

OPERATING MANUAL

Multi-Parameter Controller

KM 3000

Hardware version 2.0

Caution!

Changed pin assignment of
the analogue outputs.

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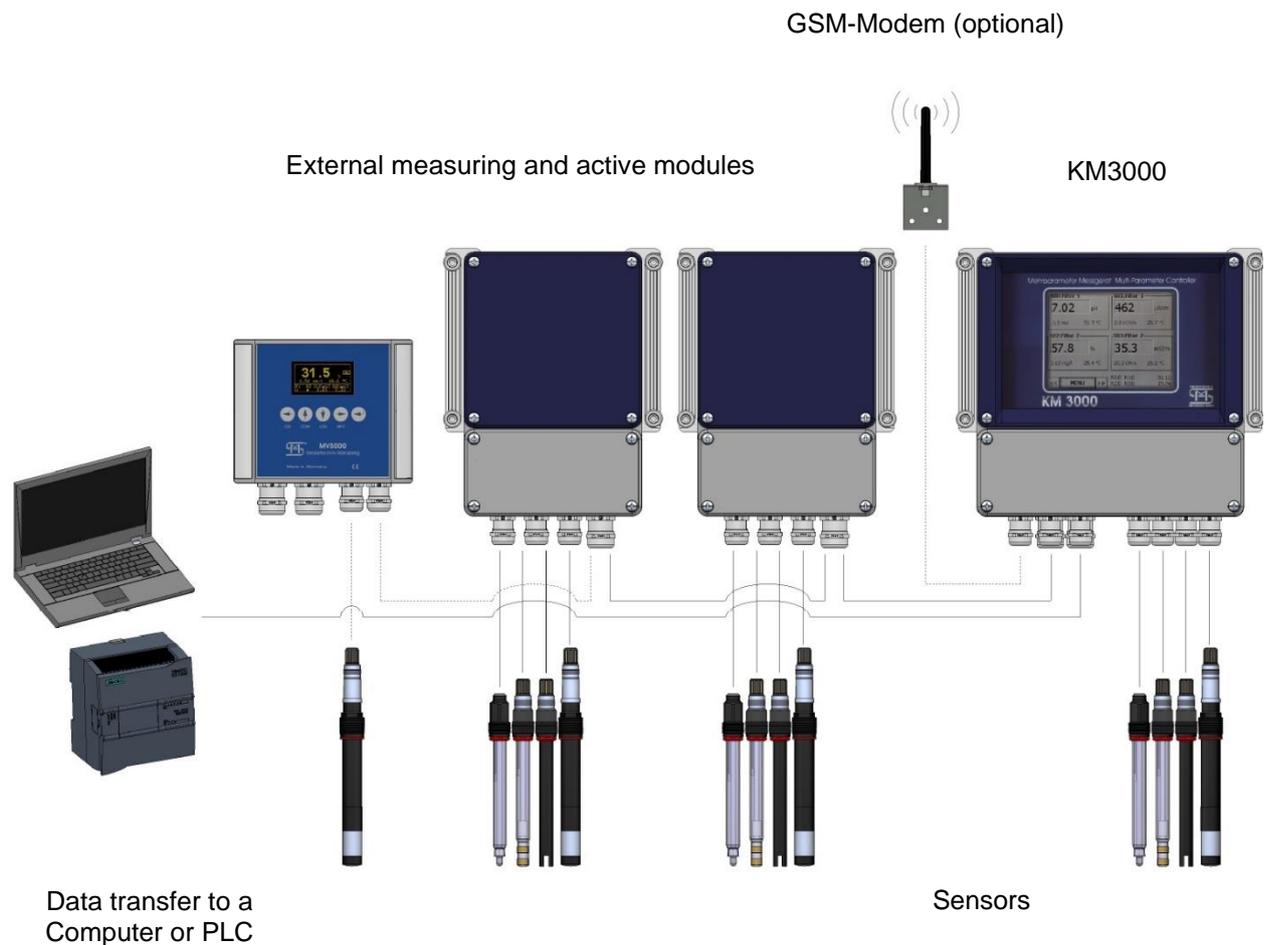
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1 Overview

This microcontroller-operated KM 3000 Multi-Parameter Measuring System is your individual complete solution in analytical instrumentation and control. With the aid of up to 16 measuring modules in any combination, you can determine pH, conductivity, oxygen, redox potential, temperature, chlorine, turbidity and other parameters. This is based on a patented modular bus-compatible system structure using measuring and active modules connected with one another and to the central unit via a bus. 4 of the measuring modules can be inserted into the central unit, the actual KM 3000 controller. Further 12 measuring modules can be connected to the KM 3000 via external modules and the bus system. Because of this, the measuring modules can also be used as pre-amplifiers for separated measuring points. Active modules are interface modules for measured-value outputs, DAC modules for 0(4)...20 mA analogue current outputs, depending on the measuring signal, and relay modules for switching, alarm and control tasks.

The KM 3000 Multi-Parameter Measuring System consists of the following main components:

- KM 3000 multi-parameter controller with power supply, touch screen display, internal modules, data logger and logbook, several digital interfaces like RS232, RS485, USB, Ethernet (in preparation), extension of an integrated GSM modem interface is possible.
- External measuring and active modules.
- PC visualisation software.
- Sensors and accessories.



KM 3000 Multi-Parameter Controller

The KM 3000 multi-parameter controller as the central unit of the measuring system contains power supply, a touch screen display, up to 4 internal measuring modules as well as output signal and relay boards. The clearly arranged terminal box of the KM 3000 represents the interface with the power supply, sensors, data output or control outputs, respectively. The coloured touch screen display is a distinguishing outward feature of the new generation of multi-parameter measuring systems and provides for easy operation, configuration and calibration of the measuring system. The handling of the KM 3000 is supported by self-explaining pictographs. Only those functions, controls and status information are indicated which are relevant for the respective task. Up to 4 measured values including their units, their temperature values, a possible second value as well as an individual description can be displayed on one screen page. A total of 4 screen pages facilitate the clear display of the measured values from all 16 modules, including their status signals. There is an additional fifth screen page to display virtual measured values by mathematical linkages (e. g. differential measurements). The KM 3000 offers room for up to 4 measuring modules in any combination and a DAC 3000 module for 4 configurable and scaleable 0(4)...20 mA current outputs. All measuring modules include Pt 1000 sensor temperature measurements. The assignment of the temperature measurement to automatic parameter compensation is freely selectable by the user.

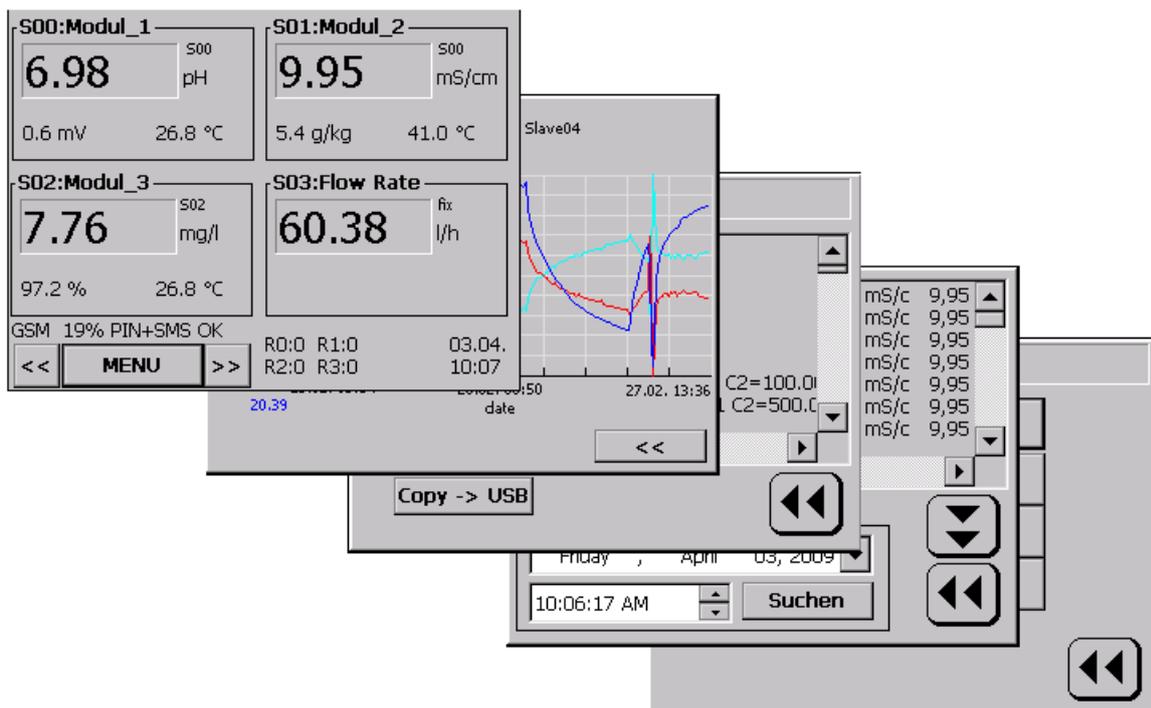
A great number of practically relevant calibration algorithms and temperature compensation methods are supported by the KM 3000. The standard version includes 4 floating relay outputs for simple control, regulation or alarm tasks. The assignment of the contacts to the measured values, the switching values as well as a hysteresis can be adjusted by the user. For complex control tasks, the controller module can be activated with two PID controllers working independently of each other. These controllers can be assigned to any measured quantities and work as analogue pulse length or pulse frequency controllers using the analogue current outputs or the relay outputs of the unit.

All values can be output in cycles and represented in graphical form via an RS-232 or RS-485 bi-directional serial interface in conjunction with the MVremote PC visualisation software program. The MVremote visualisation program includes, at the same time, all functions for reading out and configuring the data logger. Even without the MVremote program, you can use the simple DataReader software program that each unit comes with to utilise the data logger via the RS-232 interface or the data transfer is realised by USB stick. The data logger can be configured for infinite or finite logging with an adjustable sampling interval and works independently of data output.

The data recorder graphically shows on the touch screen the measured data curve of the main measured quantity of each measuring module received within the last 48 hours. This display offers the user a quick overview of the measured value development, giving average, maximum and minimum values.

It is a big advantage that the software of the measuring instrument can be updated. This software can be saved on an USB stick and transferred via update function. That means the user can realise software extensions himself very quickly.

The units will come from the factory with pre-settings per your order and are provided with a power supply cable.

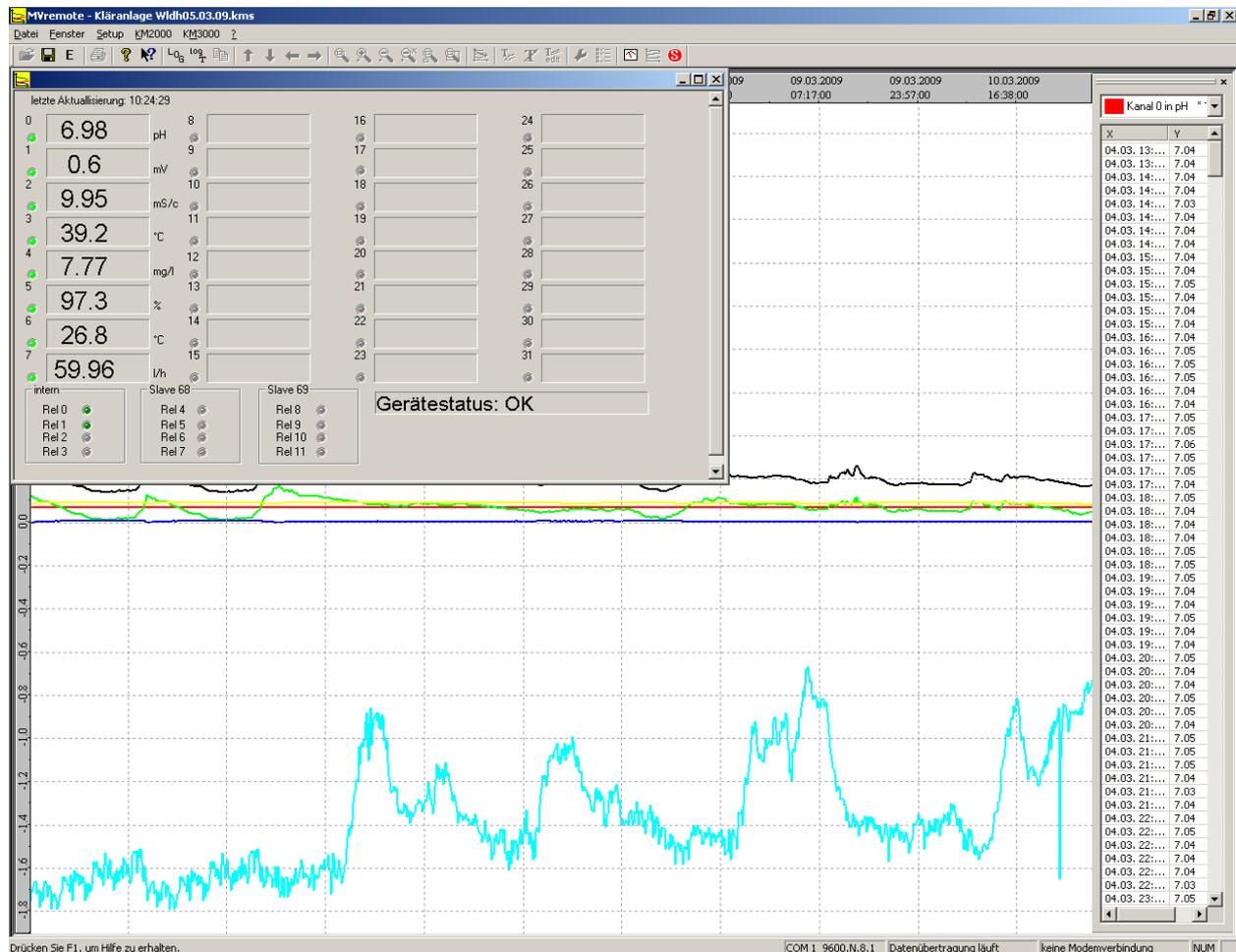


External measuring and active modules

Besides the 4 internal measuring modules, up to 12 external measuring modules can be connected to the KM 3000 controller at any sequence and choice. In addition, up to 4 external DAC 3000 CAN modules with 4 0(4)...20 mA current outputs for each DAC 3000 CAN module are available to utilise all measured values (also virtual ones) as current signals for further processing. Up to 4 external relay modules REL 2000 CAN with 4 relays for each REL 2000 CAN module complete the 4 internal relays of the measuring instrument. All in all 20 relay outputs can be realised. The KM 3000 controller provides the power supply for the measuring and active modules and automatically detects the modules connected.

