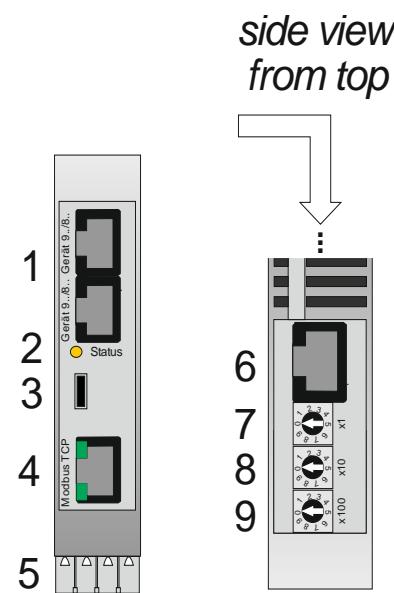


- 1 RJ-45 KFM device connectors
- 2 Status LED bus adapter
- 3 Mikro- USB connector (internal only)
- 4 RJ-45 connection Modbus TCP
- 5 Connection power supply. 24V DC
- 6 RJ-45 service- connection for PC
- 7 Coding switch IP- address adjustment x1
- 8 Coding switch IP- address adjustment x10
- 9 Coding switch IP- address adjustment x100

**General:**

The Modbus TCP interface can replace the wiring of external analog (external setpoints, signal outputs) or digital signals (via binary inputs and status bits or via relay outputs and control bits).

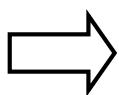
The Modbus TCP connection is made by means of an intelligent bus adapter 99smt..., which is configured for the addresses of 1-2 KFM devices and the transmission data. Communication between the bus adapter and the service interface of the device(s) is carried out using the patch cables (1.5m) supplied.

With Modbus TCP the bus adapter 99smt... is identified by its IP address, responses are sent to the IP address of the master. The Modbus telegrams are transmitted in a TCP frame via Ethernet. The data can be accessed via Modbus TCP using the functions "Read a transmission value" (function code 0x03) and "Write a transmission value" (function code 0x16). For this purpose, the write or read commands must contain, in addition to the MBAP header and the function code, the Modbus register set in the adapter and the number of data words to be transmitted (16 bits). Depending on the type of data to be transmitted, 1 (digital values, status and control word 1), 2 (analog values or parameters) or 3 data words (status and control words 2 and 3) are used.

The function of the adapter can be monitored via error bits. Additionally, connection errors are registered in the error memory and are available for diagnosis.

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REFERENCE!

This symbol refers to further information in other sections, chapters or other manuals.

Versions:

99smts12	Adapter for 12 Modbus TCP transmission values (binary, analog values, status and control words) as slave, up to two device connections, power supply 24V DC
99smts28	Adapter for 28 Modbus TCP transmission values (binary, analog values, status and control words) as slave, up to two device connections, power supply 24V DC
99smtm	Adapter for Modbus TCP transmission values (binary, analog values, status and control words) as master
<i>Power supply module</i> 99e500n	(optional for supplying type 99smt..): power supply module 100-250V AC

Intended use

The device is used for the communication of digital and analog signals with measuring and control devices as well as higher-level controllers in an industrial environment in accordance with the technical data.

Any other use or use beyond this is considered improper.

The device has been built in accordance with the applicable standards, directives and safety regulations. Nevertheless, improper use may result in personal injury or damage to property. To avoid hazards, the device may only be used for its intended purpose in a safe and proper condition and in accordance with the technical documentation supplied. Even if the device is used properly or as intended, it may still present application-related hazards, e.g. due to missing safety equipment or incorrect settings.

Personell qualification

This document contains the information required for the intended use of the device described in it. use of the device described in it.

It is intended exclusively for technically qualified personnel who are specially trained and have relevant knowledge in the field of automation technology. Knowledge and correct implementation of the information in the documentation supplied are prerequisites for safe installation, commissioning and safety during operation. Work on the device may only be carried out to the extent described and, like the electrical connection, only by qualified personnel.

