 kΩ		10 kΩ	
Voltage drop, input					
Output		0/2…10 V		0/4…20 mA	
Output frequency, end value					
Frequency adjustment		DIL switch		DIL switch	
Readjustment range					
Output level					
Output current					
Display					
Decoupling diode					
Supply voltage		24 Vdc ±10 %		24 Vdc ±10 %	
Power consumption		32 mA + I_{Load}		32 mA + I_{Load}	
Making current limit					
Polarisation protection		yes		yes	
Accuracy		0.5 % (8-bit resolution)		0.5 % (8-bit resolution)	
Coordination of insulation to DIN VDE 0160, Draft 11/94					
Voltage strength input/output		2.5 kV		2.5 kV	
Rated voltage					
Rated surge voltage					
Overvoltage category					
Voltage strength to mounting rail		4 kV$_{eff}$		4 kV$_{eff}$	
Operating temperature		0 °C…+50 °C		0 °C…+50 °C	
Storage temperature		-25 °C…+60 °C		-25 °C…+60 °C	
Overall width		6 mm		6 mm	
Conductor cross-section		0.5…4 mm^2		0.5…4 mm^2	
Dimensions and accessories see		Page 305		Page 305	

Monitoring Revolutions

DK LW
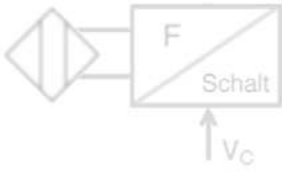
If only one revolution limit is to be evaluated, the potentiometer for f_{max} must be set to end stop or the potentiometer for f_{min} to left stop. Then only the other is in each case active for setting the limit value.

Block diagram/settings

Ordering data		Type	Cat. No.
for TS 32	Y		
for TS 35	W	DK LW	**8258680000**

Technical data	
Input	Initiators, NPN **or** PNP
Number of inputs	1
Input frequency	10 - 6250 U/min.
Range selection	3 switchable revolutions ranges: 10-130, 100-1300, 1000-7800 r.p.m.
Fine adjustment	2 potentiometers for upper/lower revs limit
Input nominal level	24 Vdc = High, O V = Low
Overload limits	30 Vdc
Switching threshold	High >18 V, Low <7 V
Pulse duration	>0.5 ms
Input current	approx. 3.5 mA (24 V)
Reverse polarity protection	yes
Output	Optional PNP **or** NPN
Function	Output active, if f within set revs limit
Output level	Ub- 1.8 V
Output current	20 mA max.
Decoupling diode	yes
Status LED	green LED
Short-circuit proof	no
Operating voltage	24 V –10 % + 20 %
Power consumption	<10 mA, w/o load, without initiator
Reverse polarity protection	yes
Galvanic isolation	no
Voltage strength to mounting rail	4 kV$_{eff}$
Operating temperature	0…+50 °C
Storage temperature	-40…+60 °C
Overall width	12 mm
Conductor cross-section	0.5…4 mm^2
Insulation stripping length	7 mm
Others	Initiator power supply via module possible

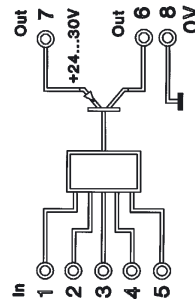| Accessories		Type	Cat. No.
End plate		AP DKT4	**0687560000**
Dimensions and accessories see		Page 278	

Preprocessing Logic

- Screw connection
- logic function and time function combined
- individually programmable (further functions on request)

DK PL
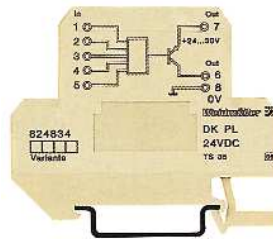
Block diagram

Ordering data		Type	Cat. No.
for TS 32	Y	on request	
for TS 35	W	DK PL	**8248340000***

Technical data		
Logical function		Programmable, see note
Number of inputs		5
Input nominal level		24 Vdc = High, 0 V = Low
Overload limits		30 Vdc
Switching threshold		High >18 V, Low <7 V
Pulse duration		>1 ms
Input current		approx. 1.5 mA per input (24 V)
Output		PNP
Output level		Ub- 1 V
Output current		20 mA max.
Decoupling diode		no
Status LED		green LED
Short-circuit proof		no
Operating voltage		24 V ±20 %
Power consumption		<10 mA
Reverse polarity protection		yes
Galvanic isolation		no
Voltage strength to mounting rail		4 kV$_{eff}$
Operating temperature		0 °C…+50 °C
Storage temperature		-40 °C…+60 °C
Overall width		12 mm
Conductor cross-section		0.5…4 mm^2
Insulation stripping length		7 mm

Accessories		Type	Cat. No.
End plate		AD DKT4	**0687560000**
Ordering example: RS FLIP-FLOP			**8248340002**
Dimensions see		Page 278	

* (not programmed - function next page)

824834 0001 DKPL

A = (E1 OR E2) AND (E3 OR E4) AND E5

State	Input					Output
	5	4	3	2	1	6
1	0	0	0	0	0	0
2	0	0	0	0	1	0
3	0	0	0	1	0	0
4	0	0	0	1	1	0
5	0	0	1	0	0	0
6	0	0	1	0	1	0
7	0	0	1	1	0	0
8	0	0	1	1	1	0
9	0	1	0	0	0	0
10	0	1	0	0	1	0
11	0	1	0	1	0	0
12	0	1	0	1	1	0
13	0	1	1	0	0	0
14	0	1	1	0	1	0
15	0	1	1	1	0	0
16	0	1	1	1	1	0
17	1	0	0	0	0	0
18	1	0	0	0	1	0
19	1	0	0	1	0	0
20	1	0	0	1	1	0
21	1	0	1	0	0	0
22	1	0	1	0	1	1
23	1	0	1	1	0	1
24	1	0	1	1	1	1
25	1	1	0	0	0	0
26	1	1	0	0	1	1
27	1	1	0	1	0	1
28	1	1	0	1	1	1
29	1	1	1	0	0	0
30	1	1	1	0	1	1
31	1	1	1	1	0	1
32	1	1	1	1	1	1

