METZ CONNECT

We realize ideas

Modbus RTU components for automation in buildings, installations and systems

C | Logline

I/O components with Modbus RTU

For automation in buildings, installations and systems

Safe and low-cost operation of infrastructures in large as well as small buildings requires that the most important operational functions such as system control, air conditioning, ventilation and lighting are automated. However, this also increases the demands on the functions of the building installation, which can usually be met by conventional technology only at considerable expense. For this reason, building automation increasingly uses serial bus systems that transmit information between sensors and actuators, switches and higher-level control systems.

Bus systems such as Modbus RTU offer various advantages:

- easier planning and installation of building functions
- high flexibility in building use, as the functions are freely configurable and can therefore be adjusted and readjusted at any time and as required.

Compact and intelligent I/O components for decentralised applications

Thanks to their compact design for the top-hat rail (front height of 45 mm) and the wide variety of models, also in IP65 housing screw and spring clamp technology, METZ CONNECT I/O components are ideally suited for use in decentralised applications. The modules can be used where they are really needed. This considerably reduces the amount of control cabling required compared to a centralised installation in a switch cabinet. Moreover, the compact mixing ratio of the METZ CONNECT I/O components, which is adapted to the respective application, optimises the number of unused inputs or outputs.

Minimal cabling required and series connection of the I/O components using jumper plugs

The power supply and the bus connection → Voltage and bus are fed in and passed on via the contacts on the topside or front side of the I/O components. By plugging in jumper connectors → with jumper plugs, up to 15 I/O components can be connected to one another quickly and easily and arranged in a row. An end terminal allows transition to a continuing cable.

Modbus components

Modbus RTU (remote terminal unit) is the most widely used fieldbus in industrial automation worldwide. Here Modbus has developed into a de facto standard, since it is an open communication protocol. This fieldbus also uses the master-slave method based on the RS485 interface. Our components are Modbus slaves and are queried and controlled by a Modbus master.

RS485 interface

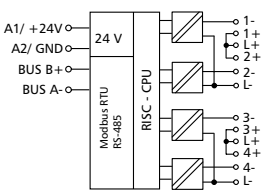
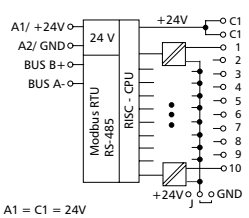
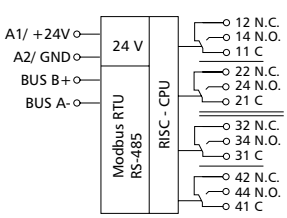
The RS485 interface has been developed for fast data transmission over long distances in the field, i.e. directly to sensors (such as our input modules) and actuators (such as our output modules). Thus, it allows for cable lengths of up to 1.2 km and data transmission rates of up to 500,000 bps via so-called twisted pair installation or fieldbus cables. It is also becoming increasingly widespread with the above-mentioned Modbus RTU communication protocol.

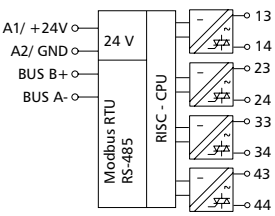
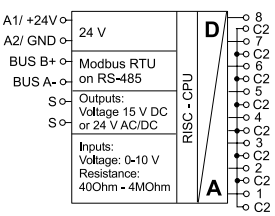
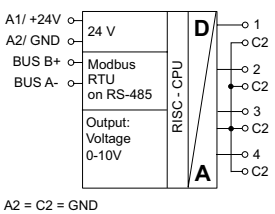
Pictograms key

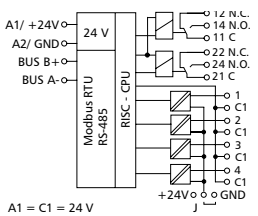
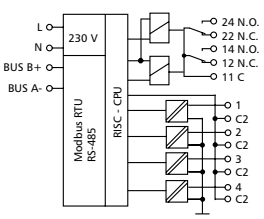
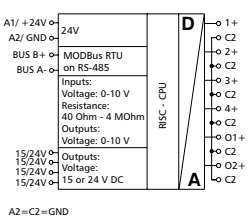
with screw type terminal blocks