Installation

Before mounting: Check the device for externally visible transport damage. Check the supply voltage on the basis of the type plate. Devices in modular design are supplied individually and must be snapped onto the standard rail intended for use one after the other in the specified sequence. The module housings must then be pushed together. The plug connectors then connect the individual modules to each other. Finally, the end pieces must be mounted on both sides of the module housings.

Electrical safety

- All electrical connection lines of the device must be disconnected during assembly/disassembly, service and repair work.
- The device is not suitable for installation in hazardous areas.
- In addition to faulty installation, parameters set incorrectly or inappropriately on the device can also impair communication. Safety devices independent of the device should therefore always be provided. The relevant safety regulations must be observed.
- Before plugging in and unplugging connecting cables, it must be ensured that the person electrostatically discharged (e.g. by touching grounded metal parts).
- metallic parts).
- The delivery condition of the device can deviate from the intended application during commissioning. The installer of the system is always responsible for commissioning.

Electrical wiring

- Pluggable terminal block; connection according to the connection diagram on the device.
- Only the supplied terminal blocks are to be used. Replace existing old terminal blocks.
- When connecting the power supply, do not interchange the phase and neutral conductor.
- Use cables with a wire cross-section of max. 1.5 mm².
- Keep the communication and supply lines separate and do not lay them parallel to each other and not parallel to each other.
- Do not loop the grounding lines, but route them individually to a common grounding point in the control cabinet.
- Make sure that the cables are as short as possible and that the potential equalization is carried out correctly.
- For the cable material, during installation and also for the electrical
- For the cable material, during installation and also for the electrical connection of the device, the regulations of DIN VDE 0100 "Erection of low voltage installations" or the respective national regulations (e.g. based on IEC 60364) must be observed.
- Establish the connection between the adapter and the controller using the patch cable supplied.

Maintenance

All electronic devices of the manufacturer's program are practically maintenance-free. Provided that installation and commissioning have been carried out correctly and the equipment is protected against mechanical damage and inadmissible operating conditions, many years of trouble-free operation can be expected. In case of malfunctions, interventions are to be limited only to elements accessible outside the device or to elements expressly released for this purpose (connections, switching bridges, fuses).

Any intervention beyond this, especially inside the unit, will invalidate the warranty, make it more difficult to check and rectify the fault at a later date and, if carried out incorrectly, can cause considerable damage to the circuit.

To send in the unit for repair, disconnect the rear connectors with the supply lines connected, loosen the clamping devices, remove the controller from the front of the control cabinet.

In the interest of the quickest and most cost-saving repair possible, the faults and error messages detected should be specified as precisely as possible when sending in the unit.



see chapter Diagnosis on page 7

Settings: The Modbus TCP Adapter is delivered preset:

IP-address: 192.168.1.254 / MAC- address (see type plate)

The IP address setting of the Modbus TCP adapter is made via 3 rotary coding switches according to the following table and, if necessary, to set the higher IP addresses (first 3 number blocks) and other communication parameters using a configuration program in the PKS PC software (from version 2.02.81) via the configuration interfaces (Service).

IP Address setting	IP-address (Modbus TCP- Port address: 502)	Coding switch table of values Hundreds, tens, ones		
		x100	x10	x1
DHCP active	automatic			
Manual setting via coding switch, lowest IP address block (max. 254)	192* 168* 1* 254			

* = first 3 number blocks using PKS- PC software

Commissioning:

Please connect the supplied patch cable (1.5m) with the service interface of the KFM device and the RJ-45 socket "9../8.." of the bus adapter. The Modbus TCP connection is made at the Ethernet socket.

Switch on the mains supply. Control lamps, if present, light up after a few seconds. Check other settings.