Input

824834 0002 DKPL

Inputs 1 and 2 have the function of a RS FLIP-FLOP
Inputs 3, 4 and 5 have no function

Input		Output
2	1	6
0	0	0 (is stored)
0	1	No change of stored state
1	0	No change of stored state
1	1	1 (is stored)

Inputs 3, 4 and 5 no function

Input

824834 0003 DKPL - Frequency divider

Inputs 1 - 5 determine the divider factor
Input 1 = divider factor 1: $F_{OUT} = F_{IN}$ 1
Input 2 = divider factor 2: $F_{OUT} = F_{IN}$ 2
Input 5 = divider factor 5: $F_{OUT} = F_{IN}$ 5; F_{IN} max. = 12 kHz

Input	Output
	6
1	$f_{out} = f_{in}$
2	$f_{out} = f_{in} / 2$
3	$f_{out} = f_{in} / 3$
4	$f_{out} = f_{in} / 4$
5	$f_{out} = f_{in} / 5$

Note: An new divider factor can only be used if operating voltage is switched off.
f_{in} max. = 12 kHz

Input

824834 0004 DKPL

Input 1: Signal A of an incremental generator
Input 2: Signal B 90 is shifted
Input 3: Enable High Active
Input 4: Output signal inverts High Active
Input 5: No function
Output: For each slope of signal A or B, the output is set to 20 - 30 Us.
(I.e.: $F_{OUT} = 4 \times F_{IN}$)
F_{IN} max. 1 kHz

	Connection	Description
1	A	Signal A 90 ° leading F_{max} = 1 kHz
2	B	Signal B 90 ° following F_{max} = 1 kHz
3	Enable	Output is released
4	Invert	Output signal invert
5		No function
6		$f_{out} = 4 \times f_{A/B}$ (max. 4 kHz)

Input

824834 0005 DKPL

Length of input signal between 80 and 100 ms.
Length of output signal 100 ms, only 2 pulses,
Relation pulse-interruption 1:1.
The positive slope of the input signal has to be analysed. Only input E1 is used.

824834 0006 DKPL

Input 1: $F_{OUT} = F_{IN}$
Input 2: $F_{OUT} = F_{IN}$ 10

Input	Output
	6
1	$f_{out} = f_{in}$
2	$f_{out} = f_{in} / 10$
3	$f_{out} = f_{in} / 50$
4	$f_{out} = f_{in} / 100$
5	$f_{out} = f_{in} / 1000$

Note: A new divider factor can only be used if the operating voltage is switched off. f_{in} max. = 3 kHz

Input

824834 007 DKPL

Input					Output
1	2	3	4	5	Out
L	L	X	X	X	No function
H	L	X	X	X	f = 1 Hz
L	H	X	X	X	f = 10 Hz
H	H	X	X	X	f = 1 Hz

L -> 0 V or connection open
H -> +24 …30 Vdc
X -> no effect on output function, L or H

824834 0008 DKPL

Input		Output
1	2	
H	H	H
L	H	L

824834 0010 DKPL

RS FLIP-FLOP with superior S - input (connection 2)
Input connections 3, 4 and 5 must have 0 V or remain open!

Connection 1 Logic		Connection 2	Logic	Connection 6	Logic
R-Input		S-Input		Output	
0 V or open	L	0 V or open	L	previous state is stored	
+24 Vdc	H	0 V or open	L	0 V	L
0 V or open	L	+24 Vdc	H	+24 Vdc	H
+24 Vdc	H	+24 Vdc	H	+24 Vdc	H

### 824834 0501 DKPL

The module allows the input frequency at connection 1 (0...max. 50 kHz) to be divided with 2 fixed divider factors.
Depending on connection 2, the output frequency is transmitted from output connection 6.
Connections 3, 4 and 5 have no function.

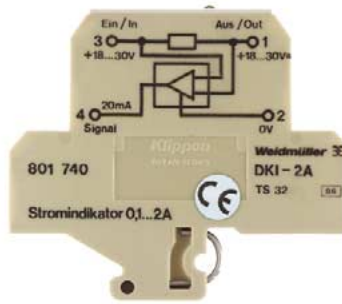| Connect. 2 Logic		Factor	Inp. frequency	Outp. frequency
			Connection 1	Connection 2
0 V or open	L	75	0…30 kHz	0…400 Hz
24 Vdc	H	27	0…10.8 kHz	0…400 Hz

Threshold Monitoring

Current sensor

- Screw connection
- Mounts onto on mounting rail
- Wide spectrum of functions
- In part, individually adjustable
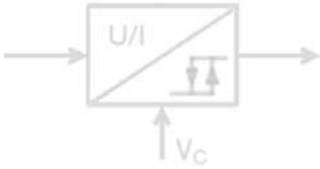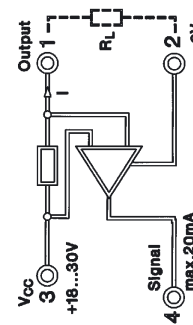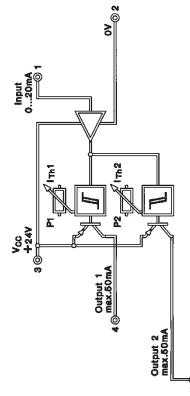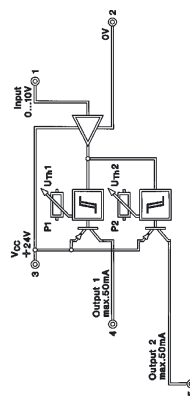

	DKSC 0-10 V	DKSC 0-20 mA	DKI 2A

Block diagram/settings

S1	S2	DIP switch
on	on	10…100 mV
on	off	30 mV…1 V
off	X	300 mV…10 V

Ordering data

		DKSC 0-10 V	DKSC 0-20 mA	DKI 2A
		Type Cat. No.	Type Cat. No.	Type Cat. No.
for TS 32	Y			DKI 2A **8017400000**
for TS 35	W			DKI 2A **8017410000**
with combi foot TS 32/TS 35		DKSC 0-10 V **8019640000**	DKSC 0-20 mA **8031320000**	