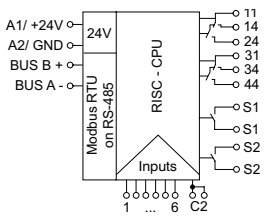
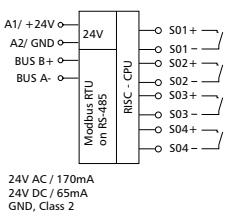
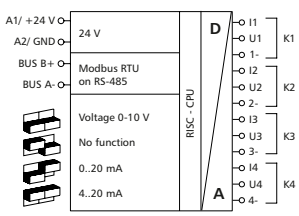
with spring clamp terminal blocks

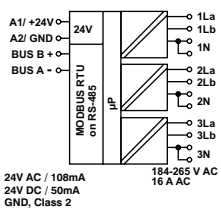
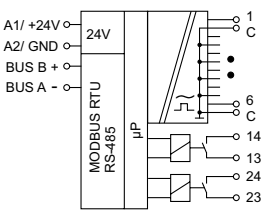
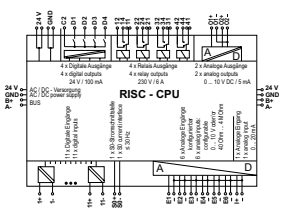
Part numbers end with „70“
Designations contain a „F“

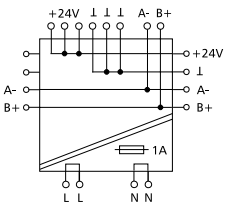
Module	 MR-DI4, MR-DI4-IP, MR-DI4-IP with external display MR-F-DI4 4 inputs – digital	 MR-DI10 MR-F-DI10 10 inputs – digital	 MR-DO4, MR-DOA4 MR-F-DO4, MR-F-DOA4 4 outputs – digital (relay)
P/N	1108341319, 1108341319IP 110834131901IP, 110834131970	1108311319 110831131970	1108361321, 110836132101 110836132170, 11083613210170
Description	Suitable for the detection of potential-free switch states of electrical limit switches on ventilation flaps or auxiliary contacts on contactors. Examples are fire dampers or ventilation dampers. The inputs can be connected by means of potential-free switches or contacts as well as voltage inputs. The inputs can be queried via standard registers via a Modbus master. The settings of the module address, baud rate and parity are made via two address switches or via software. The MR-DI4-IP is available in IP65 housing and with external status display.	To detect potential-free switch states, for example electrical end position switches on ventilation dampers or auxiliary contacts of power contactors. Depending on how the jumper J has been set, the inputs can be operated as contact and voltage inputs (J-GND jumper) or with activation to GND (A2, J - + 24 jumper).	Suitable for switching electrical components, such as motors, contactors, lamps, louvers, etc. With strong inductive loads, we recommend protecting the relay contacts additionally with an RC element. The outputs can be switched by means of standard objects via a Modbus master. The module address, the baud rate and the parity are set by means of two address switches on the front. The MR-DOA4 without manual operation (potentiometer) is available to prevent unauthorized switching.
Inputs	› 4 potential-free contact inputs › Voltage input 30 V AC/DC › Switching threshold > 7 V AC/DC	› 10 contact or voltage inputs › Voltage input 30 V AC/DC › High signal detection > 7 V AC/DC	
Outputs			› 4 changeover contacts › Switching voltage max. 250 V AC › Rated current max. 5 A/relay › Total current of all contact 12 A › Service life electrical 9 x 10^4 › Service life mechanical 15 x 10^6
Principle diagram	 Circuit diagram MR-DI4 and MR-DI4-IP see data sheet	 A1 = C1 = 24V	
Size	MR-DI4: 35 x 70 x 65 mm MR-DI4-IP: 159 x 41.5 x 120 mm	35 x 70 x 65 mm	MR-DO4: 35 x 70 x 65 mm MR-DOA4: 35 x 70 x 65 mm