The LEDs signal the operating states:

LED	display	Meaning
Modbus TCP-adapter, LED "status"	green permanent*	<i>Normal operation</i>
	green flashing*	<i>Connection error between device 9../8... and bus adapter</i>
	red flashing	<i>Connection error between bus adapter and Modbus</i>
	red yellow flashing	<i>Connection error between device 9../8... and bus adapter and between bus adapter and Modbus</i>
	red permanent	<i>Error while loading the parameters, send in device for repair</i>
Power supply module, Power Led	green permanent*	<i>Power supply connected to power supply module</i>

*= yellow alternative, depending on version

Diagnosis:

For error analysis, three resettable internal error counters are available for recording connection errors on the fieldbus and on the device interfaces.

Under codes 5281 (connection error to the fieldbus), 5282 (connection error to device device 1) and 5283 (connection error to device 2) the numbers of connection errors are recorded.

By setting code 5280 (reset) to 1, all counters are set to 0. Reading the diagnostic codes and the reset function is only possible via the configuration interface.

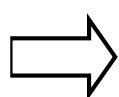
Data transmission:

The preconfigured transmission values are updated cyclically between bus adapter and connected KFM device.

The data can be accessed via the Modbus TCP with the functions "Read a transmission value" (function code 0x03) as well as "Write a transmission value" (function code 0x16).

For this purpose, the write or read commands must contain, in addition to the MBAP header and the function code, the Modbus register set in the adapter and the number of data words to be transmitted (16 bits).

Depending on the type of data to be transmitted, 1 (digital values, status and control word 1), 2 (analog values or parameters) or 3 data words (status and control words 2 and 3) are used.



Note: Each desired KFM parameter code (see page 10 Transmission data) must be assigned a freely adjustable memory area ("Modbus register") in the adapter, which can be accessed via the Modbus.

Structure of the supported Modbus functions:*Modbus requests data (read, 0x03)*

MBAP header	Function code	Modbus-register	Modbus-register	quantity data words	quantity data words
-------------	---------------	-----------------	-----------------	---------------------	---------------------

KFM Modbus adapter responds

MBAP header	Function code	quantity bytes	value data w.1 Hi Byte	value data w.1 Lo Byte	value data w.2 Hi Byte	value data w.2 Lo Byte	value data w.3 Hi Byte	value data w.3 Lo Byte
-------------	---------------	----------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------

Modbus sends data (write, 0x16)

MBAP header	Function code	Modbus-register	Modbus-register	quantity data words	quantity data words	quantity bytes	value data w.1 Hi-Byte	value data w.1 Lo-Byte	value data w.2 Hi-Byte	..
-------------	---------------	-----------------	-----------------	---------------------	---------------------	----------------	------------------------	------------------------	------------------------	----

KFM Modbus adapter responds

MBAP header	Function code	Parameter code	Parameter code	quantity data words	quantity data words
-------------	---------------	----------------	----------------	---------------------	---------------------

Examples:*Modbus master requests actual value 1 from KFM-Modbus adapter register 30 (code 1010**)*

*	03	00	1E	00	02
---	----	----	----	----	----

KFM-Modbus adapter responds with value 100

*	03	04	00	00	42	C8
---	----	----	----	----	----	----

*Modbus master sends to KFM-Modbus adapter Register 20 Setpoint 1 (Code 1060**) value 100*

*	16	00	14	00	02	04	00	00	42	C8
---	----	----	----	----	----	----	----	----	----	----

KFM Modbus adapter responds

*	16	11	00	00	02	04
---	----	----	----	----	----	----

** see allocation table page 12

*** MBAP (Modbus Application Protocol)- header:**

Fields	Length	Description
Transaction identifier	2 byte	Identification of a Modbus TCP request/reply transaction
Protocol identifier	2 byte	0: = Modbus TCP protocoll
Length	2 byte	Number of the following bytes
Unit identifier	1 byte	Detection of a remote slave that is connected to a serial line or other buses.

Structure of the analog transmission values (2 data words)

Analog data or parameters are transmitted in MODBUS float format (2 x 16 bit data words).