Technical data

	DKSC 0-10 V	DKSC 0-20 mA	DKI 2A
Input signal	0…10 V	0(4)…20 mA	0.1…2 A
Input resistance	60 kΩ	50 Ω	
Voltage drop, input		1 V	125 mV at 2 A
Cut-off frequeny	100 Hz	100 Hz	
Switchable input range	DIL switch for 3 ranges		no
Switching point settings	2 threshold Uth 1 and Uth 2	2 threshold Uth 1 and Uth 2	Fixed: ON >90 mA
	with 2 front potentiometers	with 2 front potentiometers	OFF <50 mA
Hysteresis	each 1 %	each 1 %	
Output	double switch output	double switch output	single switch output
Output level	per PNP, Ub- 1.2 V	per PNP, Ub- 1.2 V	PNP, Ub-0.1 V
Output current	50 mA	50 mA	20 mA
Function	Uin <Uth1: output 1 active	Iin <Ith1: output 1 active	
	Uin >Uth2: output 2 active	Iin >Ith2: output 2 active	
Status LED	no	no	green LED
Operating voltage	24 Vdc ±20 %	24 Vdc ±20 %	18…30 Vdc
Power consumption	approx. 15 mA	approx. 15 mA	approx. 10 mA
Galvanic isolation	no	no	no
Voltage strength to mounting rail	4 kV$_{eff}$	4 kV$_{eff}$	4 kV$_{eff}$
Operating temperature	0 °C…+50 °C	0 °C…+50 °C	-25 °C…+50 °C
Storage temperature	-25 °C…+60 °C	-25 °C…+60 °C	-40 °C…+85 ° C
Overall width	6 mm	6 mm	6 mm
Conductor cross-section	0.5…4 mm^2	0.5…4 mm^2	0.5…4 mm^2

EMC resistance

		DKSC 0-10 V	DKSC 0-20 mA	DKI 2A
Burst acc. to EN 61000-4-4	Input/outputs	Test severity 4, self restoring		
	Power supply	Test severity 4, self restoring		
ESD acc. to EN 61000-4-2	Contact discharge	Test severity 4		
	Air discharge	Test severity 3		

Accessories

	DKSC 0-10 V	DKSC 0-20 mA	DKI 2A
	Type Cat. No.	Type Cat. No.	Type Cat. No.
End plate	AP DK5 **8268870000**	AP DK5 **8268870000**	AP DKT4 **0687560000**
Dimensions see	Page 278	Page 278	Page 278

Threshold Monitoring
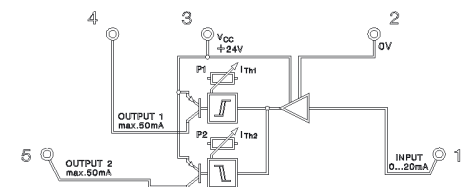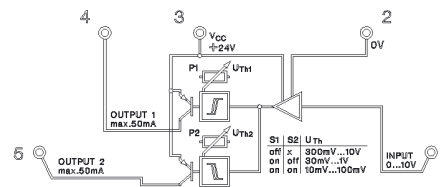

The Setpoint Controller allows cost effective units to be built for monitoring analogue signals. An upper and lower limit value, which covers the entire signal range, can be set by the user via 2 potentiometers. The respective statuses of the upper and lower limit value are indicated at the 2 digital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

MCZ SC 0…10 Vdc

MCZ SC 0…20 mA
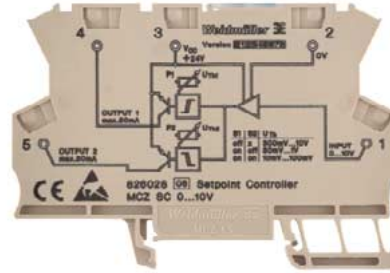
Block diagram

Ordering data	Type	Cat. No.	Type	Cat. No.
for TS 35	MCZ SC 24 V/0…10V	**8260280000**	MCZ SC 24 V/0…20 mA	**8227350000**

Technical data		
Voltage supply		
Supply voltage	24 Vdc ± 20 %	24 Vdc ± 20 %
Supply current	15 mA	15 mA
Input		
Input voltage	0…10 V	0.5…20 mA
Input resistance	60 kΩ	50 Ω
Voltage drop at full scale		1 V
Max. input current		40 mA
Cut-off frequeny	100 Hz	100 Hz

Transmission behaviour					
Threshold voltage ranges of U_{th}		S1	S2	Temperature coefficient T_k	Temperature coefficient T_k 250 ppm max.
	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)				via 2 potentiometers (12 turns)
Hysteresis of switching threshold	1 % of the end value				1 % of the end value
Function of output 1	active High for $U_{Input} < U_{th1}$ (set via P1)				active High for $I_{Input} < I_{th1}$ (set via P1)
Function of output 2	active High for $U_{Input} > U_{th2}$ (set via P2)				active High for $I_{Input} > I_{th2}$ (set via P2)
Response time	< 250 µs (switch threshold at 90% of the max. input signal;				< 250 µs (switch threshold at 90% of the max. input signal;
	R_L ≤ 1 kΩ)				R_L ≤ 1 kΩ)

Output		
	2 channel switching PNP	2 channel switching PNP
Output current per output	max. 50 mA	max. 50 mA
Voltage drop at output transistor	< 1.2 V at 50 mA	< 1.2 V at 50 mA

Insulation coordination/safe separation to EN 50178		
Separation input / output	none	none
Dielectric strength I/O to mounting rail	4 kVeff / 1 min	4 kVeff / 1 min
Ambient temperature	0 °C…+50 °C	0 °C…+50 °C
Storage temperature	-25 °C…+60 °C	-25 °C…+60 °C
Conductor	AWG 22…12	AWG 22…12
Conductor cross-section	1.5 mm^2	1.5 mm^2
Approvals	CE, UL, CSA	CE, UL, CSA
Overall width	6 mm	6 mm
Dimensions and accessories see	Page 305	Page 305