PC visualisation software

The optional MVremote PC visualisation software facilitates the comfortable representation, configuration and logging of the measured values of the KM 3000 Multi-Parameter Measuring System on an external PC. The configuration can be realised via RS-232. The protocols can be edited and printed. It is also possible to create, edit and save configurations also there is no data connection to the KM 3000. Via USB stick these configurations can be transferred to the measuring device. Furthermore data logger and log-book can be read out and configured.



Sensors and accessories

A particular feature of the KM 3000 Multi-Parameter Measuring System is that conventional electrodes and sensors (pH and redox electrodes, conductivity measuring cells, oxygen sensors, etc.) can be connected without integrated pre-amplifiers or electronic circuitry. That means that the complete range of electrodes, sensors and accessories for connection with the multi-parameter measuring system is available. Specific electrically isolated measuring modules with linear transmission characteristics are provided for the connection of sensors with integrated measured value processing. In addition to chlorine measuring cells (MVM 2260 C module), flow, level or other sensors providing an output signal of 0...5 VDC (MVM 2260 A) or of 0(4)...20 mA (MVM 2260 B) can be integrated into the multi-parameter measuring system by means of the MVM 2260 measuring modules.

Web server / Web interface

Measured values, diagrams and other information about the individual slaves can be conveniently displayed in an Internet browser. The data logger can also be read out via the web interface.

The screenshot shows a web browser window displaying the Sensortechnik Meinsberg KM3000 web interface. The browser address bar shows the URL `http://80.153.251.119:50081/` and the page title is "KM3000 - Sensortechnik M...". The interface features the company logo and name at the top, followed by navigation links: "Display", "Chart", "Data logger", and "Logbook". The date and time "15.08.2019 13:10" are displayed in the top right. The main content area contains four sensor data cards for "slave0", "slave1", "slave2", and "slave3".

Slave	Value	Unit	Additional Data
slave0	-2.0230	V	0.0 mA, 471.5 °C
slave1	-0.00	mg/l	-0.0 %, 481.5 °C
slave2	7.433	pH	-31.9 mV, 23.5 °C
slave3	135.9	μS/cm	7.4 kOhm, 488.1 °C

2 Safety



These Operating Instructions contain fundamental information that should be observed in connection with the installation, start-up, operation and maintenance of the KM 3000 Multi-Parameter Measuring System. Therefore, it is absolutely vital for the user to read this Manual completely prior.

The symbol  "General Warning" indicates special warnings in the manual.

User qualification



The multi-parameter controller and the entire measuring system have been designed for analytical multi-parameter measurements. It is assumed that the user/operator and the maintenance personnel have the proper professional skills and experience to know the specific properties of analytical measuring systems, master the safe handling of chemicals, for example, in the maintenance of electrodes/sensors, and can assess any dangers and risks resulting thereof. The user must ensure that the national legislation and procedures concerning the protection of labour, the prevention of accidents and the handling of chemicals are observed.

Electrical installation work



The multi-parameter controller comes ready for operation together with a power supply cable. Do not insert the plug into sockets other than shock-proof. The used wall socket must be easily accessible always. Do not use an extension cable without any protective conductor, as this would eliminate the protective function. Any interruption of the protective conductor inside or outside the unit may result in the latter becoming dangerous if another fault occurs. There can be fire hazard or an electric shock. Connect the power plug to an easy accessible wall socket for quickly disconnection of the device from the power supply in any emergency. Check the power cable regularly. If the power cable is damaged, it must be replaced.

The demands on the power cord to be used for a permanent installation, please refer to chapter 15 TECHNICAL DATA. In addition, at a fixed wiring an external mains separation / circuit protection is required. This protection should be a maximum of 10A (slow). The external switch must be suitable in accordance with IEC 60947-1 and EN 60947-3 and marked for the instrument.

Opening the unit will expose live parts. The terminal box may only be opened for the connection of sensors and other peripheral units after the mains supply has been unplugged. Such work should be done by a skilled person who is familiar with the hazards associated therewith. Intervention into the unit will result in expiration of the warranty.

Installation and getting started



Install the unit and the external modules so that the conditions specified under 'Specifications' will be kept under any circumstances. The enclosures meet the IP 65 degree of protection requirements. A prerequisite to this, however, is the proper installation of the enclosure cover of the terminal box and of the seals (Important: Distinguish between the inside and outside.). Also, properly install the cables in the glands and tightly seal all cable glands not used. For outdoor application of the KM 3000 controller and its modules, the use of a stand and a weather-proof roof is recommended.

The distance between the drill holes can be found in the dimensional drawing in Chapter 15 Specifications. For wall mounting, use the material suitable for the wall structure (screws, dowels, etc.). The wall mounting must be carried out in accordance with DIN, i.e. the suspension must support 4 times the weight of the device (15 Specifications).

Do not use any sensor and bus cables other than recommended by the manufacturer. For the sensors and accessories, the instructions and regulations in the respective operating instructions manuals and specification sheets shall apply.

To prevent relay damage, the load circuit must be fused for the maximum permissible current!

Proper usage



The KM 3000 multi-parameter controller is intended for measuring, controlling and regulating analysis parameters in a Not-Ex-area. The control and regulating outputs must not be used for protective or safety circuits. Taking into consideration the 'Specifications' paragraph in Chapter 15, operating and using the unit for this application is the proper usage. Any application beyond this and individual modifications or extensions are improper and will lead to loss of entitlement to the warranty. When connecting the unit with electrochemical sensors, always take into account their life and natural wear as this may result in malfunctioning of the measuring system and the regulation or control associated therewith. The user must take suitable measures to limit harmful effects of such malfunctioning.

General safety instructions



All components of the KM 3000 multi-parameter controller have been manufactured and tested in accordance with the relevant guidelines and standards for electronic measuring equipment. They have left the factory in technically unobjectionable condition.

The proper functioning and the operational reliability of the KM 3000 controller and of the measuring system components will only be guaranteed if the generally usual safety precautions and the specific safety instructions given in this Operating Instructions Manual and in the operating instructions manuals of the components are observed.

If it is assumed that safe operation of the unit or of its components is no longer possible, remove the unit and its components from service and protect it against unintentional operation.

Safe operation will no longer be possible if the unit or its components:

- show any transport damage
- have been stored under unsuitable conditions for a longer time
- show any apparent damages
- do no longer work as described in this Operating Instructions Manual

If in doubt, please contact your supplier.

3 Controller Layout



- 1 Power supply
- 2 Relay
- 3 Analogue output / Hold input
- 4 CAN-Bus
- 5 Serial interface
- 6 Fault relay
- 7 PE
- 8 USB and Ethernet
- 9 Sensor

4 Installation

The KM 3000 multi-parameter controller including its associated modules is supplied ready for operation and is preset according to your order. The scope of supplies includes all parts required for installation and getting started, except for the materials for wall or post installation. You can separately order such materials from the manufacturer or from your dealer. The internal hardware configuration of the KM 3000 controller is fixed by the manufacturer in accordance with the tasks to be accomplished. The entire measuring system can be subsequently completed by the user with the aid of external measuring and active modules, taking into account the instructions given in this manual.

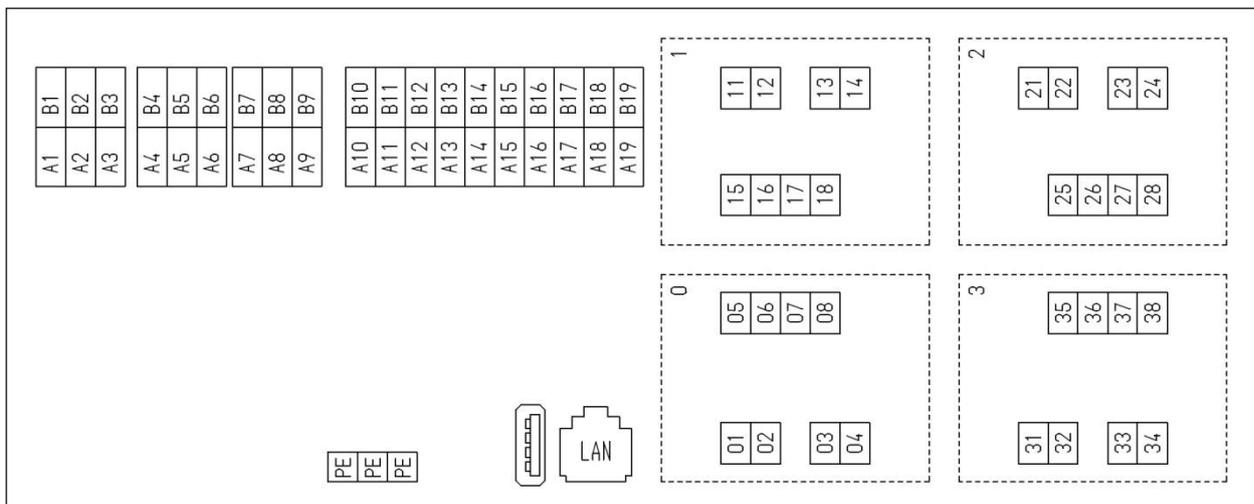
The respective locations of all components of the measuring system must realise the ambient requirements given in the 'Specifications' paragraph. Because this measuring system is intended for the measurement, control and regulation of analysis parameters, it should be noted that calibration and maintenance of the sensors at regular intervals is necessary for the interaction between the measuring module and the KM 3000 controller.



The control and regulating outputs must not be used for protective or safety circuits. Some areas of the device are protected with a code word.

When shipped, the password is "1".

4.1 KM 3000 Terminal Box– [Hardware version 2.0](#)



KM 3000 power supply and outputs

Terminal	Description	Terminal	Description
A1 & B1	Mains supply L1 conductor	A1 & B1	GND (only 24V version)
A2 & B2	Mains supply PE-conductor	A2 & B2	Mains supply PE-conductor
A3 & B3	Mains supply L2-conductor	A3 & B3	18...36 VDC (only 24V version)
A4	Relais 0 CO contact (max. 230 V AC, 5 A)	B4	Relay 0 NO contact
A5	Relais 0 NC contact	B5	Relay 1 CO contact (max. 230 V AC, 5 A)
A6	Relay 1 NO contact	B6	Relay 1 NC contact
A7	Relay 2 NO contact	B7	Relay 0 CO contact (max. 230 V AC, 5 A)
A8	Relay 3 NO contact	B8	Relay 2 NC contact
A9	Relay 3 NC contact	B9	Relay 0 CO contact (max. 230 V AC, 5 A)
A10	Earth – current output 0	B10	Current output 0
A11	Earth – current output 1	B11	Current output 1
A12	Hold	B12	Current output 2
A13	Hold	B13	Current output 3
A14	+12V CAN supply	B14	CAN L
A15	-12V CAN supply	B15	CAN H
A16	B (-) – RS485	B16	Relay 4 NC contact
A17	TX – RS232	B17	Earth - RS232/RS485
A18	A (+) – RS485	B18	RX – RS232
A19	Relay 4 NO contact	B19	Relay 4 CO contact (max. 24 V AC/DC, 0,3 A)

The earth terminals of the current outputs are all referred to the same potential.

The connection diagram of the previous version can be found in the appendix!

KM 3000 Sensor Inputs

terminal	potentiometric sensors (i. e. pH / redox / ISE electrodes)	amperometric and conductive sensors (i. e. oxygen sensors, conductivity cells)	DC voltage / current input signal (linear characteristic)	flow sensors
X.1	measuring electrode	signal connector	signal connector +	vacant
X.2	vacant	screen	signal connector -	vacant
X.3	screen/reference elec- trode	vacant	vacant	vacant
X.4	screen/reference elec- trode	vacant	vacant	vacant
X.5	temperature sensor connection 1	temperature sensor connection 1	temperature sensor connection 1	GND
X.6	temperature sensor connection 1	temperature sensor connection 1	temperature sensor connection 1	frequency output signal from the flow sensor
X.7	temperature sensor connection 2	temperature sensor connection 2	temperature sensor connection 2	GND
X.8	temperature sensor connection 2	temperature sensor connection 2	temperature sensor connection 2	+5 V power supply for flow sensor

X indicates the respective item number (0-3) of the sensor.

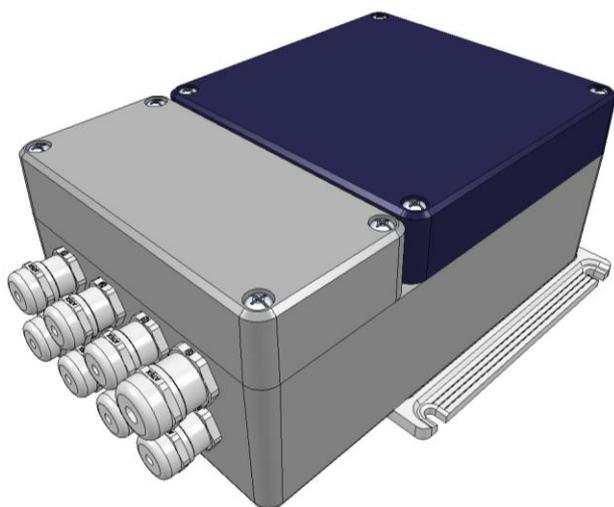


The measuring inputs must be potential-free and must have no connection to mains voltage potentials. All inputs must be operated with the appropriate sensors only. Connect directly from foreign signals is not allowed.