Compared to the single-float format (32bit) according to standard IEEE754, the sequence of the individual bytes is swapped. Depending on the master system used, this sequence must be checked and, if necessary, adapted.

MODBUS-float-format

MMMMMM	MMMMMM	SEEEEEE	EMMMMM
--------	--------	---------	--------

Single-float-Format (32bit) in accordance to standard IEEE 754

SEEEEEE	EMMMMM	MMMMMM	MMMMMM
---------	--------	--------	--------

S = sign (sign, 1 bit); E = exponent in the complement of 2; M = normalized mantissa (23 bit)

Transmission data:

The adapters are supplied preset according to the example single controller.

Changes to the transmission data (e.g. actual value, setpoint and status word) can be made with the PKS PC software (from version 2.02.81) via the interface (Service).

Example single controller: (Corresponds to preset parameters - view from PKS PC software)

Device	KFM Parameter	Save Address	Function	Label	Modbus values	HEX	DEC
Dev. 1	1001	10	Read, 1 Word	<input checked="" type="checkbox"/> Input status <input type="checkbox"/> ####	00 83	00	83
Off				<input type="checkbox"/> Steuerwort Bus-Sollwert <input type="checkbox"/> ####	00 00	00	00
Dev. 1	1004	30	Write, 1 Word				
Off							
Dev. 1	1060	50	Write, 2 Word	Bus-Sollwert	00 00 00 00 00 00	00	00
Dev. 1	1010	60	Read, 1 Word	Istwert 1	00 00 00 00 00 00	00	00
Dev. 1	1011	70	Read, 2 Word	Istwert 2	00 00 00 00 00 00	00	00
Off				####			
Off				####			
Off				####			
Off				####			
Off				####			
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Off				####			
Off				####			

Important: A changed or loaded data set (display 99smt ONLINE, highlighted orange) must be sent to the device with the "send" button (display 99smt ONLINE, highlighted green) for activation and for displaying the Modbus values.



Structure of the status and control words**Read:** (From adapter)***Status word 1 → Status measuring inputs and device interface***

(1 byte, basically available, code 1001)

Byte 1 (Bit 1-8)
8 7 6 5 4 3 2 1

Bit 1..7: Status measuring inputs 1 ... 7

0 = measurement is error-free; 1 = error at the associated measurement input

Bit 8: Status device interface, 1 = normal operation; 0 = connection error

Status word 2 → Status binary inputs

(5 bytes, only available if code 1002 is configured). Alternatively, code 1003 for devices 826... or code 100F for devices 821 (status fault indicator)

Byte 5 (Bit 33-40)	Byte 4 (Bit 25-32)	Byte 3 (Bit 17-24)	Byte 2 (Bit 9-16)	Byte 1 (Bit 1-8)
8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1

Bit 1 ... 40: Status binary inputs 1 ... 40

0 = binary input is switched off; 1 = binary input is switched on

Status word 3 → Status binary outputs

(5 bytes, only available if code 1005 is configured)

Byte 5 (Bit 33-40)	Byte 4 (Bit 25-32)	Byte 3 (Bit 17-24)	Byte 2 (Bit 9-16)	Byte 1 (Bit 1-8)
8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1

Bit 1..40: Status binary output (e.g. relay) 1..40

0 = binary output is switched off; 1 = binary output is switched on

Write: (To the adapter)***Control word 1 → Control bus setpoint***

(1 byte, only available if code 1004 is configured)

Basically available for Profinet and Profibus.

Byte 1 (Bit 1-8)
8 7 6 5 4 3 2 1

Bit 1 ... 8: Control bus setpoint 1 ... 8 (for types 90. / 93 max. 1 ... 4)

0 = bus setpoint is not active, internal setpoint (SP) is effective

1 = Bus setpoint is active (SPB)

Control word 2 → Control additional contact

(5 bytes, only available if code 1005 is configured)

Byte 5 (Bit 33-40)	Byte 4 (Bit 25-32)	Byte 3 (Bit 17-24)	Byte 2 (Bit 9-16)	Byte 1 (Bit 1-8)
8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1

Bit 1 ... 40: Control additional contact 1 ... 40, as far as configured to "Bus" in the controller

0 = Switch off contact; 1 = Switch on contact

Configuration level: (Usable parameter depending on the type, consider potential mutual interference !)