Analogue Signal Processing

Passive Isolator DC/DC

WAVEANALOG DC/DC

- input loop powered
- galvanic isolation
- 1-, 2-channel versions
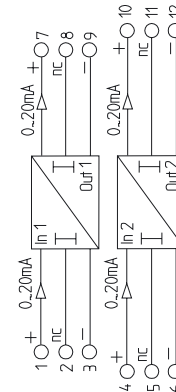- low power consumption
- safe separation

Approvals:

CE UL CSA GL

Block diagram

CCC LP (1 channel)
0(4) ... 20 mA / 0(4) ... 20 mA
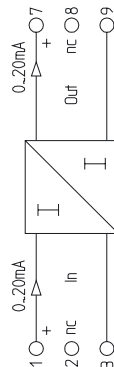
CCC LP (2 channel)
0(4) ... 20 mA / 0(4) ... 20 mA

Ordering data		
	Type	Cat. No.
Screw connection 1 channel	WAS5 CCC LP	**8444950000**
Tension clamp connection 1 channel	WAZ5 CCC LP	**8444960000**
Screw connection 2 channel		
Tension clamp connection 2 channel		
Input/output	0(4) ... 20 mA / 0(4) ... 20 mA	

	Type	Cat. No.
	WAS5 CCC LP	**8463580000**
	WAZ5 CCC LP	**8463590000**
	0(4) ... 20 mA / 0(4) ... 20 mA	

Technical data* (per channel)		
Input signal	0 ... 20 mA (4 ... 20 mA)	0 ... 20 mA (4 ... 20 mA)
Input voltage max.	18 V	18 V
Input current max	50 mA	50 mA
Operating current	< 100 µA	< 100 µA
Voltage drop	approx. 3 V at R_L= 0 Ω	approx. 3 V at R_L= 0 Ω
	I_{in} = 20 mA	I_{in} = 20 mA
	approx. 13 V at R_L= 500 Ω	approx. 13 V at R_L= 500 Ω
	at I_{in} = 20 mA	at I_{in} = 20 mA
Output signal	0 ... 20 mA (4 ... 20 mA)	0 ... 20 mA (4 ... 20 mA)
Load resistance	≤ 500 Ω	≤ 500 Ω
Accuracy at Tu=23 °C	< 0.1% of FS	< 0.1% of FS
Influence of load resistance	< 0.1% from measurement value	< 0.1% from measurement value
	per 100 Ω load resistance	per 100 Ω load resistance
Temperature coefficient	50 ppm / K of FS	50 ppm / K of FS
Set time	4.5 ms at 500 Ω working resistance	4.5 ms at 500 Ω working resistance
Residual ripple	< 20 mV$_{eff}$	< 20 mV$_{eff}$
Chopper frequency	approx. 170 kHz	approx. 170 kHz

General		
Operating temperature	-25 °C ... +70 °C	-25 °C ... +70 °C
Storage temperature	-40 °C ... +80 °C	-40 °C ... +80 °C
Dimensions L / H / W mm	92.4 / 112.5 / 17.5	92.4 / 112.5 / 17.5
Approvals	CE, UL, CSA, GL	CE, UL, CSA, GL

Coordination of insulation according to EN 50178, 04/98 (safe separation)		
Rated voltage	300 V	300 V
Rated surge voltage	6 kV	6 kV
Overvoltage category	III	III
Contamination class	2	2
Clearance and creepage distance	≥ 5.5 mm	≥ 5.5 mm
Isolation voltage, voltage strength		
Input/output, channel / channel	4 kV$_{eff}$ / 1 s	4 kV$_{eff}$ / 1 s
Input/output to mounting rail	4 kV$_{eff}$ / 1 min	4 kV$_{eff}$ / 1 min
Standards/specifications	EN 50178 (safe separation)	EN 50178 (safe separation)
EMC standards	EN 50081, EN 50082,	EN 50081, EN 50082,
	EN 55011	EN 55011
Dimensions and accessories see	Page 298 + 308	Page 298 + 308

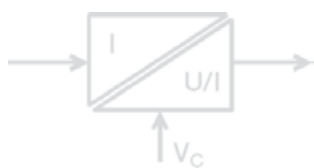*T$_U$ = 23 °C single module

DC/DC-Signal Conditioners

WAVEANALOG DC/DC

- voltage supply on output side
- 2-way-isolation
- analogue signal conditioning
- galvanic isolation between input/output signal
- Input loop powered
- cross-connectable voltage supply via cross-connectors
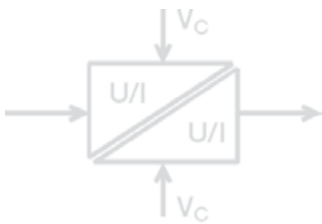
Approvals:

CE RU CSA

	CCC DC	**CCC DC**	**CVC DC**
	4 ... 20 mA / 4 ... 20 mA	4 ... 20 mA / 0 ... 20 mA	4 ... 20 mA / 0 ... 10 V

Block diagram
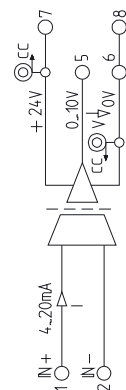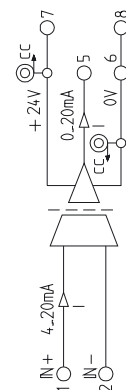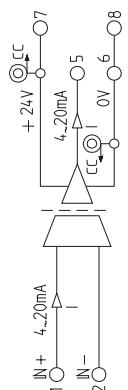
Ordering data	Type	Cat. No.	Type	Cat. No.	Type	Cat. No.
Screw connection	WAS4 CCC DC	**8444980000**	WAS4 CCC DC	**8445010000**	WAS4 CVC DC	**8445040000**
Tension clamp connection	WAZ4 CCC DC	**8444990000**	WAZ4 CCC DC	**8445020000**	WAZ4 CVC DC	**8445050000**
Input/output	4 ... 20 mA / 4...20 mA		4 ... 20 mA / 0 ... 20 mA		4 ... 20 mA / 0 ... 10V	