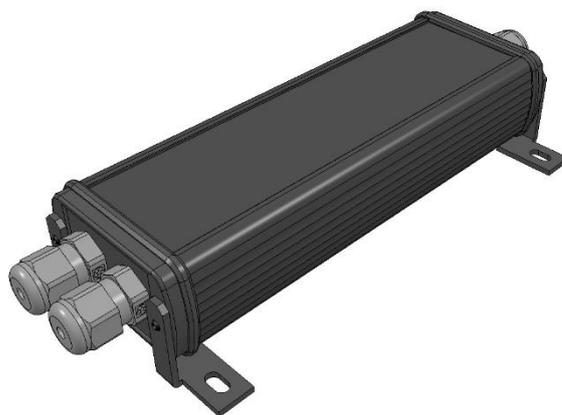
4.2 Connecting of External Modules

The KM 3000 measuring system has been designed so that you can connect further measuring amplifiers or current outputs, respectively. The layout of the bus system necessitates series connection of the modules, the bus line being looped through the module. The bus-side connector is suitable for this purpose.

Remove your system from operation for the time of installation.

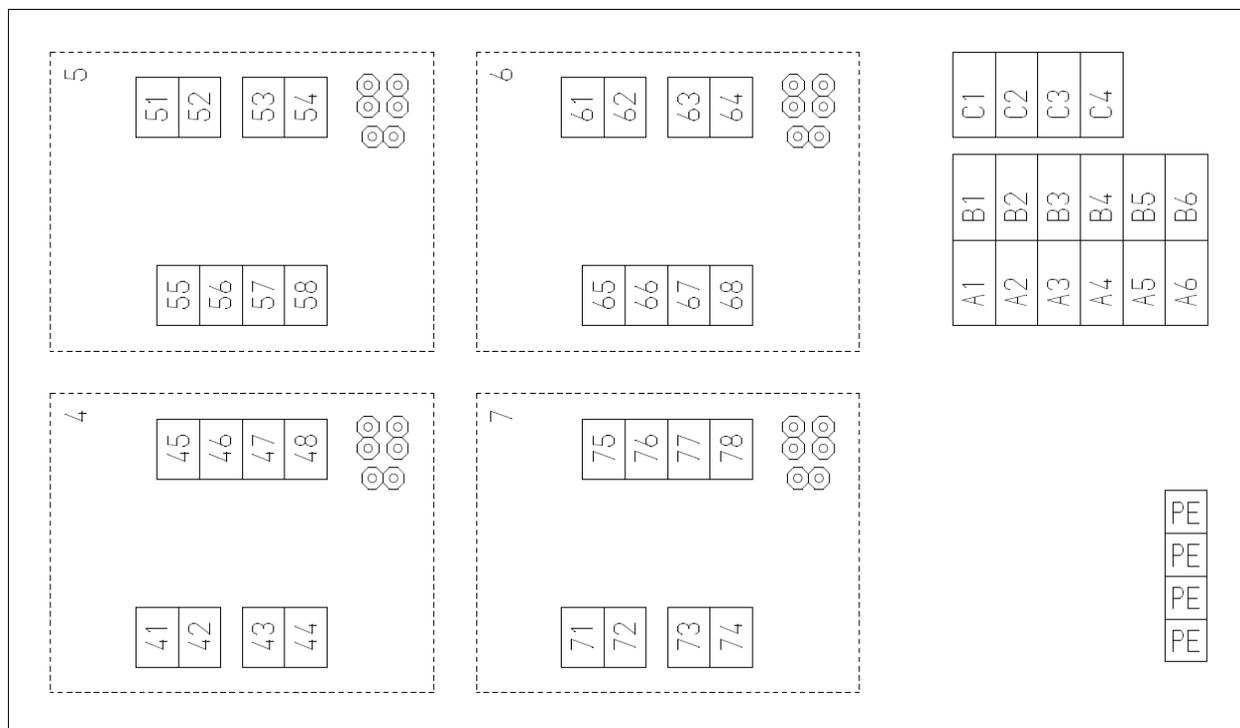


KM3000-E
(External module up to 5 measuring modules)



External measuring module
(max. 1 parameter)
no longer available

4.2.1 Connecting of KM3000-E



Terminal	Description	Terminal	Description
A1	+12V CAN supply	B1	CAN L
A2	-12V CAN supply	B2	CAN H
A3	Relay 0 (max. 24 V DC, 5 A)	B3	Relay 0 (max. 24 V DC, 5 A)
A4	Relay 1 (max. 24 V DC, 5 A)	B4	Relay 1 (max. 24 V DC, 5 A)
A5	Relay 2 (max. 24 V DC, 5 A)	B5	Relay 2 (max. 24 V DC, 5 A)
A6	Relay 3 (max. 24 V DC, 5 A)	B6	Relay 3 (max. 24 V DC, 5 A)
C1	CAN L	C3	+12V CAN supply
C2	CAN H	C4	-12V CAN supply

terminal	potentiometric sensors (i. e. pH / redox / ISE electrodes)	amperometric and conductive sensors (i. e. oxygen sensors, conductivity cells)	DC voltage / current input signal (linear characteristic)	flow sensors
X.1	measuring electrode	signal connector	signal connector +	vacant
X.2	vacant	screen	signal connector -	vacant
X.3	screen/reference elec- trode	vacant	vacant	vacant
X.4	screen/reference elec- trode	vacant	vacant	vacant
X.5	temperature sensor connection 1	temperature sensor connection 1	temperature sensor connection 1	GND
X.6	temperature sensor	temperature sensor	temperature sensor	frequency output

	connection 1	connection 1	connection 1	signal from the flow sensor
X.7	temperature sensor connection 2	temperature sensor connection 2	temperature sensor connection 2	GND
X.8	temperature sensor connection 2	temperature sensor connection 2	temperature sensor connection 2	+5 V power supply for flow sensor

X indicates the respective item number (4-7) of the sensor.

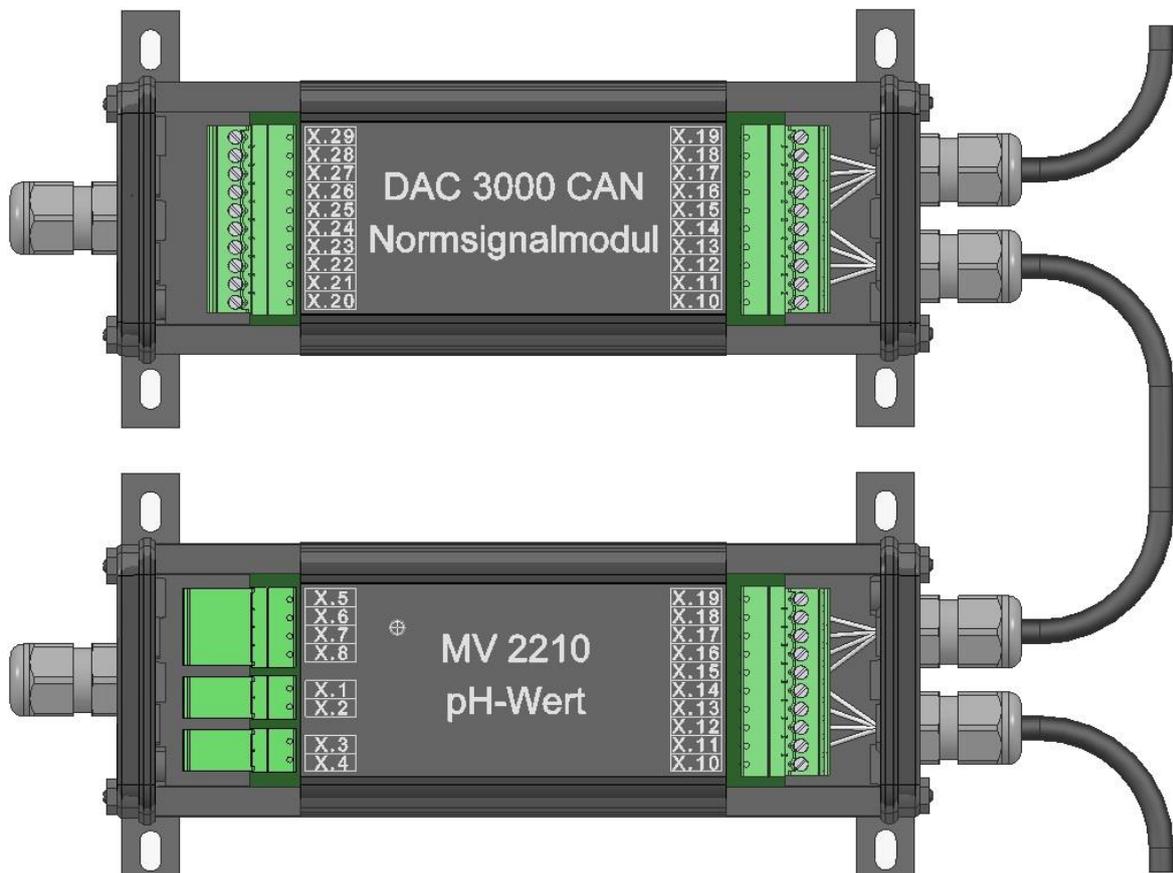


The measuring inputs must be potential-free and must have no connection to mains voltage potentials. All inputs must be operated with the appropriate sensors only. Connect directly from foreign signals is not allowed.

4.2.2 Connecting of external measuring module

Open the module at the bus connection side (two screws under the sealing caps). If the module has been wired up already, undo the heavy-gauge conduit screws to be able to remove the cover. Now, unplug the connector. Connect the bus cable to the measuring amplifier. Ensure correct polarity of the voltage supply and properly connect the CAN-H and CAN-L signal lines. If the new module is the last one in the chain, i. e. it has a bus input at one side only, then you will have to connect a terminating resistor (120 Ohms) to the open bus side between CAN-H und CAN-L. Connect the screen of the cable to the cover of the module by means of the earthing screw. This will earth the enclosure and connect it to the next module within the chain. In the KM 3000 controller, connect the screen to one of the PE terminals (PE 1...4). Re-plug the connector. Now, screw the cover to the module. Make sure the rubber seal fits properly. Finally, tighten the heavy-gauge conduit screws and fit the two screw covers.

Now, re-connect the mains supply. If you have wired up the new module properly, you will see the latter in the first display window where all modules connected are automatically detected. Now, you can proceed with any further settings.



Measuring Module Sensor Inputs

terminal	potentiometric sensors (i. e. pH / redox / ISE electrodes)	amperometric and conductive sensors (i. e. oxygen sensors, conductivity dells)	DC voltage / current input signal (linear characteristic)	flow sensors
X.1	measuring electrode	signal connector	signal connector +	vacant
X.2	vacant	screen	signal connector -	vacant
X.3	screen/reference elec- trode	vacant	vacant	vacant
X.4	screen/reference elec- trode	vacant	vacant	vacant
X.5	temperature sensor connection 1	temperature sensor connection 1	temperature sensor connection 1	GND
X.6	temperature sensor connection 1	temperature sensor connection 1	temperature sensor connection 1	frequency output signal from the flow sensor
X.7	temperature sensor connection 2	temperature sensor connection 2	temperature sensor connection 2	GND
X.8	temperature sensor connection 2	temperature sensor connection 2	temperature sensor connection 2	+5 V power supply for flow sensor

X indicates the respective measuring amplifier number (slave 0 - slave 15).



The measuring inputs must be potential-free and must have no connection to mains voltage potentials. All inputs must be operated with the appropriate sensors only. Connect directly from foreign signals is not allowed.

Measuring and Active Modules Supply and Bus Connection

terminal	description / function
X.10	vacant
X.11	+12 V CAN supply
X.12	-12 V CAN supply
X.13	CAN L
X.14	CAN H
X.15	CAN L
X.16	CAN H
X.17	+12 V CAN supply
X.18	-12 V CAN supply
X.19	vacant

DAC 3000 CAN Active Module Current Outputs

terminal	description / function
X.20	vacant
X.21	current output 0
X.22	earth - current output 0
X.23	current output 1
X.24	earth - current output 1
X.25	current output 2
X.26	earth - current output 2
X.27	current output 3
X.28	earth - current output 3
X.29	vacant

X indicates the respective DAC 3000 CAN number (slave 64 - slave 67)
All earth connections (0-4) are referred to the same potential.



REL 2000 CAN Active Module Relay Outputs

terminal	description / function
X.30	relay 3
X.31	relay 3
X.32	relay 2
X.33	relay 2
X.34	relay 1
X.35	relay 1
X.36	relay 0
X.37	relay 0

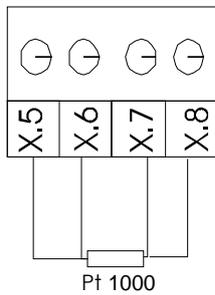
X indicates the respective REL 2000 CAN number (slave 68 or slave 71)

All contacts or closing contacts, suitable for resistive loads max. 3A/250V AC or 30V DC

4.3 Sensor Connection Diagrams

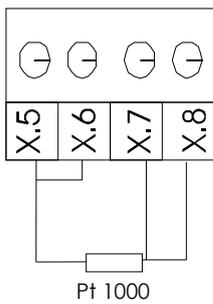
4.3.1 Temperature Sensors

Four-wire circuit

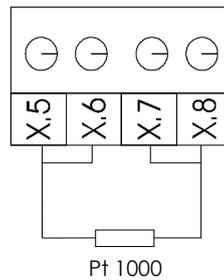


	X.5 PT1000-1	X.6 PT1000-1	X.7 PT1000-2	X.8 PT1000-2
measuring cable K 43-PT/...	cable core	cable core	shield	shield