<u>display</u>	<u>purpose</u>	<u>value range</u>	<u>CODE (HEX)</u>
ConF	type of controller		013C
Cod1	code number	0...9999	0142
Cod2	code 2..4	0...9999	0161..63
LNG	language selection	0=DEUTSCH, 1=ENGLISH, 2=USER DEF, 3=OFF	8800
Ist1..6	correction actual value 1..6	blo...bHi (+/-)	0124..29
Ain1..6	type of measuring input 1..6	0=4-20, 1=2-10, 2=0-20, 3=0-10, 5=rtd, 20=n100	011E..23
SP-F	switch-over of the ext. setpoint via menu / bin. input (SP/SPE)	-2=AUS, -1=SPEB(bin.), 0=SPEM(menu), 1=SP2	014F
YE	switch-over SPE / YE	0=SPE, 1=YE	114E
SPE	function of the ext. setpoint	2=AbS, 3>Add, 4=Sub	112D
REL_	switch.behaviour of step 1,step contr.	0=stat, 1=rel	1144
(1) Y"	travel time of actuator channel 1	6...600	1(1)3A
(1) TE	switch-on delay per step, step controller	0...600	1(1)43
Cy"	cycle time	2...120	013D
(1) TP	pause time step controller	0...60	1(1)45
(1)out	type of output signal 0 / 4...20mA	0=0-20, 1=4-20	1(1)3B
(1)out	output direction di / in	0=in(in), 1=(in)di, 2=diin, 3=didi	1(1)3C
dSLo	valve drop. minimum	0...50	1122
out	limitation selection (min / max)	0=Lo, 1=Hi	1127
dSHi	valve drop. maximum	50...100	1123
(1) ib	integration range limit channel 1	0...100	1(1)40
(1)YLo	low limit control output	0...Yhi	1(1)38
(1)YHI	limitation control output	-100...100	1(1)41
(1)YHi	high limit control output	YLo...100	1(1)39
(1) TY	control output slope	0...100	1(1)42
(1) DB	damping range	0...100	1(1)25
(1) D"	damping value	0...100	1(1)26
Gr1..2	gradient 1..2	0...100	1132..33
rF1..2	waiting window value 1..2	0.1...999.9	1134..35
td	dead range	0.0...10.0	113D
Sout(1..3)	signal output 0/4...20mA	0=0-20, 1=4-20	0136..38
Sou1..5	assignment signal output	11=lst1, 12=lst2, 21=SP	0155..5A
(1)Y_S	output reaction at meas.fault (relais)	0=off, 1=K1, 2=K2	1(1)3E
(1)Y_S	output reaction at meas.fault (Y)	YLo...YHi (continuous)	1(1)3F
(1)YAP	operating point	YLO...Yhi	1(1)37
YH	switch over control val. on / off	0=off, 1=on	1148
YH	external control value	0...100	1149
d.SP	max. deviation actual value	0.1...200.0	0147
t"	tolerance period act.value (ser. interface)	1...100	014E
rEL1..8	function selection additional contact 1..8	0=LCA, 1=LCE, 2=SuA, 3=SuE, 4=SoA, 5=SoE, 6=StA, 7=USA, 8=USE, 11=OFF, 12=ON	2010..17
rEL1..8	input selection additional contact 1..8	1...6=lst1...6, 11=1Y...	2018..1F
rEL1..8	channel / setpoint selection additional contact 1..8	1...4=1..4SP, 11=rSP...	2020..27
rEL1..8	condition relay 1...8 for measuring line fault	0=SiA, 1=SiE	2028..2F
Adr	controller address	1...255	0141
BAUD	baud rate	0=9600, 1=19200, 2=38400	2629
anSERin	analog input value (via interface)	-10000..10000	6200..09
digSERin	8-bit digital input value (via interface)	00 .. FF hex e.g. 0..255	6210..19
anSERout	analog output value (via interface)	-10000..10000	6220..29
digSERout	8-bit digital output value (via interface)	00 .. FF hex e.g. 0..255	6230..39