Module			
	MR-TO4 MR-F-TO4 4 outputs – digital (triac)	MR-AI8 MR-F-AI8 8 inputs – analog universally configurable	MR-AOP4, MR-AO4 MR-F-AOP4, MR-F-AO4 4 outputs – analog
P/N	11083013 1108301370	11083213 1108321370	1108371302, 1108351302 110837130270, 110835130270
Description	To switch electrical components, such as relays, contactors, HVAC valves, etc. Especially suitable for noiseless and cyclic switching (PDM).	To detect resistances and voltages of, for example, passive and active temperature sensors, electrical vent and mixing valves, valve positions, etc. The following characteristic temperature curves are included in the device: -50°C to 150°C: PT100, PT500, PT1000, NI1000-TK5000, NI1000-TK6180, BALCO 500, KTY81-110, KTY81-210, NTC-1k8, NTC-5k, NTC-10k, NTC-20k -40°C to 120°C: LM235 -50°C to 110°C: NTC-10k CAREL	It can be used as an encoder for control variables, such as electrical vent and mixing valves, valve positions, etc. The front-side potientiometers of the MR-AOP4 allows switching between automatic and manual mode. The MR-AO4 without manual operation (potentiometer) is available to prevent unauthorized switching.
Inputs		› Selectable temperature characteristic curve › Resolution 14 Bit › Voltage input 0 to 10 V DC › Resolution 10 mV (0.0 to 100 %) › Resistance range 40 Ohm - 4 MOhm	
Outputs	› 4 digital triac outputs › Switchung voltage 24 to 250 V AC › Rated current 0.5 A/Triac › Switching current <30 s 0.8 A › Fuses (triacs) 2 A each › Total current over all outputs max. 2.4 A		› Output voltage 0 to 10 V DC › Output current 5 mA at 10 V DC › Resolution 10 mV/Digit
Principle diagram			
Size	35 x 70 x 75 mm	50 x 70 x 65 mm	MR-AOP4: 35 x 70 x 65 mm MR-AO4: 35 x 70 x 65 mm

Module			
	MR-DIO4/2, MR-DIO4/2S MR-DIO4/2-IP, MR-F-DIO4/2 4 inputs – digital 2 outputs – digital (relay) c	MR-DIO4/2-IP65 230 V 4 inputs – digital 2 outputs – digital (relay)	MR-AIO4/2-IP65 4 inputs - analog configurable 2 outputs - analog
P/N	1108331326, 110833132601 1108331326IP, 110833132670	1108330526IP	11084213IP
Description	Suitable, for accommodating light switches and window contacts in a room, switching two striplights on and off or for controlling blinds. The control of 2 motorized fire dampers is also possible, as are many other applications.	Suitable, for accommodating light switches and window contacts in a room, switching two striplights on and off or for controlling blinds. The control of 2 motorized fire dampers is also possible, as are many other applications.	The Modbus module in an IP65 housing with 4 individually configurable resistance or voltage inputs and 2 analog outputs was developed for decentralized tasks. The inputs are suitable for measuring resistances and voltages of e.g. passive and active temperature sensors, electrical ventilation and mixing dampers, valve positions, etc. The outputs are suitable as manipulated variable transmitters for e.g. electrical ventilation and mixing dampers, valve positions, etc. The inputs can be universally configured and the outputs set via a Modbus master using standard registers. The module address, bit rate and parity can be set using two rotary switches or via the Software.
Inputs	› 4 digital voltage inputs 30 V AC/DC › High signal detection > 7 V AC/DC	› 4 digital voltage inputs 30 V AC/DC › High signal detection > 7 V AC/DC	› Voltage input 0 to 10 V DC › Resolution 15 Bit › Resistance range 40 Ohm to 4 MOhm
Outputs	› 2 changeover contacts › Switching voltage 250 V AC › Switch-on peak MR-DIO4/2: 80 A/20 ms MR-DIO4/2S: 160 A/20 ms › Continuous current per relay MR-DIO4/2: 16 A MR-DIO4/2-IP: 10 A › Total current of all contacts MR-DIO4/2: 25 A MR-DIO4/2-IP: 20 A › Service life mechanical: 30 x 10^6, electrical: 1 x 10^5	› 2 changeover contacts › Switching voltage 250 V AC › Switch-on peak: 65 A/20 ms › Continuous current per relay: 10 A › Total current of all contacts: 11 : 10 A › Service life mechanical: 10 x 10^6 electrical: 1 x 10^5	› Voltage output 2 x 0 to 10 V DC › Output current 5 mA to 10 V DC › Resolution 0,625 m V/Digit › 4 support contacts 15/24 V DC for active sensors
Principle diagram			
Size	MR-DIO4/2: 35 x 70 x 65 mm MR-DIO4/2-IP: 159 x 41.5 x 120 mm	159 x 41.5 x 120 mm	159 x 41.5 x 120 mm