Three-wire circuit

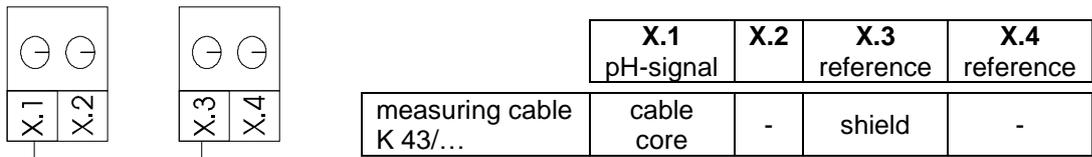


Two-wire circuit

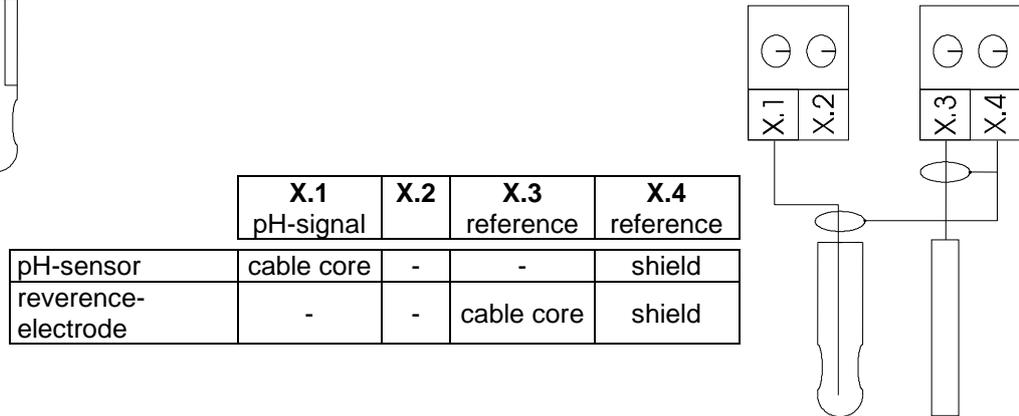


4.3.2 pH/redox (ORP) and Ion-Selective (ISE) Electrodes

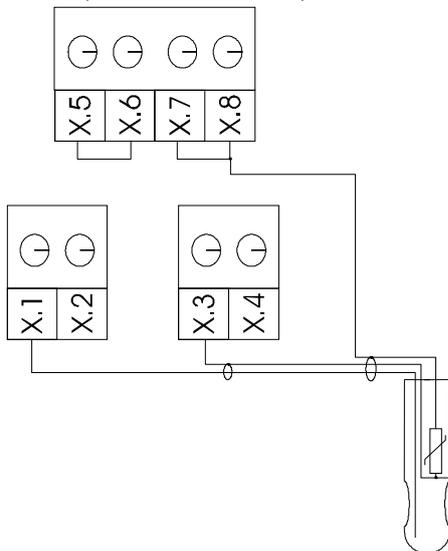
Combination electrode



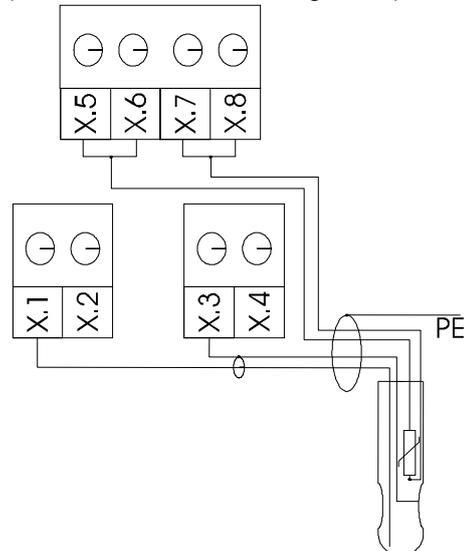
Separated measuring and reference electrode



pH combination electrode with integrated temperature sensor (K 54 triaxial cable)



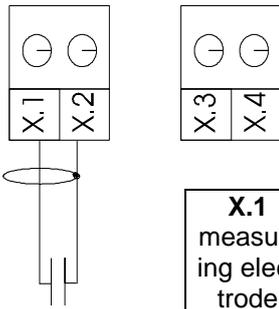
pH combination electrode with integrated temperature sensor (K 19 multi wire measuring cable)



	X.1	X.2	X.3	X.4	X.5	X.6	X.7	X.8
	pH-signal	-	reference	rev.	PT1000-1	PT1000-1	PT1000-2	PT1000-2
measuring cable K 54/...	cable core (blue)	-	inner shield (red)	-	bridge circuit to X.6	bridge circuit X.5	bridge circuit X.8	outer shield (grey)
measuring cable K 19/...	cable core	-	shield	-	green	brown	yellow	white
measuring cable K-VP/...	cable core	-	shield (red)	-	gray	white	green	pink
measuring cable K19-VP/...	cable core	-	shield (red)	-	green	green	brown	brown

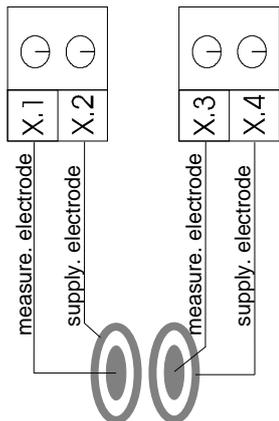
4.3.3 Conductivity Measuring Cell

Conductivity 2-electrode cell

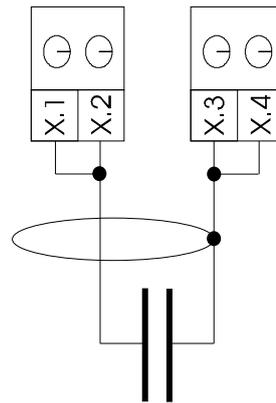


	X.1 measuring electrode	X.2 measuring electrode	X.3 -	X.4 -	X.5 PT1000-1	X.6 PT1000-1	X.7 PT1000-2	X.8 PT1000-2
measuring cable K 43/...	cable core	shield	-	-	-	-	-	-
measuring cable K 18/...	white	shield	-	-	grey	green	brown	pink
measuring cable K-VP	cable core	blue			grey	white	green	pink
measuring cable K19-VP	cable core	white			green	green	brown	brown

Conductivity 4-electrode cell



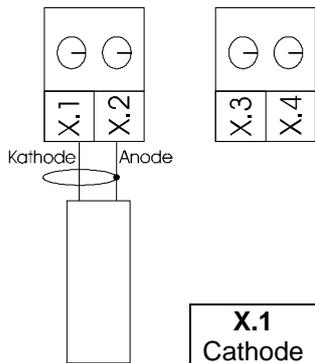
Conductivity 2-electrode cell to an MVM2225



	X.1 measuring electrode	X.2 supplying electrode	X.3 measuring electrode	X.4 supplying electrode	X.5 PT1000-1	X.6 PT1000-1	X.7 PT1000-2	X.8 PT1000-2
measuring cable K 17/...	pink	brown	grey	green	shield	white	yellow	blue
measuring cable K-VPLF4/	cable core	red	gray	blue	white	white	green	pink
measuring cable K19-VP/	cable core	red	yellow	white	green	green	brown	brown

4.3.4 Oxygen Sensor

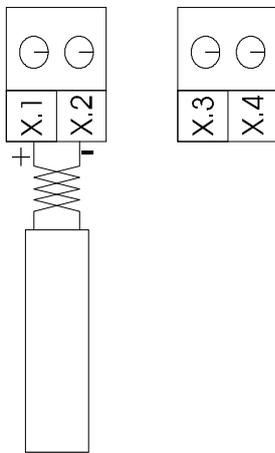
Membrane covered amperometric oxygen sensor



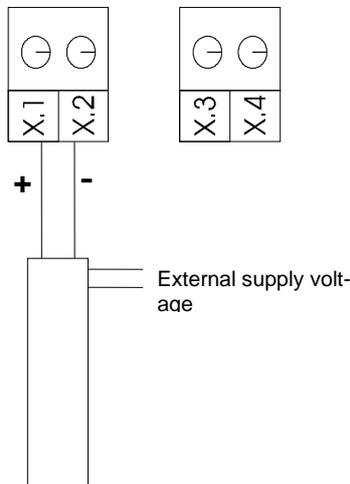
	X.1 Cathode	X.2 Anode	X.3 -	X.4 -	X.5 PT1000-1	X.6 PT1000-1	X.7 PT1000-2	X.8 PT1000-2
measuring cable K 39/...	white	shield	-	-	grey	brown	green	pink
MF 41-N, MF 441 Fixcable	white	shield	-	-	grey	green	brown	yellow
measuring cable K-VP	core	red	-	-	grey	white	green	pink
measuring cable K19-VP	core	red	-	-	green	green	brown	brown

4.3.5 Chlorine Measuring Sensor, Turbidity Probe and Analogue Output Signal Sensor (Instrument)

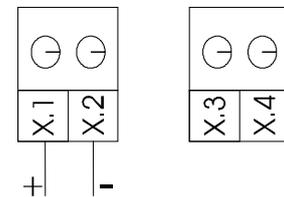
Chlorine measuring



Turbidity probe

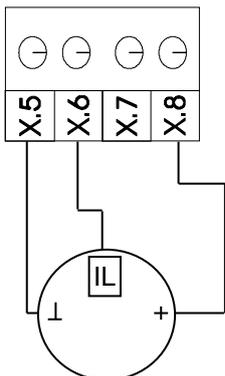


Sensor (instrument) with analog output signal



an integrated temperature sensor connected as per para. 4.3.1

4.3.6 Flow sensor



4.4 Cable Length Influence

The bus connection among the modules and to the KM 3000 as well as the individual power supply of the modules facilitates cable lengths of up to 800 m. It is absolutely vital that you should use specific cable intended for the connection among the modules and to the KM 3000. For this purpose, please contact the manufacturer or supplier of your measuring system. The connection is easy to establish. For up to 12 external measuring modules, the supply voltage for the modules is provided by the KM 3000. In the last module of the chain, you must add a terminating resistor to the open bus connection between CAN-H and CAN-L as described in para. 4.2. The modules can be arranged either directly in the vicinity of the KM 3000, or as pre-amplifiers in the vicinity of the sensors. In addition, the series connection facilitates subsequent extension of the measuring system by one or several modules.

If no impedance converter is used, the wiring for potentiometric sensors should not exceed 10 m. For conductivity and amperometric sensors and measuring cells, limit the maximum wiring length to 20 m. For detailed information, please refer to the specification sheets of the sensors and to the technical information.

5 Basic Functions of the KM 3000 System

5.1 Measured Parameters

Each measuring module features determination of a main measuring parameter and the temperature. In addition to each main measuring parameter one or several so called secondary measuring parameters are calculated or directly measured. These secondary measuring parameters can be also selected for displaying on the screen (look as described in para 5.2 Display Elements).

Temperature

Each measuring module has an input of its own for the connection of a Pt 1000 temperature sensor. Such temperature measurement can be used for automatic temperature compensation of the measuring parameter or of other parameters. The entry of an additive, linear zero displacement (offset) is possible as calibration. The display of the temperature value can be arranged individually. In principle, temperature measuring takes place within the range of -10 to 130 °C. For automatic temperature compensation, however, limited value ranges are available only, depending on the sensors used.

Redox potential (ORP)

In redox potential measuring, the voltage difference between the measuring and reference electrodes is displayed directly. In addition, conversion of the redox voltage in relation to the potential of the standard hydrogen electrode as per DIN 38404, Part 6, is possible. For this purpose, it will be necessary to enter a temperature value or utilise a temperature measurement. The entry of an additive, linear zero displacement (offset) is possible as calibration. The span of the input voltage range is ± 2000 mV.

pH value

The pH value is the main measuring parameter directly calculated from the electrode voltage difference (secondary measuring parameter) between the measuring and reference electrode. For the exact determination of the pH value, calibration, i. e. adaptation of the measurement to the specific ratings of the measuring chain, is required. The gradient of the pH measuring chain indicates the variation of the voltage as a function of the pH value (mV/pH). The second parameter is the offset voltage at chain zero point pH 7 (asymmetry voltage). The temperature-dependent variation of the measuring chain gradient can be compensated automatically (ATC, automatic temperature compensation). The KM 3000 supports single-point, two-point or automatic calibration, using prescribed or freely selectable pH buffer solutions.

Conductivity

The measuring ranges for conductivity two-electrode cells are 0 to 200 $\mu\text{S}/\text{cm}$, 0 to 2 mS/cm , 0 to 20 mS/cm and 0 to 100 mS/cm . The useful measuring ranges depend on the cell constant and on the measuring cell used. Automatic temperature compensation takes place via the temperature measurement, e. g. by the temperature sensor integrated in the measuring cell. The KM 3000 measuring system supports the non-linear automatic temperature compensation (nlf), the linear automatic temperature compensation with an adjustable temperature coefficient (both referred to the reference temperature of 25 °C) and measurements without temperature compensation. The calibration to determine the cell constant of the conductivity measuring cell should be done as described in para. 9.2.1.

The conductivity module features calculation of resistance and salinity as secondary measuring parameters. The salinity is a sum parameter especially for sea water. The calculation for salinity from the temperature compensated conductivity value based on the "International Oceanographic tables" of the National Institute of Great Britain and UNESCO. These tables define the salinity in a range of 2 to 42 g/kg.

Therefore only the conductivity values in the range of 0 to 20 mS/cm and 0 to 100 mS/cm are used for this calculation. In the range 0 to 200 µS/cm and 0 to 2 mS/cm the salinity value is given with zero. A special non-linear function for seawater is used for temperature compensation.

Oxygen content

The oxygen measuring module based on connection with membrane-covered amperometric sensors with an integrated temperature probe (use of other sensors on request). The limiting diffusion current upon the application of a suitable polarisation voltage is the measuring signal. From this the oxygen partial pressure, the percent air saturation (oxygen saturation index as per DIN 38404, Part 23) and the concentration of dissolved oxygen within the aqueous solutions as mass per unit volume (mg/l) or ppm are calculated. For measurements in gases, the measured value is represented as volume concentration (vol. % - special version). The KM 3000 system supports single-point calibration by comparison with known measured values or automatic air calibration.

Chlorine (free chlorine, total chlorine, chlorine dioxide, ozone and other disinfectants)

The sensors used to determine the concentration of disinfectants supply a DC output current signal (4...20 mA). The measuring signal is temperature compensated in the sensor. The corresponding measuring module ensures power supply for the sensor via a two-wire connection including electrical isolation. Single-point calibration by comparison with known measured values is required at regular intervals.

Turbidity

A specific probe is required for turbidity measurements. The measuring curve is exactly described by the entry of two values prescribed for each probe. The turbidity probe requires an external power supply that comes together with the probe.

General linear and logarithmic characteristics

Measuring modules for analogue current or voltage input signals are used for integration of external instruments, analysers or sensors with built-in electronics into the system. By means of the linear characteristic function the course of the measuring curve can be fixed or determined by two-point calibration. This measuring method serves for the integration and adaptation of sensors (instruments) having a linear output characteristic.

Another option is the logarithmic characteristic. The logarithmic measuring curve is used for measured quantities where the relation between the measured quantity and the sensor signal corresponds to the following equation:

$$U = U_0 + S \cdot \lg MW$$

MW: measured value
U: measuring module/sensor output voltage
U₀: constant
S: gradient

The use of the logarithmic curve always requires previous two-point calibration. The logarithmic characteristic in conjunction with the measuring modules MV 2216 or MVM 2216 facilitates the measurement, conversion and display of the measuring signal of ion selective electrodes (ISE) in concentration units according to the calibration.