Technical data*			
Input signal	4 ... 20 mA	4 ... 20 mA	4 ... 20 mA
Input voltage max.	7 V	7 V	7 V
Input current max	25 mA	25 mA	25 mA
Output signal	4 ... 20 mA	0 ... 20 mA	0 ... 10 V
Load resistance	≤ 500 Ω	≤ 500 Ω	≥ 1 kΩ
Accuracy at Tu=23 °C	± 0.2% of FS	± 0.2% of FS	± 0.2% of FS
Temperature coefficient	≤ 250 ppm / K of FS	≤ 250 ppm / K of FS	≤ 250 ppm / K of FS
Response time	≤ 30 ms (typ. 20 ms)	≤ 30 ms (typ. 20 ms)	≤ 30 ms (typ. 20 ms)
Cut-off frequeny (-3 dB)	≥ 15 Hz (typ. 20 Hz)	≥ 15 Hz (typ. 20 Hz)	≥ 15 Hz (typ. 20 Hz)

General			
Voltage supply	24 Vdc ±20% (19.2 ... 28.8 Vdc)	24 Vdc ±20% (19.2 ... 28.8 Vdc)	24 Vdc ±20% (19.2 ... 28.8 Vdc)
Power consumption	< 32 mA at I_{out} = 20 mA	< 32 mA at I_{out} = 20 mA	< 20 mA at I_{out} = 10 mA
Current carrying capacity of cross-connection	≤ 2 A	≤ 2 A	≤ 2 A
Operating temperature	0 °C ... +55 °C (mounted)	0 °C ... +55 °C (mounted)	0 °C ... +55 °C (mounted)
Storage temperature	-20 °C ... +85 °C	-20 °C ... +85 °C	-20 °C ... +85 °C
Dimensions L / H / W mm	92.4 / 112.5 / 12.5	92.4 / 112.5 / 12.5	92.4 / 112.5 / 12.5
Approvals	CE, UL, CSA	CE, UL, CSA	CE, UL, CSA

Coordination of insulation according to EN 50178, 04/98			
Rated voltage	300 V	300 V	300 V
Rated surge voltage	4 kV	4 kV	4 kV
Overvoltage category	III	III	III
Contamination class	2	2	2
Clearance and creepage distance	≥ 3 mm	≥ 3 mm	≥ 3 mm
Isolation voltage, voltage strength			
Input/output to mounting rail	4 kV$_{eff}$ / 1 min	4 kV$_{eff}$ / 1 min	4 kV$_{eff}$ / 1 min
Standards/specifications	EN 50178	EN 50178	EN 50178
EMC standards	EN 50081, EN 50082, EN 55011	EN 50081, EN 50082, EN 55011	EN 50081, EN 50082, EN 55011
Dimensions and accessories see	Page 298 + 308	Page 298 + 308	Page 298 + 308

*T$_U$ = 23 °C single module

Analogue Signal Processing

DC/DC-Signal Conditioners

WAVEANALOG DC/DC

- voltage supply on both sides
- 2-way-isolation
- analogue signal conditioning
- galvanic isolation between input/output signal
- cross-connectable voltage supply via cross-connectorss
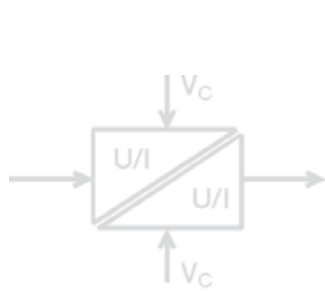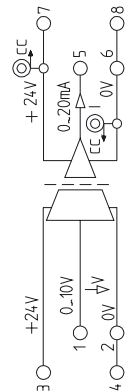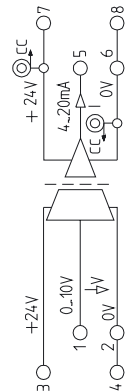
Approvals:

CE UL CSA

	CCC DC	**CCC DC**	**CVC DC**
	0 ... 20 mA / 0 ... 20 mA	0 ... 20 mA / 4 ... 20 mA	0 ... 20 mA / 0 ... 10 V

Block diagram

Ordering data	Type	Cat. No.	Type	Cat. No.	Type	Cat. No.
Screw connection	WAS4 CCC DC	**8445070000**	WAS4 CCC DC	**8446970000**	WAS4 CVC DC	**8447020000**
Tension clamp connection	WAZ4 CCC DC	**8445080000**	WAZ4 CCC DC	**8446990000**	WAZ4 CVC DC	**8447030000**
Input/output	0 ... 20 mA / 0 ... 20 mA		0 ... 20 mA / 4 ... 20 mA		0 ... 20 mA / 0 ... 10 V	

Technical data*			
Input signal	0 ... 20 mA	0 ... 20 mA	0 ... 20 mA
Input current max	25 mA	25 mA	25 mA
Input resistance	50 Ω	50 Ω	50 Ω
Output signal	0 ... 20 mA	4 ... 20 mA	0 ... 10 V
Load resistance	≤ 500 Ω	≤ 500 Ω	≥ 1 kΩ
Accuracy at Tu=23 °C	± 0.2% of FS	± 0.2% of FS	± 0.2% of FS
Temperature coefficient	≤ 250 ppm / K of FS	≤ 250 ppm / K of FS	≤ 250 ppm / K of FS
Response time	≤ 30 ms (typ. 16 ms)	≤ 30 ms (typ. 16 ms)	≤ 30 ms (typ. 16 ms)
Cut-off frequeny (-3 dB)	≥ 15 Hz (typ. 25 Hz)	≥ 15 Hz (typ. 25 Hz)	≥ 15 Hz (typ. 25 Hz)

General			
Voltage supply	24 Vdc ±20% (19.2 ... 28.8 Vdc)	24 Vdc ±20% (19.2 ... 28.8 Vdc)	24 Vdc ±20% (19.2 ... 28.8 Vdc)
Power consumption input	< 11 mA at I_{in} = 20 mA	< 11 mA at I_{in} = 20 mA	< 11 mA at I_{in} = 20 mA
Power consumption output	< 32 mA at I_{out} = 20 mA	< 32 mA at I_{out} = 20 mA	< 20 mA at I_{out} = 10 V
Current carrying capacity of cross-connection	≤ 2 A	≤ 2 A	≤ 2 A
Operating temperature	0 °C ... +55 °C (mounted)	0 °C ... +55 °C (mounted)	0 °C ... +55 °C (mounted)
Storage temperature	-20 °C ... +85 °C	-20 °C ... +85 °C	-20 °C ... +85 °C
Dimensions L / H / W mm	92.4 / 112.5 / 12.5	92.4 / 112.5 / 12.5	92.4 / 112.5 / 12.5
Approvals	CE, UL, CSA	CE, UL, CSA	CE, UL, CSA