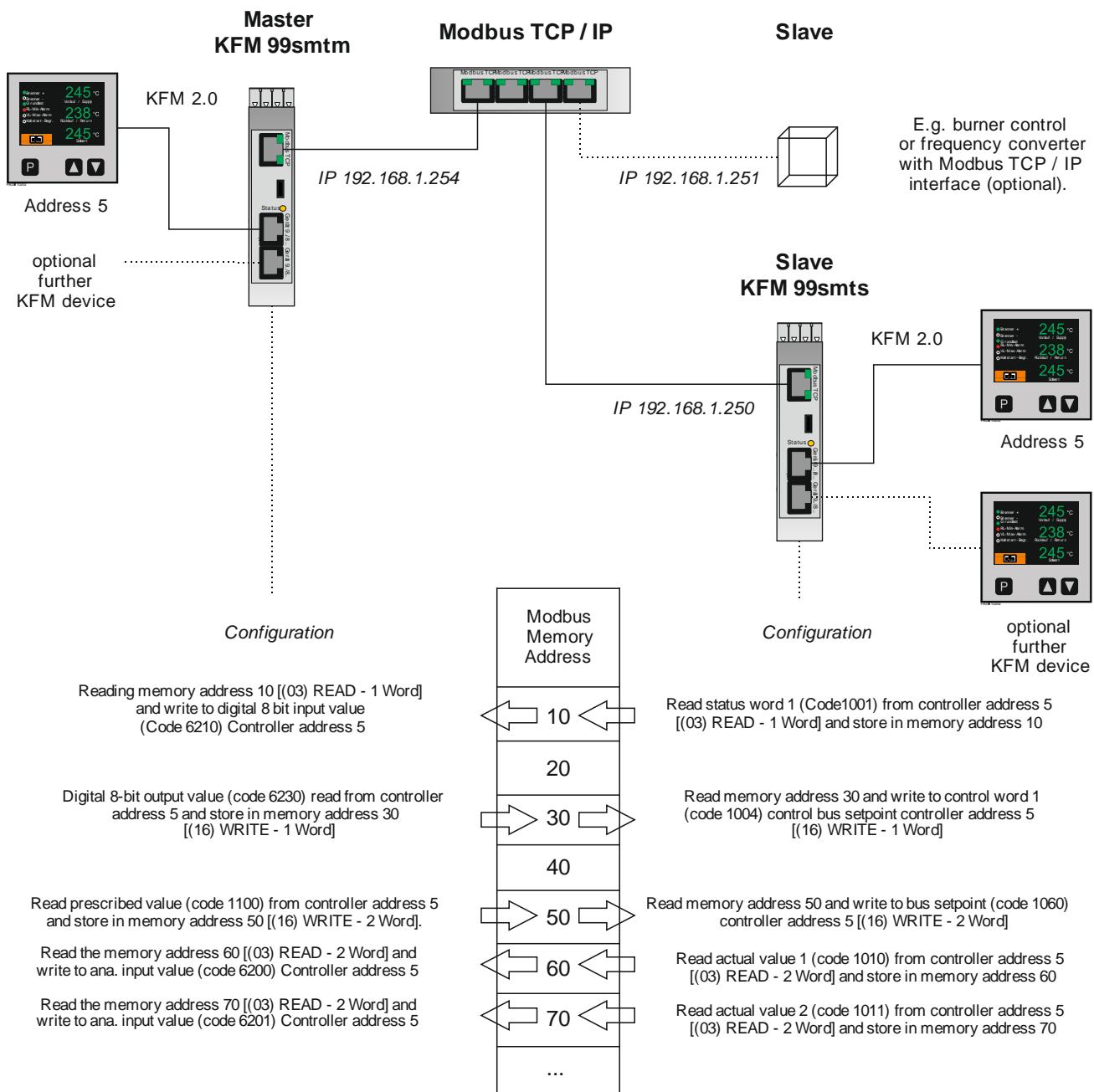
Modbus TCP / IP Master – KFM 99smtm

Modbus TCP / IP is a master / slave protocol for the exchange of process data. The slave processes a request from the master and acknowledges the request with a response, which may include requested data or status information.

In addition to the slave connection via KFM bus adapter 99smts..., e.g. burner controls, frequency converters or decentralised I/O systems with Modbus TCP / IP interface can be used on the Modbus TCP / IP master KFM 99smtm.

The Modbus TCP / IP Master KFM 99smtm... is configured to the addresses of 1-2 KFM units and the Modbus TCP / IP transmission data.

Wiring example:



Example single controller: (corresponds to the factory default setting)

Quelle	99smtm32				99smt ONLINE / Modbus OFFLINE						
Bezeichnung	Kunde: Anlage: Regler: Ort:										
A	Gerät 1, KFM Adr.	5	903K5828								
	Gerät 2, KFM Adr.	0	Aus	Deaktivierung Gerät 2 = Adr 0							
B	Master IP Adresse*	192 . 168 . 1 . 250	KFM-Modbus TCP/IP	MAC Adr.	04 91 62 CD 54 04						
	Subnetz Maske	255 . 255 . 255 . 0	Port	502	Überwachungszeit, sek 2						
*Änderung der IP-Adresse ist erst nach Neustart wirksam!											
C	Gerät	KFM Parameter	Slave IP Adresse*	Slave Adr.	Speicher Adresse	Bezeichnung	Funktion	Format	Modbus Werte	HEX	DEC
	Gerät 1	6210	192 . 168 . 1 . 254	2	10	Seriell DigitalIn	(03)Read	uint16	B-endian	00 00	0
	Gerät 1	6230	192 . 168 . 1 . 132	2	30	Ser. Digital OUT	(16)Write	uint16	B-endian	00 00	0