5.2 Display Elements

After powering the KM 3000 initialises the latter. Then all possible slaves (measuring modules) that may be connected to the CAN bus are localised. The measuring modules connected are recognised automatically and displayed together with a description of what type they are. After all modules have been detected, the unit immediately changes to measured value display. All enabled outputs such as of relays, current drivers, interface communication and data logger storage are now active. You can use the << >> arrow keys to navigate through to your desired screen page. The representation of the individual measured values can be configured individually. So each main measuring parameter can be represented together with an accompanying secondary measuring parameter derived there from.

Slave 93.5 % 9.3 21.2	In- 103 μS 21.2		
Slave -273 mV	Slave Efflu- 7.03 pH 18.5		
◀	MENU	▶	R0:0 R1:1 23.01

The status of the internal relays is signed in the display field in the below right corner. The active status of the relay is shown by "1". If the unit KM 3000 is in the active hold function (automatic timer or manual hold function) this status is signalled by the sign "Hold" in this display field. Switch to the status of the external relays by touching this display field, if one or two external relay output modules REL 2000 CAN are connected. The "LIMIT" information flash with one of the other status information appears if one value of any channel is out of the limit band (see para 8.6). If a GSM-Modem is installed, information about the operating status and the radio signal will be shown in the status line above the menu line. For every measuring channel automatic temperature compensation is available. The connection of this temperature compensation is displayed above the unit of the main value. If a fixed temperature value is adjusted, "fix" will be displayed.

Measured Value Representation Examples

Measuring module	Main measuring parameter	Secondary measuring parameter examples
MV 2210 / MVM 2210	pH value	electrode voltage in mV
MV 2215 / MVM 2215	redox voltage mV	redox voltage in mV referred to the standard hydrogen electrode potential
MV 2216 / MVM 2216	ion concentration in concentration units acc. sensor specification (ISE) and calibration	electrode voltage of the ISE in mV
MV 2220 / MVM 2220	conductivity in mS/cm, μS/cm	resistance in ohm or salinity in g/kg
MV 2230 / MVM 2230	oxygen saturation in %	oxygen concentration in mg/l (ppm)

In addition to displaying the main measuring parameter and a possible secondary measuring parameter the temperature can be displayed if the temperature function of the accompanying module is used (compare 7.1 and 7.2). To identify the module the measured value is associated with, the measuring point number is always indicated in the upper left corner. So as not to lose track of the measuring points, you can assign your own individual names (10 characters max.).

In addition, a current time display window is provided on each screen page.

The background lighting can be switched off by touching the symbol "clock". The background lighting is switched on by touching the display. The operation of the device is made by touching the relevant buttons and symbols.

5.3 Menu Structure

To return to measured value reading from the individual menu items you must exit them one by one. All menu items of the unit for adjusting controller- or sensor-specific data have been designed so that the changes can be saved or cancelled. Two buttons are provided for this purpose:

Save and exit



Exit without saving



All controller-specific data can be set from the **MENU** item. These are all output options such as current output, serial data output, controller and limiting values as well as certain configurations of the unit itself. Such menus are password-protected.

All sensor-specific settings can be done from the sensor (measuring module) menus. You can call them by touching the display area of the respective sensor (measuring module). The first to appear is an overview page of the current data/settings of the measuring point. All calibration data of the sensor, the time of the last calibration, the temperature compensation used, the name of the measuring point as well as the data logger and serial output will be displayed. Corresponding changes of such data will only be possible in conjunction with a password (default password is "1").

5.4 System Startup / Extension

1. Switch on the unit.
2. Check whether all modules (slaves) are recognised.
3. Set up the display (refer to para. 6, 'Setting up the Display')
4. Set temperature compensation (refer to para. 7, 'Temperature Compensation').
5. Set data output/data saving (refer to para. 8, 'Data Output / Data Saving').
6. Calibrate the sensor (refer to para. 9, 'Calibration').
7. Set the current outputs, limiting values and controllers (refer to para. 10, 'Switching and Current Outputs', and 11, 'Controller Module').

6 Setting up the Display

6.1 Displaying / Removing Secondary Measuring Parameters

1. Touch the display value area.
2. Now, you will see the current settings of the measuring point.
3. Touch the button below:



4. Enter your password.
5. Select the **Display Setup** menu item.
6. To display the secondary measuring value put $\sqrt{\quad}$ before "disp. value". Remove the hook, if this value should not be displayed. By touching the button you change between both values.
7. Touch the symbol to accept your settings



or touch the symbol below to cancel your settings.



The possibility to select between displaying the accompanying resistance or salinity value, as secondary measuring parameter is a special feature of the conductivity measuring module. The following steps are necessary:

1. Select the display page where the conductivity value is displayed and where you want to do your setting. Touch the accompanying display value area.
2. Now, you will see the actual settings for this measuring point.
3. Touch the button below:



4. Enter your password.
5. Now you are in dialogue "slave setup". Touch the button second value and make your selection resistance or salinity value.



Touch the symbol above to accept your settings or cancel them by touching the symbol below.



Furthermore it is possible to choose the measuring range for connecting 2-pol or 4-pol conductivity cells. On the one hand a single measuring range can be chosen. On the other hand an automatic change because of exceeding measuring range is available.

1. Select the display page where the conductivity value is displayed and where you want to do your setting. Touch the accompanying display value area.
2. Now, you will see the actual settings for this measuring point.
3. Touch the button below:



4. Enter your password.
5. Now you are in dialogue "slave setup". Touch the button cond. ranges and choose the desired adjustment



Touch the symbol above to accept your settings or cancel them by touching the symbol below.



It is possible to change the main measuring values of the oxygen module. That means you can choose between % saturation and mg/l dissolubility. The following steps are necessary:

1. Select the display page where the oxygen value is displayed and where you want to do your setting. Touch the accompanying display value area.
2. Now, you will see the actual settings for this measuring point.
3. Touch the button below:



4. Enter your password.
5. Now you are in dialogue "slave setup". Touch the button mg/l or % and choose the desired measuring value



Touch the symbol above to accept your settings or cancel them by touching the symbol below.



6.2 Displaying / Removing the Temperature Value

1. Select the measured value display page where you wish to do your setting.
2. Touch the display value area.
3. Now, you will see the current settings of the measuring point.
4. Touch the button below:



5. Enter your password.
6. Select the **Display Setup** menu item.
7. To display the temperature value put $\sqrt{\quad}$ before "Display Temp". Remove the hook, if this value should not be displayed. By touching the button you change between both values.
8. Touch the symbol to accept your settings



or cancel them by touching the symbol below.



6.3 Assigning an Individual Measuring Point Name

1. Select the measured value display page where you wish to do your setting.
2. Touch the display value area.
3. Now, you will see the current settings of the measuring point.
4. Touch the button below:



5. Enter your password.
6. Select the **Display Setup** menu item.
7. Touch the **Name** button.
8. Through the keyboard displayed you can now type in any text with a maximum of 10 characters. Important keys are:

Keys	Function
	SHIFT To shift to the second keyboard level.
	ENTER To complete and accept your text entry.
	DELETE To delete the last character.
	ESCAPE To complete your text entry without accepting it.

9. Press **ENTER** to complete your text entry. The **Name** button will now read your text in the second line.



Touch the symbol above to accept your settings or cancel them by touching the symbol below.



7 Temperature Compensation

7.1 General

The KM 3000 measuring system facilitates the automatic temperature compensation of further channels of the measuring system by one temperature measurement. For this purpose, the respective probe and the Pt 1000 temperature sensor (special version: O₂-transmitter with temperature input for NTC 22 kΩ) must be in the same measuring medium (note the temperature equalisation). If this requirement is realised it will be possible to compensate several measured quantities by one single temperature measurement. The connection of the temperature compensation is displayed above the unit of the main measuring value. However, you can also set a fixed compensation temperature for each measuring channel. If a fixed value is adjusted the display "fix" will appear.

Pay attention: If a temperature sensor or probe is used for temperature compensation of a different sensor please note that it will also have to be put in the calibration solution in order to facilitate temperature equalisation or compensation during calibration.

Please pay attention that although if you take over the temperature measurement for temperature compensation for a channel acc. para 7.2 the displayed temperature value is in accordance with the connected temperature sensor. If no temperature sensor is connected, the temperature display for this channel should be switched off in acc. para 6.2.

7.2 Setting up a Temperature Measuring Channel for a Measuring Point

1. Select the measured value display page where you wish to do your setting.
2. Touch the display value area.
3. Now, you will see the current settings of the measuring point.
4. Touch the button below:



5. Enter your password.
6. Select the **Temperature Setup** menu item.
7. The **Fixed Temperature** button must read "N". If this is not the case touch this button once to make it change to "N".
8. Now, touch the **Temp. SlaveX** button and select the slave that provides the temperature signal for compensation.



Touch the symbol above to accept your settings or cancel them by touching the symbol below.



7.3 Setting a Fixed Temperature for a Measuring Point

1. Select the measured value display page where you wish to do your setting.
2. Touch the display value area.
3. Now, you will see the current settings of the measuring point.
4. Touch the button below:



5. Enter your password.
6. Select the **Temperature Setup** menu item.
7. The **Fixed Temperature** button must read "Y". If this is not the case touch this button once to make it change to "Y".
8. Now, touch the **Fixed Temperature** button and enter the temperature value in the subsequent dialogue. Press **ENTER** to complete this dialogue.



Touch the symbol above to accept your settings or cancel them by touching the symbol below.



8 Data Output / Data Saving

8.1 Serial Interface

The KM 3000 multi-parameter controller has 2 serial ports, 1xRS232 and 1xRS485. Both ports can be configured individually, that means it can be support a cyclical ASCII-protocol or it can be communicated via Modbus protocol.

For comfortable data recording and evaluation on a PC, the RS-232 port can be used in conjunction with the MVremote visualisation software. At the same time, this program guarantees the evaluation of a data logger and the changing of configurations (this function is only usable via RS-232 port) of the KM 3000.

Both interfaces are independent form each other and can be used parallel. Before connecting the cables separate the unit from power supply.

Depending on the type of interface, use the following terminals:

Serial interface used as RS-232

Terminal	RS232
B18	RxD
A17	TxD
B17	GND

Serial interface used as RS-485

Terminal	RS485
A18	A(+)
A16	B(-)
B17	GND

120 Ohm terminating resistor required.

8.2 Serial Data Output ASCII

To cyclically output a measured value through the interface two settings is necessary. This is, on the one hand, the unit's default setting where the output cycle is prescribed. On the other hand, the individual measuring points must be enabled for data output one by one.

The individual data blocks are always 10 bytes long. Each line begins with a start string as well as with the date and the time and then outputs one by one all enabled measuring channels. The interface setting is between 9600 baud and 38400 baud, 1 stop bit and no parity. All output characters are in the ASCII format. This protocol can communicate via RS232 or RS485. It is completely compatible to ASCII protocol of the unit KM 2000.

Transmit status information:

Relay outputs can be used for supervision of limits or alarms as well as for switching determined functions. In this case it is possible to transmit the states of the relays in a special status message. The configuration of the relay outputs should be done on the KM 3000 in accordance with para. 10.1 'Configuring a Relay Output'.

With reference to the experiences of the user about the usual ranges for his measuring values under the given application, individual limits can be defined so that the system will create maintenance requirements if the limits are exceed (refer to para. 8.6 'Adjustment of individual limit bands').

Additional some states of the system are transmitted.

The transmission of the status for all available relay outputs, the limit states of the measurement values and the device status information of the KM 3000 needs release of serial data interface as descript in the section 8.2.2 'Basic Setting'. The information about the relay status will be connected to the line after the last transmitted value.

The output is in the following form:

Description	Start Line	Date/Time	Value 1	Value x
Data	0x13 0x10	ddmmyyhhminmin	EEEEWWWWWW	EEEEWWWWWW
Data length in bytes	2	10	10	10

Status information:

Start	Status Relay	Separator	Status measurement value	Status
STATUS_	RRRRRRRRRRRR	_	LLLLLLLLLLLLLLLL	SSSS
7	12	1	16	4

dd 2 bytes for the day
mm 2 bytes for the month
yy 2 bytes for the year
hh 2 bytes for the hour
minmin 2 bytes for the minute
EEEE 4 bytes for the measured value unit
WWWWWW 6 bytes for the measured value
R 1 Byte Status Relay
L 1 Byte Status measurement value
SSSS 4 Byte Status device

R- Status: 0: open relay contact
 1: closed relay contact
 3: relay is not released

L- Status: 0: measurement value is in range
 1: underflow of range
 2: overflow of range
 3: Slave is not available

Status Code	meaning
0000	No problems on KM 3000
0001	HOLD manual activated
0002	HOLD in calibration mode
0003	HOLD in timer mode

All changes to HOLD state or return are transmitted. No transmission takes place during HOLD state.

The value output sequence is prescribed as follows:

Slave0 main measured value, slave0 secondary measured value, slave0 temperature value are followed by the respective three values for slave1 to slave15 and then by the 4 virtual channels with one value each. All slaves or measured values not enabled will not be output.

If you want to use KM 3000 it is necessary to communicate via RS232. If you communicate via RS485 the following functions like configuration adjustments, data logger and logging book will not work.

8.2.1 Enabling the Individual Measured Values for Data Output

Prior to the basic setting, the individual measured values must be enabled for data output. The output sequence is prescribed by the slave numbers.

1. Select the measured value display page where you wish to do your setting.
2. Touch the display value area.
3. Now, you will see the current settings of the measuring point.
4. Touch the button below:



5. Enter your password.
6. Select the **Data Output** menu item.
7. To output this value put $\sqrt{}$ before "serial value". Remove this hook if this value should not be output. By touching the button you change between both values.
8. Use the same procedure if you want to release the other both values ("serial val. 2", "serial temp.")



Touch the symbol above to accept your settings or cancel them by touching the symbol below.



8.2.2 Basic Setting

The basic setting can be used to adjust the time interval. You can specify every how many minutes/seconds the measured values are to be outputs. Furthermore you define baud rate, interface type (RS232, RS485), adding of status information and general releasing of the ASCII protocol.