Coordination of insulation according to EN 50178, 04/98			
Rated voltage	300 V	300 V	300 V
Rated surge voltage	4 kV	4 kV	4 kV
Overvoltage category	III	III	III
Contamination class	2	2	2
Clearance and creepage distance	≥ 3 mm	≥ 3 mm	≥ 3 mm
Isolation voltage, voltage strength			
Input/output to mounting rail	4 kV$_{eff}$ / 1 min	4 kV$_{eff}$ / 1 min	4 kV$_{eff}$ / 1 min
Standards/specifications	EN 50178	EN 50178	EN 50178
EMC standards	EN 50081, EN 50082, EN 55011	EN 50081, EN 50082, EN 55011	EN 50081, EN 50082, EN 55011
Dimensions and accessories see	Page 298 + 308	Page 298 + 308	Page 298 + 308

*T$_U$ = 23 °C single module

DC/DC Signal Conditioners

WAVEANALOG DC/DC

- voltage supply on both sides
- 2-way-isolation
- analogue signal conditioning
- galvanic isolation between input/output signal
- cross-connectable voltage supply via cross-connectors

Approvals:
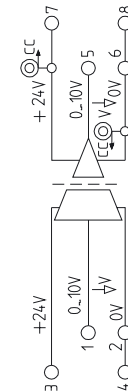
CE RU CSA

	VCC DC 0 ... 10 V / 0 ... 20 mA	VCC DC 0 ... 10 V / 4 ... 20 mA	VVC DC 0 ... 10 V / 0 ... 10 V

Block diagram

		VCC DC		VCC DC		VVC DC	
Ordering data		Type	Cat. No.	Type	Cat. No.	Type	Cat. No.
Screw connection		WAS4 VCC DC	**8447050000**	WAS4 VCC DC	**8447100000**	WAS4 VVC DC	**8447130000**
Tension clamp connection		WAZ4 VCC DC	**8447080000**	WAZ4 VCC DC	**8447110000**	WAZ4 VVC DC	**8447140000**
Input/output		0 ... 10 V / 0 ... 20 mA		0 ... 10 V / 4 ... 20 mA		0 ... 10 V / 0 ... 10 V	
Technical data*							
Input signal		0 ... 10 V		0 ... 10 V		0 ... 10 V	
Input voltage max.		15 V		15 V		15 V	
Input resistance		500 kΩ		500 kΩ		500 kΩ	
Output signal		0 ... 20 mA		4 ... 20 mA		0 ... 10 V	
Load resistance		≤ 500 Ω		≤ 500 Ω		≥ 1 kΩ	
Accuracy at Tu=23°C		± 0.2% of FS		± 0.2% of FS		± 0.2% of FS	
Temperature coefficient		≤ 250 ppm / K of FS		≤ 250 ppm / K of FS		≤ 250 ppm / K of FS	
Response time		≤ 30 ms (typ. 25 ms)		≤ 30 ms (typ. 25 ms)		≤ 30 ms (typ. 25 ms)	
Cut-off frequeny (-3 dB)		≥ 13 Hz (typ. 17 Hz)		≥ 13 Hz (typ. 17 Hz)		≥ 13 Hz (typ. 17 Hz)	
General							
Voltage supply		24 Vdc ±20%		24 Vdc ±20%		24 Vdc ±20%	
		(19.2 ... 28.8 Vdc)		(19.2 ... 28.8 Vdc)		(19.2 ... 28.8 Vdc)	
Power consumption input		< 11 mA at U_{in} = 10 V		< 11 mA at U_{in} = 10 V		< 11 mA at U_{in} = 10 V	
Power consumption output		< 32 mA at I_{out} = 20 mA		< 32 mA at I_{out} = 20 mA		< 20 mA at I_{out} = 10 mA	
Current carrying capacity of cross-connection		≤ 2 A		≤ 2 A		≤ 2 A	
Operating temperature		0 °C ... +55 °C (mounted)		0 °C ... +55 °C (mounted)		0 °C ... +55 °C (mounted)	
Storage temperature		-20 °C ... +85 °C		-20 °C ... +85 °C		-20 °C ... +85 °C	
Dimensions L / H / W mm		92.4 / 112.5 / 12.5		92.4 / 112.5 / 12.5		92.4 / 112.5 / 12.5	
Approvals		CE, UL, CSA		CE, UL, CSA		CE, UL, CSA	
Coordination of insulation according to EN 50178, 04/98							
Rated voltage		300 V		300 V		300 V	
Rated surge voltage		4 kV		4 kV		4 kV	
Overvoltage category		III		III		III	
Contamination class		2		2		2	
Clearance and creepage distance		≥ 3 mm		≥ 3 mm		≥ 3 mm	
Isolation voltage, voltage strength							
Input/output to mounting rail		4 kV$_{eff}$ / 1 min		4 kV$_{eff}$ / 1 min		4 kV$_{eff}$ / 1 min	
Standards/specifications		EN 50178		EN 50178		EN 50178	
EMC standards		EN 50081, EN 50082,		EN 50081, EN 50082,		EN 50081, EN 50082,	
		EN 55011		EN 55011		EN 55011	
Dimensions and accessories see		Page 298 + 308		Page 298 + 308		Page 298 + 308	

*T_U = 23 °C single module

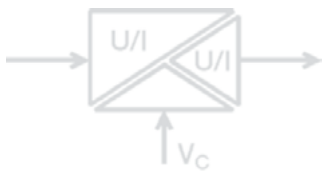**Analogue Signal Processing**

DC/DC Signal Conditioners

WAVEANALOG DC/DC

- **3-way-isolation**
- **analogue signal conditioning**
- **indication LED**
- **cross-connectable voltage supply via cross-connectors**