Module			
	MR-TP MR-F-TP 6 inputs – digital 2 two-stage relay outputs – digital (relay)	MR-SI4 MR-F-SI4 4 S0 inputs	MR-CI4 MR-F-CI4 4 Inputs – analog (universally parameterizable)
P/N	11083813 1108381370	11083913 1108391370	1108401332 110840133270
Description	Suitable to switch, for example, multi-level pumps and fans or louvers. With strong inductive loads, we recommend protecting the relay contacts additionally with an RC element. The inputs and outputs can be switched and scanned with standard commands. The input contacts 1 to 6 are wired with the C2 contacts on two poles to potential-free switches or contacts. The module has a manual control for the outputs. The module address and the bit rate are set with the two address switches on the front.	Suitable for counting S0 counter pulses. This allows very good integration of the module into an energy controlling system. In case of a power failure, the last counter readings are saved. The buttons are for counter synchronization. The inputs can be scanned by means of standard registers via a Modbus master. The module address, the baud rate and the parity are set by means of two address switches on the front.	Suitable for detecting currents and voltages of, for example, passive and active temperature sensors, electrical vent and mixing valves, valve positions, etc. The inputs can be scanned by means of standard objects via a Modbus master. The module address, the baud rate and the parity are set by means of two address switches on the front.
Inputs	› 6 digital voltage inputs 30 V AC/DC › High signal detection > 7 V AC/DC	› 4 S0 inputs according to standard DIN EN 62053-31 class A	› 4 analog voltage inputs 0 V to 10 V DC or › 4 analog current inputs 0 (4) to 20 mA DC
Outputs	› Output contacts 2x NO contact (semiconductor), 2x two-stage (relays) › Semiconductor realys Switching voltage 2x 40 V AC/DC Making/breaking current max. 500 mA Nominal current 100 mA › Relays Switching current 2x 250 V AC Nominal current 6 A (relays) Service life mechanical 30 x 10^6 cycles Service life electrical 9 x 10^4 cycles Permissible switching frequency 6 per min. at nominal current		
Principle diagram			
Size	50 x 70 x 74 mm	35 x 70 x 65 mm	35 x 70 x 65 mm

Module			
	MR-SM3 MR-F-SM3 3 inputs (230 V) - analog	MR-LD6 MR-F-LD6 6 measuring inputs electrodes (Relay) 2 outputs – digital	MR-Multi I/O 11 inputs – digital, 7 inputs – analogue 8 outputs – digital, 2 outputs – analogue 1 S0 current interface
P/N	11084113 1108411370	11084413 1108441370	11084313
Description	The module MR-SM3 is a smart meter component for use in building automation. Current, voltage, power and many other values can be recorded by three 230 volt circuits. Moreover, monitoring functions, such as asymmetry, phase failure, phase sequence, and over and undervoltage are provided. The values can be queried using a Modbus-Master. The module address, bit rate and parity are set via two rotary switches on the front or by software.	Suitable for monitoring leakage sensor electrodes or the fill level of liquid containers and switch pumps or magnet valves. The resistance of the conductive liquid is measured when the electrodes are lowered into it. It is also possible to signal a cable break (requires sensor LKS-ZD). The device can be self-reliant or operated via a Modbus-Master. The inputs and outputs can then be switched and scanned via standard registers. The module address, bit rate and parity are set via two rotary switches on the front or by software.	The Modbus module MR-Multi I/O is a compact and quickly installable solution for connecting digital and analog signals from the actuator and sensor level directly to a control unit in the building automation via the Modbus RTU protocol. For various tasks, 29 I/Os are available, some of which can be configured. With strong inductive loads, the relay contacts should also be protected with an RC element. With a Modbus master, the inputs and outputs can be switched on and off and queried via standard registers. The module address, bit rate and parity are set via two rotary switches on the front or using software.
Inputs	› 3 x analog › Input/voltage 230 V AC -20 to +15 % › Input/voltage range 84 to 265 V AC › Input/current 0 to 16 A AC	› Inputs/contacts 1 … 6 connecting the electrodes › Input/contacts C common reference potential	› 11 x digital optocoupler, indirect-coupled › 1 x S0 current interface › 6 x analogue universal input 40 Ohm to 4 MOhm, - 0 to 10 V DC › 1 x analogue 0 to 20 mA
Outputs		› 2 x relay output, normally open contact (SPST-NO) › Switching voltage 250 V AC › Persistent current 6 A	› 4 x relay, changeover contact (SPDT), switching voltage 250 V AC, persistent current 6 A, button manual control › 4 x PhotoMOS switching voltage 24 V AC/DC 100 mA › 2 x analog 0 to 10 V DC
Principle diagram			
Size	50 x 70 x 74 mm	50 x 69.3 x 60 mm	125 x 93 x 65 mm