1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the „data“ button.



4. Now, touch the **ASCII protocol** button.
5. Adjust the desired Baud rate by touching the **9600/19200/38400** button several times.
6. Adjust the desired interface type by touching the **RS232/RS485** button
7. Now use the **Minute** and **Second** buttons to set the time interval.
8. If you want to transfer the status of the relays touch the **status info** button and adjust “enable”
9. Finally, you must still enable serial data output. For this purpose, touch the **Enable/Disable** button to set it to **Enable**.



Touch the symbol above to accept your settings or cancel them by touching the symbol below.



The **disabled output of all values** button is useful to put the settings of all slaves (para. 8.2.1.) “disable”. That means no value can be transferred and the settings must be renewed. This button can be reasonable if a new basic setting of the output values should be done.

8.3 Serial Data Output Modbus

The KM 3000 is capable for integration in Modbus systems. Modbus communication allows using the interfaces RS232 or RS485 as transmitting medium. The sensor data information is made available in a sensor data block. The data communication is based on request and reply frames. The format of the frames is defined by Modbus RTU protocol. The Modbus master sends one request frame via Modbus command to the Modbus slave. Then the Modbus slave answer with a frame according to register list. The Modbus protocol of the KM 3000 is compatible to the Modbus protocol of KM 2000. That means that existing application can be easily implemented into KM 3000 system.

8.3.1 Protocol structure

Follow Modbus commands can be used:

Function	Function number
Read n (max. 16) Words, Read Input Register	0x04
Read n (max. 16) Words, Read Holding Register	0x03

8 register summarised as register blocks are associated by the slave ID of the measuring points. Slave 0 is requested by registers 1 - 8, Slave 1 by registers 9 – 16, etc. Generally one register consists of 2 Byte.

The structure of the register is described as follows:

Slave ID	Registers	Description	Data type
Slave 0	0001 Bit 7...0	sensor number (Slave ID)	Byte
	0001 Bit 15...8	sensor status	Byte
	0002 Bit 7...0	sensor type	Byte
	0002 Bit 15...8	device status	Byte
	0003 Bit 31...16	temperature value	Float 32
	0004 Bit 15...0	temperature value	
	0005 Bit 31...16	main value	Float 32
	0006 Bit 15...0	main value	
	0007 Bit 31...16	secondary value	Float 32
	0008 Bit 15...0	secondary value	
Slave 1	0009 Bit 7...0	sensor number (Slave ID)	Byte
	0009 Bit 15...8	sensor status	Byte
	0010 Bit 7...0	sensor type	Byte
	0010 Bit 15...8	device status	Byte
	0011 Bit 31...16	temperature value	Float 32
	0012 Bit 15...8	temperature value	
	0013 Bit 31...16	main value	Float 32
	0014 Bit 15...0	main value	
	0015 Bit 31...16	secondary value	Float 32
	0016 Bit 15...0	secondary value	
Slave 15	0121 Bit 7...0	sensor number (Slave ID)	Byte
	0121 Bit 15...8	sensor status	Byte
	0122 Bit 7...0	sensor type	Byte
	0122 Bit 15...8	device status	Byte
	0123 Bit 31...16	temperature value	Float 32
	0124 Bit 15...0	temperature value	
	0125 Bit 31...16	main value	Float 32
	0126 Bit 15...0	main value	
	0127 Bit 31...16	secondary value	Float 32
	0128 Bit 15...0	secondary value	
Relais	0129 Bit 7...0	relay status intern	Byte
	0129 Bit 15...8	relay status extern	Byte

Relay status: The bits 0...3 characterise the status of internal relays of KM 3000.
The bits 8...15 characterise the status of additional external relays.

Sensor status: 00: measuring value within measuring range
01: measuring value exceeds upper limit
02: measuring value exceeds lower limit

Device status: 00: Device operates normally
01: HOLD manual activated
02: HOLD by calibration activated
03: HOLD by timer activated
04: CAL failure

T1 for different baud rates:

Baud rate	T1 [mS] end detection
9600	4,2
19200	2,18
38400	1,15

Example:

Reading Slave 0 and Slave 1 each with 8 Registers with one data request.

Data request:

Slave-Address 1 Byte	Function 1 Byte	Address 2 Byte		Words 2 Byte		Check sum 2 Byte	
0x01	0x03	0x00	0x00	0x00	0x10	0x44	0x06

Reply:

Slave-Address 1 Byte	Function 1 Byte	Bytes 1 Byte	Data block x Bytes	Check sum 2 Byte	
0x01	0x03	0x20	see table	0x5A	0x09

Data block:

Slave ID		Registers	Description	Data type	
Slave 0 8Registers = 16 Byte	0x00	0001 Bit 0...7	sensor number (Slave ID)	Byte	slave 0
	0x00	0001 Bit 8...15	sensor status	Byte	within measuring range
	0x04	0002 Bit 0...7	sensor type	Byte	range 0...200µS
	0x00	0002 Bit 8...15	device status	Byte	operates normally
	0x41,0xC5	0003 Bit 16...31	temperature value	Float 32	24,7 °C
	0x7F,0x4A	0004 Bit 0...15	temperature value	Float 32	
	0x42,0xC4	0005 Bit 16...31	main value	Float 32	98,1 µS
	0x35,0xBD	0006 Bit 0...15	main value	Float 32	
	0x41,0x23	0007 Bit 16...31	secondary value	Float 32	10,2 kOhm
0x17,0x34	0008 Bit 0...15	secondary value	Float 32		
Slave 1 8Registers = 16 Byte	0x01	0009 Bit 0...7	sensor number (Slave ID)	Byte	slave 1
	0x00	0009 Bit 8...15	sensor status	Byte	within measuring range
	0x01	0010 Bit 0...7	sensor type	Byte	pH-value
	0x00	0010 Bit 8...15	device status	Byte	operates normally
	0x42,0x71	0011 Bit 16...31	temperature value	Float 32	60,3 °C
	0x36,0x5D	0012 Bit 0...15	temperature value	Float 32	
	0x40,0x9C	0013 Bit 16...31	main value	Float 32	8,89 pH
	0x7E,0xCE	0014 Bit 0...15	main value	Float 32	
	0x43,0x0B	0015 Bit 16...31	secondary value	Float 32	139,9 mV
0xE8,0x1C	0016 Bit 0...15	secondary value	Float 32		

8.3.2 Interface parameters

The interface parameters are set in according to basic adjustment of KM 3000. Baud rate, parity / stop bit and device address of KM 3000 belong to it. Follow interface parameters are:

Baud rates:

- 9600
- 19200
- 38400

Parity and stop bit:

- no parity 1 stop bit (none 1stop)
- no parity 2 stop bits (none 2stop)
- even parity 1 stop bit (even 1stop)
- even parity 2 stop bit (even 2stop)
- odd parity 1 stop bit (odd 1stop)
- odd parity 2 stop bit (odd 2stop)

Modbus address: 1...247

8.3.3 Parameter Settings

1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the „data“ button.



4. Now, touch the **MODBUS** button.
5. Adjust the interface type by touching the **RS232/RS485** button.
6. Adjust the interface parameters (baud rate, parity) by touching for example the **9600/19200/38400** button.
7. Adjust the modbus address by touching the **modbus adr.** button and release communication by touching the **enable/disable** button.



Touch the symbol below to accept your settings or cancel them by touching the symbol below.



8.4 Data Logger

The data logger saves all measuring values (including date and time) which are released for saving. It is possible to save about 100.000 values. You have got different possibilities to call the values. At first you can transfer the data logger content to an USB stick. Secondly you can transfer data via RS232 interface and Data Reader software. Thirdly you can read out your data via MV remote visualisation software. If the KM 3000 is equipped with a GSM modem and the SIM card allows data transfer you will read out your data logger with MVremote software via remote transmission.

8.4.1 Basic Setting

After the basic setting, the individual measured values must be enabled for data logging. The output sequence

You can use the basic setting to adjust the sampling time, i. e. the time interval for the logging of the measured values. You can specify every how many minutes/seconds the measured values are to be logged. In addition, you can specify the type of memory management. Infinite means that data logging will be continued at the beginning of the memory if the same is full. A finite data logger, on the other hand, means that data logging will be stopped when the memory end is reached. A **RESET** button can be used to clear the data memory.

1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the “data” button.



4. Now, touch the **data logger** button.
5. Define and choose the kind of data saving by touching the **finite/infinite** button.
6. You can use the **Minute** and **Second** buttons to set the time interval. Above the dialogue you can see how long the data logger will record data with the actual adjustments. Furthermore you can see the expected rest time.
7. Enable the data logger by touching the **enable/disable** button.
8. If you want to delete the data logger touch the **RESET** button.



Touch the symbol above to accept your settings or cancel them by touching the symbol below.



8.4.2 Enabling the Individual Measured Values for Data Logging

After basic setting the single measuring values have to be released for saving. The sequence of the values is defined by the number of the values.

1. Select the measured value display page where you wish to do your setting.
 2. Touch the display value area.
 3. Now, you will see the current settings of the measuring point.
 4. Touch the button below:
- 
5. Enter your password.
 6. Select the **data output** button.
 7. Put a hook ✓ before "logg. value" to output this value. Remove this hook if this value should not be output. By touching the button you change between both values.
 8. Release the other measuring values (value2 and temperature value) for data saving like described above.



Touch the symbol above to accept your settings or cancel them by touching the symbol below.



8.4.3 Copy the data logger content on USB stick

The easiest possibility to read out data logger content (and to edit data with calculation software) is to copy these data on USB stick.

1. Open the terminal box of the unit and put the USB Stick in the USB port. Pay attention that there is enough memory capacity on the stick. If the data logger is completely filled you need about 1.5 MB.
2. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
3. Enter your correct password.
4. Touch the "data" button.



5. Now, touch the **data logger** button. Touch the **Copy → USB** button. You need about 7 minutes for preparation and transmission of the whole data logger content (1 MB) on the USB stick. In this time the USB stick must not be disconnected because of data loss and system crash of the KM 3000. The data transfer is displayed with a progress bar. After finishing the dialogue the stick can be removed. The data type of the text-Tab file is the same type like data transfer with DataReader (para. 8.4.5.). The name of the file is defined as it follows: dl_{unit number}.txt. Pay attention that previous data files with the same name are overwritten.

8.4.4 DataReader Software

To read out the data logger, the unit comes with the DataReader software. With this program, you can read out the data logger via the RS-232 interface even without the MVremote visualisation program. How to connect the interface cable is described in para. 8 'Data Output/Data Saving'. This software runs on Windows 95 or later and is very easy to operate. Run setup.exe from the installation disk to install the software. Now, you will be prompted through the installation process. Having completed this procedure properly, you can use this program immediately. To begin with, use the **Setup** button to set up the interface of your computer, which is to be used for data transfer. Use a suitable cable to connect the KM 3000 to your computer. If the data logger contains any data the latter will be transferred after you have pressed the **Readout** button and saved in a text file you selected before. All data sets are delimited by TAB stops.

File layout:

Date TAB time TAB 1st value unit TAB 1st value TAB 2nd value unit TAB 2nd value TAB...

Example:

29.11.01	15:16	pH	6.99	µS	1961	°C	25.4
29.11.01	15:17	pH	6.99	µS	1961	°C	25.4

This facilitates the import of the text file into a different program.

The MVremote visualisation program contains a far more comfortable solution to read out and configure the data logger. It reads out the data and immediately represents it in a graph. For detailed information, please contact your local dealer.

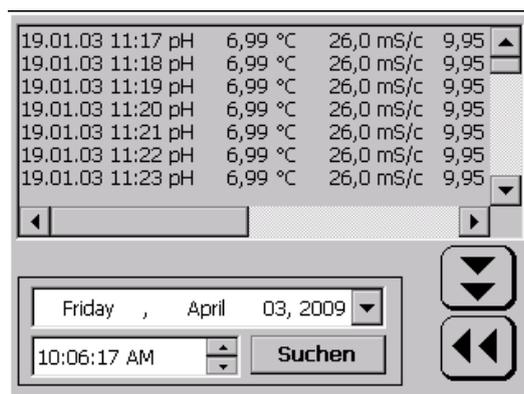
8.4.5 Software Display/search of certain data records

If you want to have a quick overview of your data records to a certain point of time you can look for this data logger. Pay attention that the data logger is configured and the measuring values are enabled.

1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the "data" button.

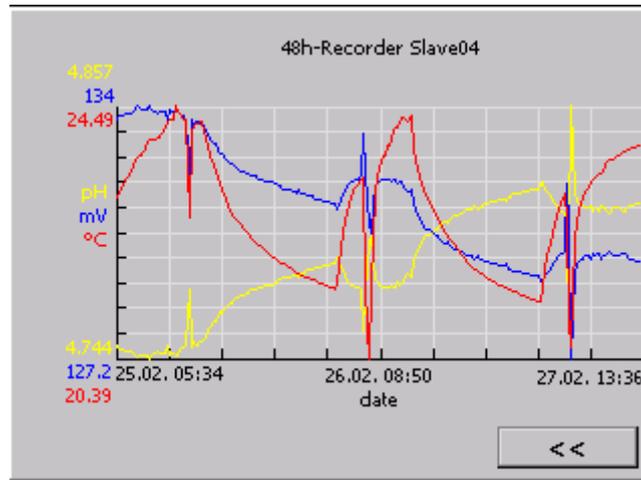


4. Now, touch the **data logger** button. Touch the **Read data** button. In the following dialogue field you can adjust date and time. With the Search button you can look for a data record to this point of time. If there is a data record to the mentioned point of time (minimum 1 data record per day) this one and the following data records (50 in maximum) are displayed.



8.5 48-Hours Data Recorder

You can use the data recorder to show a trend of measuring values in touch screen display. This recorder (available in each slave) displays main, secondary and temperature value curves of the past 48 hours. The measured values are recorded at an interval of 12 minutes. The axes are automatically scaled between minimum and maximum depending on the measuring value. The according values are displayed on the y-axis. The main measuring value is illustrated yellow, the secondary measuring value blue and the temperature value red. You can call the data recorder without any password as follows:



1. Select the display of the measured value to be represented.
2. Touch the display value area.
3. Now, you will see the current settings of the measuring point.
4. Touch the button below:



Please note that the values displayed upon powering on the KM 3000 may be of earlier origin. These will be overwritten within the next 48 hours after switching on.