Approvals:

CE cULus

	CCC	**CCC**	**CVC**
	0 ... 20 mA / 0 ... 20 mA	0 ... 20 mA / 4 ... 20 mA	0 ... 20 mA / 0 ... 10 V

Block diagram

	CCC	**CCC**	**CVC**
	8540180000	8540250000	8540270000

Ordering data	Type	Cat. No.	Type	Cat. No.	Type	Cat. No.
Screw connection	WAS5 CCC	**8540180000***	WAS5 CCC	**8540250000**	WAS5 CVC	**8540270000**
Tension clamp connection	WAZ5 CCC	**8540190000***	WAZ5 CCC	**8540260000**	WAZ5 CVC	**8540280000**
Input/output	0 ... 20 mA / 0 ... 20 mA		0 ... 20 mA / 4 ... 20 mA		0 ... 20 mA / 0 ... 10 V	

Technical data**			
Input signal	0 ... 20 mA	0 ... 20 mA	0 ... 20 mA
Input current max	25 mA	25 mA	25 mA
Input resistance	≤ 110 Ω	≤ 110 Ω	≤ 110 Ω
Output signal	0 ... 20 mA	4 ... 20 mA	0 ... 10 V
Load resistance	≤ 600 Ω	≤ 600 Ω	≥ 1 kΩ
Accuracy at Tu=23 °C	0.2%	0.2%	0.2%
Temperature coefficient	± 250 ppm / K	± 250 ppm / K	± 250 ppm / K
Response time	≤ 45 ms	≤ 45 ms	≤ 45 ms
Cut-off frequeny (-3 dB)	10 Hz	10 Hz	10 Hz

General			
Voltage supply	24 Vdc ±25%	24 Vdc ±25%	24 Vdc ±25%
	(18 Vdc ... **24 Vdc** ... 30 Vdc)	(18 Vdc ... **24 Vdc** ... 30 Vdc)	(18 Vdc ... **24 Vdc** ... 30 Vdc)
Power consumption	< 1.5 W at I_{out} = 20 mA	< 1.5 W at I_{out} = 20 mA	< 1.3 W at I_{out} = 5 mA
Current carrying capacity of cross-connection	≤ 2 A	≤ 2 A	≤ 2 A
Operating temperature	0 °C ... +55 °C	0 °C ... +55 °C	0 °C ... +55 °C
	when mounted horizontally	when mounted horizontally	when mounted horizontally
Storage temperature	-20 °C ... +85 °C	-20 °C ... +85 °C	-20 °C ... +85 °C
Dimensions L / H / W mm	92.4 / 112.5 / 17.5	92.4 / 112.5 / 17.5	92.4 / 112.5 / 17.5
Approvals	CE, cUL	CE, cUL	CE, cUL

Coordination of insulation according to EN 50178, 04/98			
Rated voltage	300 V	300 V	300 V
Rated surge voltage	4 kV	4 kV	4 kV
Overvoltage category	III	III	III
Contamination class	2	2	2
Clearance and creepage distance	≥ 3 mm	≥ 3 mm	≥ 3 mm
Coupling capacity			
Input / output to supply	1 nF	1 nF	1 nF
Isolation voltage, voltage strength			
Input/output to mounting rail	4 kV_eff / 1 min	4 kV_eff / 1 min	4 kV_eff / 1 min
Standards/specifications	EN 50178	EN 50178	EN 50178
EMC standards	EN 50081, EN 50082, EN 55011	EN 50081, EN 50082, EN 55011	EN 50081, EN 50082, EN 55011
Dimensions and accessories see	Page 298 + 308	Page 298 + 308	Page 298 + 308

** T_U = 23 °C single module
* Input/output 4 ... 20 mA/4 ... 20 mA possible
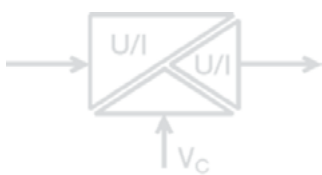
DC/DC Signal Conditioners

WAVEANALOG DC/DC

- **3-way-isolation**
- **analogue signal conditioning**
- **indication LED**
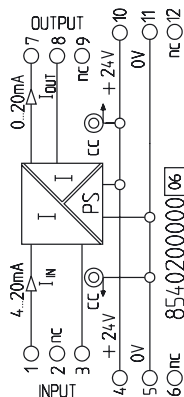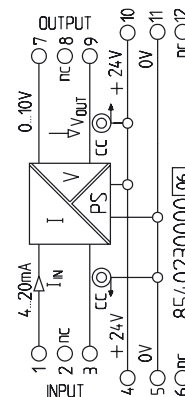- **cross-connectable voltage supply via cross-connectors**

Approvals:

CE cᴿᵁ us

Block diagram

	CCC	**CVC**
	4 ... 20 mA / 0 ... 20 mA	4 ... 20 mA / 0 ... 10 V

Ordering data	Type	Cat. No.	Type	Cat. No.
Screw connection	WAS5 CCC	**8540200000**	WAS5 CVC	**8540230000**
Tension clamp connection	WAZ5 CCC	**8540210000**	WAZ5 CVC	**8540240000**
Input/output	4 ... 20 mA / 0 ... 20 mA		4 ... 20 mA / 0 ... 10 V	

Technical data		
Input signal	4 ... 20 mA	4 ... 20 mA
Input current max	25 mA	25 mA
Input resistance	≤ 110 Ω	≤ 110 Ω
Output signal	0 ... 20 mA	0 ... 10 V
Load resistance	≤ 600 Ω	≥ 1 kΩ
Accuracy at Tu=23 °C	0.2%	0.2%
Temperature coefficient	± 250 ppm / K	± 250 ppm / K
Response time	≤ 45 ms	≤ 45 ms
Cut-off frequeny (-3 dB)	10 Hz	10 Hz