	Gerät 1	1010	192 . 168 . 1 . 254	2	40	Istwert 1	(16)Write	float	B-endian	00 00 00 00	0.00
	Gerät 1	1100	192 . 168 . 1 . 254	2	50	Sollwert Kan.1	(03)Read	float	B-endian	00 00 00 00	0.00
	Gerät 1	6200	192 . 168 . 1 . 254	2	60	Seriell AnalogIn	(03)Read	float	B-endian	00 00 00 00	0.00
	Gerät 1	6201	192 . 168 . 1 . 254	2	70	Seriell AnalogIn	(03)Read	float	B-endian	00 00 00 00	0.00
	Aus							

A: **Device 1(2), KFM Address:** Address input for connected KFM units

B: **Master IP address (DHCP) and subnet mask (see Settings page 6):** Enter first 3 number blocks, lowest IP address block according to rotary coding switch or DHCP.

Text KFM-Modbus TCP/IP and Port: Defined by Modbus specification, normally no adjustment necessary.

MAC address: Individual hardware address of the KFM adapter, readable on the housing.

Monitoring time, seconds: Time until a Modbus TCP/IP connection failure is detected.

Example single controller: continuing

C: **Device:** Selection of connected KFM devices (device 1 / 2 / off), assignment see A.

KFM parameters (if necessary, table from page 13): Enter code for selected KFM unit, preselect using button ...

Slave IP address: Enter IP address for Modbus TCP / IP slave participant (status LED green for connection to the participant, status LED orange for faulty connection).

Slave address: Fixed by Modbus specification, normally no adjustment necessary

Memory address: Each transmission value must be assigned a freely adjustable memory area that can be accessed via the Modbus TCP / IP.