8.6 Limit Bands

The adjustment of individual limit bands for each measured parameter (main measuring parameter only) is a simple, effective and practicable function for supervision of the measuring system in general inclusive sensor diagnosing. The KM 3000 checks if the measured value is between a free adjustable upper and a lower limit value. This information is transmitted as a part of the status message in the serial protocol and can be used for control systems see para 8.2).

In addition to the transmission of this status information via interface the relevant measuring page shows this information in the accompanying display area and in the status information display field in the below right corner. In the status information field the symbol "LIMIT" flashes in change with "Relay" or the "HOLD" status information if a measured value passes his limit band. In addition the symbol "Lim" flashes in the accompanying display value area behind the reading of the main measuring parameter.

Also the function SMS service can be used for transmission of the status information of the behaviour of the measured value in relation to his limit band. That means if you connect the KM3000 with a GSM Modem (see para 8.7) and you release the SMS message service (see para 8.7.2) you get information on your mobile phone if the value of one channel is out of limit band.

To adjust the individual limit bands the following steps are necessary:

1. Select the measured value display page where you wish to do your setting.
2. Touch the display value area.
3. Now, you will see the current settings of the measuring point.
4. Touch the button below:



5. Enter your password.
6. Select the **Limits setup** menu item.
7. Now, touch the **upper limits** button after that the **lower limits** button and enter the range value in the subsequent dialogue.



Touch the symbol above to accept your settings or cancel them by touching the symbol below.



8.7 Modem Operation

The KM 3000 is designed that a GSM modem module (GSM3000) can be integrated in the unit. The antenna is led outside through the PG threaded connections. With the integrated modem the following functions are possible:

- Data remote enquiry (reading out data logger and log book) and configuration of the KM 3000 with the help of visualisation software MVremote
- Remote enquiry of actual measuring values
- Information message if a limit is exceeded

If the modem function in KM 3000 is enabled the unit will search the connected modem during initialisation phase. If the modem is found all functions are enabled. With an integrated GSM modem you can use SMS service. You can send a SMS message to a mobile phone if a measuring channel is out of the limit band (para. 8.7.2 and 8.7.3).

Pay attention during using the radio modem:

If you want to realise a data connection to the unit you have to use an according data tariff with separated phone number for data communication.

8.7.1 Configuration of the KM 3000 for modem operation

If there is a modem module GSM3000 the KM 3000 can be configured for modem operation.

1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the “data” button.



4. Now, touch the **modem** button.
5. Touch the **Off/GSM** button so that **GSM** appears.
6. Touch the **PIN** button and enter the PIN of your SIM card. Confirm with “ENT”. If you re-start the KM 3000 three times with the wrong SIM-PIN the SIM-PIN will be closed → enabling only possible with PUK + mobile phone.
7. If you have more than one KM 3000 you can give them a name. If you receive SMS messages you can assign them to every single unit. Touch the **name** button and enter the individual name.
8. If you call measuring values or monitor the unit via Limit SMS you can adjust 2 phone numbers to send the according messages. If the number is free the message will be sent only to one participant. Touch the **phone number** button and enter the number.
9. If a message “limit exceeding” should arrive (setting the limit bands para. 8.6) the **Limit SMS enable** button has to appear.
10. Touch the symbol below to accept your settings.



Re-start the KM 3000 to update the changed settings. Use the "RESET" function (para. 13.4) or separate the unit from power supply. After successfully re-starting and initialising of the KM 3000 the actual status of the modem can be read in the status line in the measuring value window.

8.7.2 SMS Service

With the KM 3000 and an integrated GSM modem module GSM3000 it is possible to generate a SMS message to max. 2 free adjustable phone number if a value of any channel is out of his limit band. That is an easy method to get actual information about any problems in your running process. Therefore you have to adjust the limit band for each channel (see para 8.6). If you want to get no message of one channel set the limit band to the beginning and the end of the range of the channel. The message is only send if the value is less than lower limit or higher than upper limit. Only one time the message will send for each channel. After getting a message you have to reset the SMS status in KM 3000 than SMS service for all channels are available again. If you not RESET the SMS status only the channels that have not send a SMS message since last RESET are able to send their messages.

The message contains "KM3000" and an information string (selectable by the user up to 10 characters e. g. the name or location of the KM 3000) and the actual value with unit of the channel, which have sent the message e. g.:



To realise this service follow the advices in para. 8.7.1. There is only one message per measuring value possible if a limit is exceeded. That's why it has to be reset:

1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the "data" button.

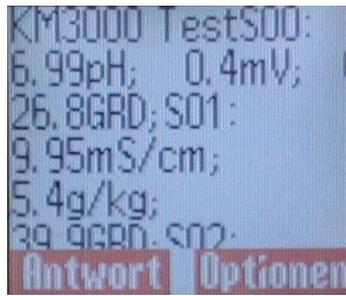


4. Now, touch the **modem** button.
5. If an exceeded limit was sent you would see the **Reset limit SMS** button. Touch this button and the sign of exceeded limit via SMS is enabled again. If resetting was successful the button would be disappeared.
6. Leave the dialogue field without saving data.



8.7.3 SMS Request Service

With KM 3000 and integrated GSM modem module GSM3000 it is furthermore possible to use the feature SMS request service. With this service it is very easy to request all the active measuring values of a KM 3000 via mobile phone. For this it is only necessary to send a SMS message to the KM 3000. After receiving this the KM 3000 itself sends a message containing all on the KM 3000 actual displayed data to the **telephone number pre-adjusted in the KM 3000 / SMS service.**



If you want to use SMS Request Service you have to configure the GSM modem correct. Enabling of the SMS-Service (LIMIT) → ENABLE is not necessary. The KM 3000 also supports the SMS Request Service if the SMS Service is switched off → DISABLE.

1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the “data” button.



4. Now, touch the **modem** button.
5. If the following step is not realised at a former configuration touch the **PIN** button and enter the PIN of your SIM card. Confirm with “ENT”. If you re-start the KM 3000 3 times with the wrong SIM-PIN the SIM-PIN will be closed → enabling only possible with PUK + mobile phone.
6. If you have more than one KM 3000 you can give them a name. If you receive SMS messages you can assign them to every single unit. Touch the **name** button and enter the individual name.
7. If you call measuring values or monitor the unit via Limit SMS you can adjust 2 phone numbers to send the according messages. If the number is free the message will be sent only to one participant. Touch the **phone number** button and enter the number.
8. If a message “limit exceeding” should arrive (setting the limit bands para. 8.6) the **Limit SMS enable** button has to appear.
9. Touch the symbol below to accept your settings.



If the PIN was changed the KM 3000 has to be re-started that the changed settings are updated. Use the “RESET” function (para. 13.4) or separate the unit from power supply. After successfully re-starting and initialising of the KM 3000 the actual status of the modem can be read in the status line in the measuring value window.

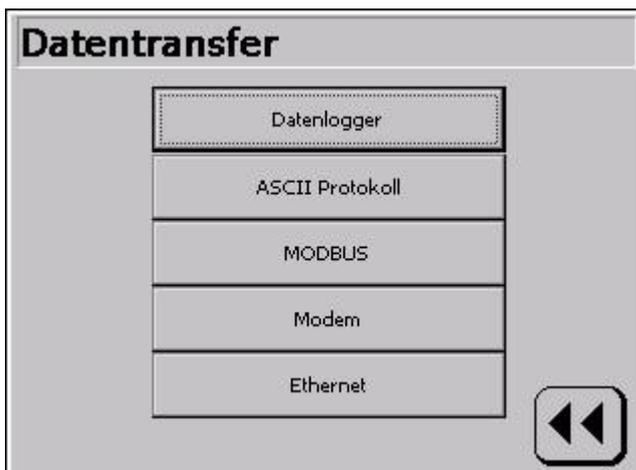
8.8 Ethernet - IP address setting, web interface, Modbus TCP / IP

The measured values of the KM 3000 can be displayed in an Internet browser

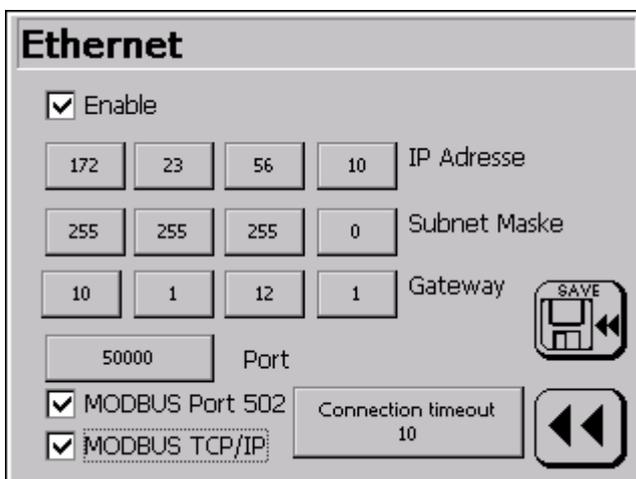
1. Menu and Data



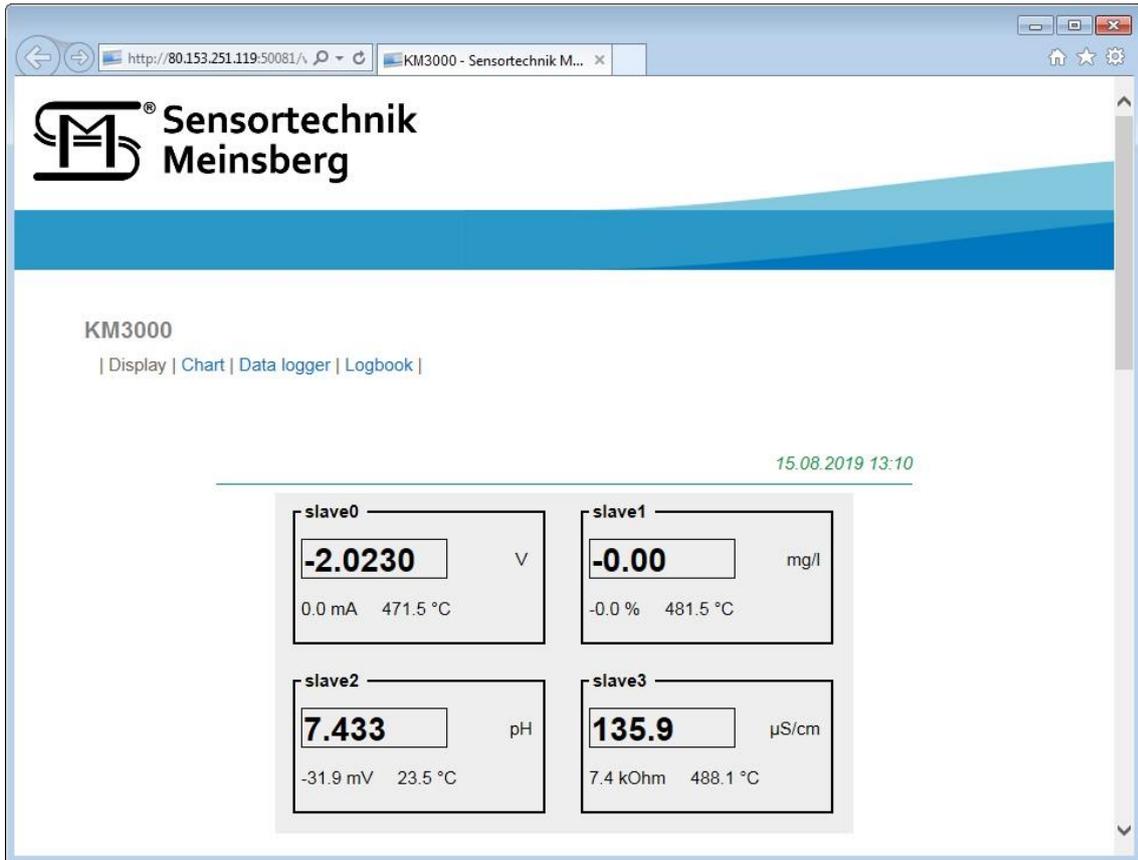
2. Ethernet



3. Change the settings according to your network.
4. Activate the Ethernet with "Enable"



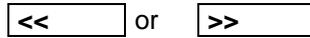
5. Enter the IP address of the KM 3000 in the browser. (Example: 172.23.56.10/values.html)



9 Calibration

9.1 Calibrating a Measuring Point

1. Select the screen page with the measuring point to be calibrated.
Use keys



to select the screen page that reads the measured value of the measuring point to be calibrated.

2. Touch the measuring point to be calibrated. Now, all settings of this measuring point are output. Current calibration data, temperature compensation settings as well as data saving (data logger) and data output (serial) are displayed.
3. Touch the calibration symbol.



4. Type in your correct password and press **ENTER** to confirm.
(You can use the **DEL** key for corrections.)
5. Select the calibration method.
All possible calibration methods for the respective measuring point type will be displayed. Press the corresponding symbol to select your desired calibration method. The individual calibration methods are explained in para. 9.2 'Calibration Methods'.
6. Return to the measurement.
After completing the calibration process, touch button



as many times as are necessary to get back to the measured value screen page.

9.2 Calibration Methods

Take account of temperature compensation for all calibration methods. This means, if measured values are compensated by temperature measurement, the associated temperature sensor must also be dipped into the calibration medium to be able to determine the exact temperature.

9.2.1 Setting the Temperature Offset



This menu item enables you to set a temperature value offset. For this purpose, touch the button that reads the current offset. Now, an input dialogue will be displayed which facilitates the setting. The offset can be positive or negative.

Use the **ENT** button to accept the entry. To cancel the input dialogue without saving the value press **ESC**, while **DEL** enables you to correct values entered.

The value changed will now be displayed in its corresponding field. You can make any further changes.

To save the value change you must exit the **Input Data** dialogue field by pressing the button below:



If you do not wish to save the change press the button below to exit the **Input Data** dialogue:



9.2.2 Single-Point Calibration



Calibrate the measuring signal at this one point using a defined calibration solution or a known set point value, e. g. determined by a separate method or by means of a laboratory/field instrument. At first, you will be prompted to dip the sensor into the corresponding calibration medium. After this step press **OK** to accept the dialogue. Now, the currently measured value will be displayed. After the measured value has

attained a stable state, accept the dialogue again by pressing **OK**. You will now be prompted to enter the set point value.