General*		
Voltage supply	24 Vdc ±25%	24 Vdc ±25%
	(18 Vdc ... **24 Vdc** ... 30 Vdc)	(18 Vdc ... **24 Vdc** ... 30 Vdc)
Power consumption	< 1.5 W at I_{out} = 20 mA	< 1.3 W at I_{out} = 5 mA
Current carrying capacity of cross-connection	≤ 2 A	≤ 2 A
Operating temperature	0 °C ... +55 °C	0 °C ... +55 °C
	when mounted horizontally	when mounted horizontally
Storage temperature	-20 °C ... +85 °C	-20 °C ... +85 °C
Dimensions L / H / W mm	92.4 / 112.5 / 17.5	92.4 / 112.5 / 17.5
Approvals	CE, cUL	CE, cUL

Coordination of insulation according to EN 50178, 04/98		
Rated voltage	300 V	300 V
Rated surge voltage	4 kV	4 kV
Overvoltage category	III	III
Contamination class	2	2
Clearance and creepage distance	≥ 3 mm	≥ 3 mm
Coupling capacity		
Input / output to supply	1 nF	1 nF
Isolation voltage, voltage strength		
Input/output to mounting rail	4 kV$_{eff}$ / 1 min	4 kV$_{eff}$ / 1 min
Standards/specifications	EN 50178	EN 50178
EMC standards	EN 50081, EN 50082,	EN 50081, EN 50082,
	EN 55011	EN 55011
Dimensions and accessories see	Page 298 + 308	Page 298 + 308

*T$_U$ = 23 °C single module

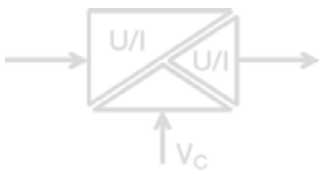**Analogue Signal Processing**

DC/DC Signal Conditioners

WAVEANALOG DC/DC

- 3-way-isolation
- analogue signal conditioning
- indication LED
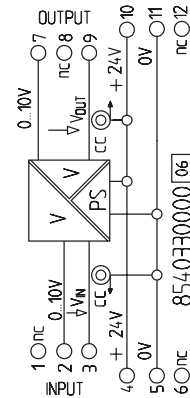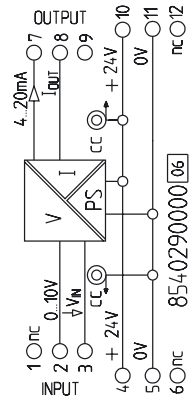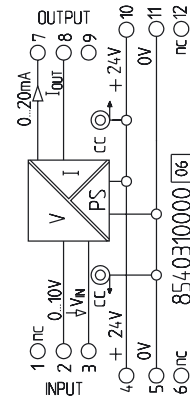- cross-connectable voltage supply via cross-connectors

Approvals:

CE cULus

	VCC 0 ... 10 V / 0 ... 20 mA	**VCC** 0 ... 10 V / 4 ... 20 mA	**VVC** 0 ... 10 V / 0 ... 10 V
Block diagram			

Ordering data	Type	Cat. No.	Type	Cat. No.	Type	Cat. No.
Screw connection	WAS5 VCC	**8540310000**	WAS5 VCC	**8540290000**	WAS5 VVC	**8540330000**
Tension clamp connection	WAZ5 VCC	**8540320000**	WAZ5 VCC	**8540300000**	WAZ5 VVC	**8540340000**
Input/output	0 ... 10 V / 0 ... 20 mA		0 ... 10 V / 4 ... 20 mA		0 ... 10 V / 0 ... 10 V	

Technical data*			
Input signal			
Input signal	0 ... 10 V	0 ... 10 V	0 ... 10 V
Input voltage max.	15 V	15 V	15 V
Input resistance	typ. 100 kΩ	typ. 100 kΩ	typ. 100 kΩ
Output signal	0 ... 20 mA	4 ... 20 mA	0 ... 10 V
Load resistance	≤ 600 Ω	≤ 600 Ω	≥ 1 kΩ
Accuracy at Tu=23 °C	0.2%	0.2%	0.2%
Temperature coefficient	± 250 ppm / K	± 250 ppm / K	± 250 ppm / K
Response time	≤ 45 ms	≤ 45 ms	≤ 45 ms
Cut-off frequeny (-3 dB)	10 Hz	10 Hz	10 Hz

General			
Voltage supply	24 Vdc ±25% (18 Vdc ... **24 Vdc** ... 30 Vdc)	24 Vdc ±25% (18 Vdc ... **24 Vdc** ... 30 Vdc)	24 Vdc ±25%) (18 Vdc ... **24 Vdc** ... 30 Vdc)
Power consumption	< 1.5 W at I_{out} = 20 mA	< 1.5 W at I_{out} = 20 mA	< 1.3 W at I_{out} = 5 mA
Current carrying capacity of cross-connection	≤ 2 A	≤ 2 A	≤ 2 A
Operating temperature	0 °C ... +55 °C when mounted horizontally	0 °C ... +55 °C when mounted horizontally	0 °C ... +55 °C when mounted horizontally
Storage temperature	-20 °C ... +85 °C	-20 °C ... +85 °C	-20 °C ... +85 °C
Dimensions L / H / W mm	92.4 / 112.5 / 17.5	92.4 / 112.5 / 17.5	92.4 / 112.5 / 17.5
Approvals	CE, cUL	CE, cUL	CE, cUL

Coordination of insulation according to EN 50178, 04/98			
Rated voltage	300 V	300 V	300 V
Rated surge voltage	4 kV	4 kV	4 kV
Overvoltage category	III	III	III
Contamination class	2	2	2
Clearance and creepage distance	≥ 3 mm	≥ 3 mm	≥ 3 mm
Coupling capacity			
Input / output to supply	1 nF	1 nF	1 nF
Isolation voltage, voltage strength			
Input/output to mounting rail	4 kV$_{eff}$ / 1 min	4 kV$_{eff}$ / 1 min	4 kV$_{eff}$ / 1 min
Standards/specifications	EN 50178	EN 50178	EN 50178
EMC standards	EN 50081, EN 50082, EN 55011	EN 50081, EN 50082, EN 55011	EN 50081, EN 50082, EN 55011
Dimensions and accessories see	Page 298 + 308	Page 298 + 308	Page 298 + 308

*T_U = 23 °C single module