Designation: Description of the transmission value, changeable, preset. KFM parameter text

Function (see also data transmission page 8): "Reading a transmission value" (function code 0x03) or "Writing a transmission value" (function code 0x16).

Format (see also structure of analogue transmission values page 9 or status and control words page 12): Depending on the type of data to be transmitted, different formats and byte sequences are available:

"bin 1 Words":	status/control word 1 or digital values (16 bit)	"little-/big-endian".
"bin 2 Words":	Digital values (32 bit)	"little-/big-endian/ each with byte swap"
"bin 3 Words":	status/control word 2 and 3	"none" (without)
"float":	Analogue values or parameters (floating point)	"little-/big-endian/ each with byte swap"
"int 16":	Data type integer 16-bit signed	"little-/big-endian".
"uint 16":	Data type integer 16 bits unsigned	"little-/big endian"
"int 32":	Data type integer 32-bit signed	"little-/big-endian/ each with byte swap"
"uint 32":	Data type integer 32-bit unsigned integer	"little-/ big-endian/ each with byte swap"

Example Byte order "float" "Big-endian":

The floating point number 123456.00 or in hexadecimal 47 F1 20 00 is transmitted as 47 F1 20 00.

Big-endian: AB CD EF GH

Little-endian: EF GH AB CD

Big-endian byte swap: BA DC FE HG

Little-endian byte swap: FE HG BA DC

Modbus values (HEX DEC): Real-time display of the transmission values in hexa and decimal system

Technical data:

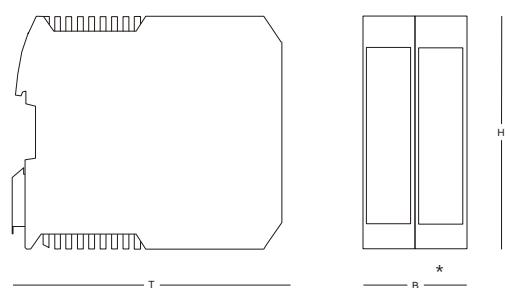
Housing: for standard rail mounting

Mounting position: any; protection class: IP20 according to EN 60529

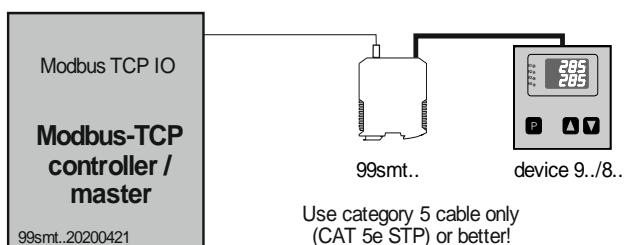
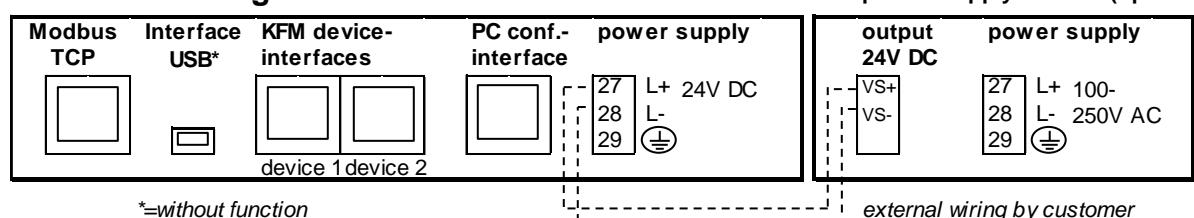
Perm. ambient temperature: 0..60°C; nominal temperature: 20°C

Power supply: 24V DC, approx. 12 VA, altern. 100-250V AC, approx. 12 VA

Modbus interface : Ethernet 10Base-T or100Base-TX (autom. Baudr.) according to IEEE802.3

Dimensions:

H= 99mm, * Version without or with power supply module:B = 22.5mm or 45mm, T = 116mm

Wiring example:**Connection diagram:** CPU-module



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