Module		
	NG4 NG4-F Power supply unit 24V DC/700mA	MR-GW MR-F-GW Modbus RTU / Modbus TCP Gateway
P/N	110561 11056170	11083001 1108300170
Description	The power supply NG4 supplies regulated direct voltages for supplying power to the respective devices of the product range I/O components. The device supplies regulated direct voltage 24 V DC at a power of 16 watts.	The MR-Gateway MR-GW enables a bidirectional data exchange between Modbus RTU fieldbus devices and a Modbus TCP master (client). The MR-GW can be operated in two modes. Either as a transparent Gateway in the Modbus RTU over TCP operating mode or as a protocol converter (Modbus TCP operating mode). The MR Gateway can be connected to METZ CONNECT Modbus RTU devices via two 4-pole connection terminals on the front of the device and a bridging plug. An integrated web server is used for setting parameters, management and monitoring of the two interfaces (Ethernet / RS485). The web interface is also used to update the firmware. The MR Gateway is suitable for decentralised mounting in electrical sub-distributors or in switch cabinets on DIN TH35 rail according to IEC 60715.
Inputs		
Outputs	› Nominal voltage 110 to 240 V AC, 50/60 Hz › Internal fuse T 1.0 A/250 V soldered fuse › Output power 16 W › Output voltage +24 V DC › Operating voltage display green LED › Output current (max.) 700 mA › As-delivered accuracy ±5 % › Mains failure backup 40 ms	› Ethernet interface Network connection: 1x Ethernet port 10/100 Mbits Protocol: Modbus RTU over TCP (Transparent Gateway), Modbus TCP/IP v1.0b, Telnet, HTTP 1.0 › RS485 interface Protocol: Modbus RTU v1.1b3 Transmission rate: 300 to 115200 Bit/s Bus terminating resistor: 120 Ohm disengageable Galvanic separation: 1.5 kV › Supply Operating voltage 24 V DC +/-10 % (SELV) Power consumption (max.) 50 mA
Principle diagram		
Size	50 x 70 x 65 mm	35 x 69.3 x 60 mm

Modul				
	Submersible electrode TE2	Leakage sensor LKS-ZD	USB/RS485 Converter	MR-CT Software Modbus configuration tool
P/N	11032401	11032902	11080101	www.metz-connect.com
Description	One-pole submersible electrode made of stainless steel with protective polypropylene cover. Applications: Electrically conductive liquids, water supply, wells, pumping stations and dry run protection. To be connected to the level sensor ENW-E12 (P/N 110308xx) and MR-LD6 (P/N 11084413). Contents of the packaging: 1 x submersible electrode 1 x protective cover 1 x PG gland	The leakage sensor LKS-ZD with wire breakage monitoring is suitable for connecting to leakage sensors, such as the MR-LD6 (P/N 11088413), to detect conductive liquids, for example, when a pipe bursts. If an electrically conductive liquid (e.g. water) comes between the two electrodes, an electrical connection is produced, which triggers an alarm in the connected leakage sensor MR-LD6. Only the MR-LD6 can carry out wire breakage monitoring for the LKS-ZD. An interruption (wire breakage) in the LKS-ZD connection line will trigger an alarm in the connected leakage sensor MR-LD6.	The USB to RS485 converter allows to connect devices with serial UART interface quickly and easily to USB. The transparent USB plug includes LEDs to view the Tx and Rx traffic on the cable. The other end of the cable consists of bare, tinned wires. Combined with our configuration software MR-CT, the Modbus devices of the MR series can be connected and configured directly. The converter is USB and USB 2.0 full speed compatible and supports a data transfer rate up to 3 Mbps. The required USB-RS485 drivers are available to download for free from http://www.ftdichip.com.	The software MR-CT is used for the parameterization of Modbus devices and also for searching devices in a Modbus network. It allows the setting of all communication parameters such as baud rate, parity, addresses and temperature characteristics of temperature sensors.

Application matrix

Application examples for I/O components

APPLICATION	FUNCTION	FUNCTION IS CARRIED OUT BY ...	APPROPRIATE DEVICE
Heating	Actuate heat registers	Relay, digital output	MR-DO4
	Measure room temperatures	Analog input	MR-AI8
	Actuate pumps (i.e. supply line)	Relay, digital output	MR-DO4
	Actuate mixer motors	Analog output	MR-AOP4, MR-AO4
	Actuate motor valves (radiators)	Triac output, analog output	MR-TO4, MR-AOP4
	Actuate fan coils	Relay, digital output, Triac output	MR-DO4, MR-TO4
Air-conditioning	Actuate motor valves (radiators)	Triac output, analog output	MR-TO4, MR-AOP4
	Collect temperature values	Analog input	MR-AI8
	Motor actuation of window flaps	Relay, digital output	MR-DO4
	Collect wind speed data	Analog input	MR-AI8
	Detect rain sensor data	Analog or digital input (depending on sensor type)	MR-AI8, MR-DI10
Aeration	Actuate fan motors	Relay, digital output	MR-DO4
	Capture the position of aeration valves	Digital or analog output (depending on flap type)	MR-AI8, MR-DI10
	Actuate aeration valves	Relay, digital or analog output	MR-DO4, MR-AOP4
	Measure and control volume flow rate	Analog input	MR-AI8
	Capture air pressure on either side of the flap	Analog input	MR-AI8
	Measure CO_2 concentration in rooms (i.e. in large stores)	Analog input	MR-AI8
	Harmful gas monitoring	Analog input	MR-AI8
Lighting and shading	Switch the light on or off	Relay, digital output	MR-DO4, MR-DIO4/2
	Collect switch states (i.e. light switches)	Digital input	MR-DI10
	Up or down movement of sun blinds (three-point drive)	2 two-level relay outputs	MR-TP
	Brightness measurement	Analog input	MR-AI8
	Collect wind speed (i.e. sun blind protection)	Analog input	MR-AI8
	Actuate motorized window curtains	2 two-level relay outputs	MR-TP
Fire alarm systems	Actuate fire damper motors	Relay, digital output	MR-DO4, MR-DIO4/2
	Detect end positions of fire dampers	Digital inputs	MR-DI10, MR-DIO4/2
	Turn-on sprinkler system	Relay, digital output	MR-DO4

APPLICATION	FUNCTION	FUNCTION IS CARRIED OUT BY ...	APPROPRIATE DEVICE
Smoke extraction	Smoke extraction with flap drives	Relay, digital output	MR-DO4
	Detect flap position	Digital or analog output	MR-DI10, MR-AI8
	Smoke extraction by fan actuation	Relay, digital output	MR-DO4
	Unblock light barriers of elevators	Digital input	MR-DI10, MR-DI4
Burglary and access control	People counting	Digital input, counting input	MR-SI4, MR-DI10
	Collect motion detector data	Digital input	MR-DI10, MR-DI4
	Monitor window contacts	Digital input	MR-DI10, MR-DI4
	Collect data of vibrabtion detectors (i.e. window panes)	Digital input	MR-DI10, MR-DI4
	Collect infrared sensor data	Digital input	MR-DI10, MR-DI4
	Collect radar sensor data	Digital input	MR-DI10, MR-DI4
	Trigger the alarm sensor	Relay, digital output	MR-DO4
Energy management	Meter reading (water, gas, current, heat)	Digital input, counting input	MR-SI4
	Load throw-off	Relay, digital output	MR-DO4
	Motion sensor (turn the light off)	Digital input	MR-DI10
	Collect temperature values	Analog input	MR-AI8
	Allocate energy consumption to cost centers	Counting input	MR-SI4
Room control	see functions from: heating, air conditioning, ventilation, smoke extraction, burglar alarm, access control, energy management, lighting and shading, fire alarm	Digital input	MR-Multi I/O, MR-DI10, MR-DI4, MR-SI4, MR-DO4, MR-AI8, MR-AOP4, MR-AO4, MR-CI4, MR-TP, MR-DIO4/2
		S0 current interface	
		Analog input	
		Relay, Photo MOS, digital output	
		Analog output	
leakage and level Monitoring	Recording filling levels	Measuring inputs electrodes	MR-LD6, TE1
	Recording water leaks/burst pipes	Measuring inputs electrodes	MR-LD6, LKS-ZD
	Switching valves on and off	Relay, digital output	MR-LD6, MR-DO4

METZ CONNECT GmbH is member of the following organizations and associations.

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