Use the **ENT** button to accept the entry. To cancel the input dialogue without saving the value press **ESC**, while **DEL** enables you to correct values entered.

As a result, you will now be given the new calibration values that you can save (**SAVE** button) or cancel (**CANCEL** button).

For calibration of measuring modules with linear characteristic for measurement of free or total chlorine (MVM 2260 C or MV 2260 C) in conjunction with corresponding chlorine measuring sensors, a single-point calibration as comparison with a known set point value determined by a means of a photometric laboratory method is recommended. Chlorine measuring sensors feature automatic temperature compensation integrated in the sensor. The temperature value shown during calibration should be adjusted to a fixed temperature (i. e. 25 °C) and is not taken into account.

In addition the KM 3000 offers a special free chlorine measurement method with automatic pH and temperature compensation. In this case the concentration of free chlorine is calculated as a virtual value on the basis of the real measured concentration of HOCl (Chlorine Measuring Cell Cl 4) in combination with a simultaneous pH measurement and a mathematical pH compensation automatically in a given pH range. The method for determining and calculation of virtual measured values is decrypting in para 12. For the calibration of the virtual value free chlorine a special procedure is necessary explained in para.12.2.

9.2.3 Two-Point Calibration



Calibrate the sensor at two separate points using two different defined calibration solutions or known set point values. The calibration points are supposed to include the measuring range or the measured values to be expected, respectively. You can choose any sequence of the calibration solutions or set point values.

At first, you will be prompted to dip the sensor into the first calibration medium. After this step press **OK** to accept the dialogue. Now, the currently measured value will be displayed. After the measured value has attained a stable state, press **OK** to accept the dialogue. You will now be prompted to enter the associated set point value.

Use the **ENT** button to accept the entry. To cancel the input dialogue without saving the value press **ESC**, while **DEL** enables you to correct values entered.

The next dialogue field will now prompt you to dip the sensor into the second calibration medium. After you have accepted this, the currently measured value will, again, be displayed. Press **OK** again to accept the stabilised measured value, before you will be prompted to enter the associated set point value.

As a result, you will now be given the new calibration values that you can save (**SAVE** button) or cancel (**CANCEL** button).

9.2.4 Automatic Calibration



For this method of calibration, the unit automatically recognises the value of the calibration solution used, taking into account the temperature of the calibration solutions. Automatic calibration may be single-point or two-point and is limited to the calibration solutions stored in the unit. This calibration method is applied to pH, conductivity and oxygen content measurements only.

Conductivity

The automatic calibration of the conductivity measurement is of single-point type and requires either a 0.01 molar (1.41 mS/cm at 25 °C) or a 0.1 molar (12.9 mS/cm at 25 °C) KCl solution. The temperature coefficients of these two calibration solutions are stored in the unit. The unit will automatically recognise which calibration solution you are using (observe the measuring range). For further conditions and tips, please refer to the sensor specifications.

At first, you will be prompted to dip the sensor into the calibration solution. Press **OK** to accept this dialogue. Now, an output window will appear reading the current measured value. After this value has stabilised, touch the **OK** button.

pH value

The automatic calibration of the pH measurement is of two-point type and requires knowledge of what buffer solutions you wish to use. The KM 3000 multi-point controller offers the following buffer solutions for calibration:

NBS standard buffer solution as per DIN 19266:	pH value at 25 °C 1.68 / 4.01 / 6.86 / 9.18 / 12.45
Technical buffer solution as per DIN 19267:	pH value at 25 °C 1.09 / 3.06 / 4.65 / 6.79 / 9.23
Knick/Mettler-Toledo/Ingold buffer solution:	pH value at 25 °C 2.00 / 4.01 / 7.00 / 9.21
Laboratory buffer solution:	pH value at 25 °C 2.00 / 4.01 / 6.98 / 8.95 / 11.88

You must take a choice in the first dialogue box. Again, you can choose any sequence of the buffer solutions. For further conditions and tips, please refer to the sensor specifications.

A subsequent dialogue will prompt you to dip the sensor into the first buffer solution. Press **OK** to confirm. Now, the current measured value will be displayed. After the display reads a stabilised value, touch the **OK** button. Now, the same procedure as for the first buffer solution will follow (dip sensor into buffer solution 2, wait for value stabilisation) for the second one.

As a result, you will now be given the new calibration values that you can save (**SAVE** button) or cancel (**CANCEL** button).

Oxygen content

The automatic calibration of the oxygen content measurement is a single-point calibration in the ambient air. Take the sensor out of the measuring medium and expose it to the ambient air. When doing so, make sure that neither considerable air flows nor direct sun radiation onto the sensor will affect calibration. For further conditions and tips, please refer to the sensor specifications. Now, the current measured value will be displayed. After the display reads a stabilised value, touch the **OK** button. In this connection, temperature compensation calls for particular attention and may require a setting time of up to 30 minutes.

After calibration is done, the new calibration values will be displayed. You can now decide whether you wish to save (**SAVE** button) or cancel (**CANCEL** button) the new calibration values.

9.2.5 Data Input

Data input stands for the input of the specific ratings of the sensor connected that have, for example, been determined at the laboratory before.



Touch the field to select the corresponding calibration value whose settings you wish to change. An input dialogue will now enable you to change the values within corresponding limits. If you exceed these you will get an error message to prompt you to enter a value within the fixed limits. Use the **ENT** button to accept the entry. To cancel the input dialogue without saving the value press **ESC**, while **DEL** enables you to correct values entered.

The value changed will now be displayed in its corresponding field. You can make any further changes.

To save the value change you must exit the Input Data dialogue field by pressing the button below:



If you do not wish to save the change press the button below to exit the Input Data dialogue:



Under the Conductivity (Cond) - Calibrate - Input Data menu items the cable offset calibration value is included. The latter allows the entry of a value (offset) for the compensation of the cable resistance. For this purpose, enter the cable resistance in Ohms for the 20 mS/cm and 100 mS/cm measuring ranges.

Measuring modules with linear characteristic can be calibrated by setting of two calibration values of the linear characteristic. Alternative to this two-point calibration a data input for two set points within the range of the corresponding linear characteristic is possible. You have to enter the corresponding measuring value (data input) to the given set points of the input signal (output signal of the sensor). The module MV 2270 is also a module with linear characteristic but for a counter signal (up to a frequency of 1.5 kHz).

Measuring modules MVM 2260 A or MV 2260 A:	data input for the input voltage 1 V DC and 5 V DC
Measuring modules MVM 2260 B or MV 2260 B:	data input for the input current 4 mA and 20 mA
Measuring modules MVM 2270 or MV 2270:	data input for the input frequencies 100 Hz and 500 Hz

10 Switching and Current Outputs

10.1 Configuring of a Relay Output

The KM 3000 features 4 internal relay outputs for use as limit, alarm, timer or controller function. This chapter describes the configuration of a relay output for use as a limit or alarm output and the configuration of one relay output as an adjustable timer i. e. for use as an automatic washing or rinsing contact for the electrode/sensor. The configuration of the controller functions is decrypting in para. 11.

Each of these relays can be individually assigned to any measured value. In addition application of up to 4 external active relay modules (REL 2000 CAN) feature expansion of the system of up to 16 relay outputs. The controller KM 3000 provides the power supply for the external modules and automatically detects the measuring and active modules connected. With the internal 4 relay outputs up to 20 relay outputs are available for the complete system KM 3000. The external relay output modules have the identification numbers 68 to 71. The connection to the system is realized via CAN bus as described in para. 4.2 'Connecting of External Modules'.

Always make sure that the relay you wish to employ is not used by a timer or controller function at the same time.

10.1.1 Internal Relay Outputs

This chapter describes the configuration of the four internal relay outputs as limit or alarm outputs.

Linking a relay with a measured value

1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the "limit val." button.



4. Touch the **setup limits** button.
5. To configure an internal relay touch the button **internal relays**
6. Now, you can touch the corresponding area to select your desired relay. You will be given an overview of the current settings of the relay selected.
7. At first, select the measured value you wish to assign the limit to. Touch the **1st Slave** button for this purpose. Now, you will be given an overview of all measuring points connected to the bus. Touch the area that displays the slave you wish to use. In the subsequent dialogue, you must take the choice which value of the slave you wish to output as limit. Value1 is the main quantity and Value2 the secondary quantity (refer to para. 5.2, 'Display Elements').
8. Change the values for the limit and the hysteresis. Touch the respective button and enter your desired values.
9. Use the **MINIMUM** or **MAXIMUM** buttons to set the type of limit.
10. At the end, enable the relay. For this purpose, the **Disable** or **Enable** button must read **Enable**.



Touch the symbol above to accept your settings or cancel them by touching the symbol below.



10.1.2 External Relay Outputs

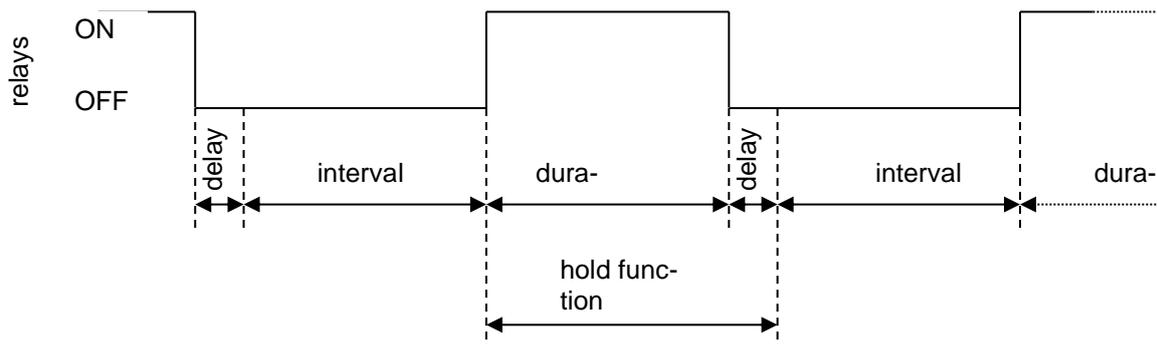
This chapter describes the configuration as limit or alarm relay outputs of the max. 16 relay outputs, which can be used for expansion of the controller system KM 3000 by means of 2 additional external active relay modules (REL 2000 CAN).

The external relay output modules (REL 2000 CAN) have the identification numbers 68 to 71. The modules are shown with this numbers in the selection menu described in para. 5, but the menu shows the connected modules only. All other adjustments and configurations are identical to those for configuration of the internal relay outputs (see para. 10.1.1 'Internal Relay Outputs').

10.1.3 Configuring of a Timer Relay

The KM 3000 features to switch one relay time controlled by an adjustable timer function. This function is the basis to realise an automatic washing or rinsing function for the electrodes/sensors in connection with suitable pumps or valves, a very useful function for process application.

Connect each internal or external relay with this function. Always make sure that the relay you wish to employ is not used by a limit or controller function at the same time. The two times for the control of the timer function are configured in this menu. The time for switch on of the relay is the cycle or interval time. The duration time gives how long the relay will be switched. During the duration time, the relay is switched on; all measured values are frozen for the analogue current and relay outputs (hold function). In addition a delay time can be adjusted. This delay time has no influence to the switching behaviour of the relay contacts. Only the hold function for the frozen of the measured values for current and relay outputs is influenced. The additional delay time for the hold function overwrites the specific response behaviour of the electrodes/sensors after the end of a washing or rinsing cycle, so that this changes do not influence the current and relay outputs.



Linking a relay with a timer function

1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the "limit val." button.



4. Touch the **Timer** button.
5. Now, you can change the times for interval/cycle and duration. Touch the corresponding area to select your desired times and enter your requested values. Both values must be entered in hours.
6. Select the requested relay output by touching the button **Relay**. You will be given an overview of the useable relays (internal and external relays). Only make sure that the relay you wish to employ is not used by a limit or controller function at the same time.
7. At the end, enable the relay. For this purpose, the **Disable** or **Enable** button must read **Enable**.

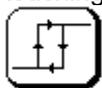


Touch the symbol above to accept your settings or cancel them by touching the symbol below.



10.1.4 Manual Activation of a Relay Function

For maintenance and service purposes the relay functions can be activated or released manually by touching the corresponding button. To select this menu please touch button "limit val."



and select **Manual**.

10.2 Configuring a Current Output

It can be said that it is possible to output any measured value through any existing current output. There are two different options for the current outputs. 4 internal current outputs will be available in the terminal box of the KM 3000 if the DAC 3000 analogue current output module has been installed in the KM 3000. In addition, up to four external DAC 3000 CAN analogue current output modules with four 0(4)...20 mA current outputs each can be connected to the KM 3000 controller to utilise all measured values (also virtual ones) as current signals for further processing. The KM 3000 controller provides the power supply for the external modules and automatically detects the modules connected. Thus, a maximum of 16 current outputs can be realised. The external current modules DAC 3000 and DAC 3000 CAN have identification numbers 64, 65, 66, or 67.

They can be connected via the CAN bus as described in para.4.2, 'Connecting of External Modules'.

10.2.1 Internal Current Outputs

Linking a current output with a measured value

1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the "Current" button.



4. Here all modules with their identification numbers are displayed which are connected with KM 3000 via CAN bus. Touch the button of this module you want to adjust.
5. Now, you can touch the corresponding area to select your desired output. You will be given an overview of the current settings of the output selected.
6. At first, select the measured value you wish to output. Touch the **1st Slave** button for this purpose. Now, you will be given an overview of all measuring points connected to the bus. Touch the area that displays the slave you wish to use. In the subsequent dialogue, you must take the choice which value of the slave you wish to output. Value1 is the main quantity and Value2 the secondary quantity (refer to para. 5.2, 'Display Elements').
7. Change the value ranges for the 0/4 mA start value and for the 20 mA end value. Touch the respective button and enter the values.
8. Use the **0...20 mA** or **4...20 mA** buttons to set the current range.
9. At the end, enable the output. For this purpose, the **Disable** or **Enable** button must read **Enable**.



Touch the symbol above to accept your settings or cancel them by touching the symbol below.



11 Controller Module

11.1 Basic Information

For complex control tasks, the controller module can be activated with two PID controllers working independently of each other. These controllers can be assigned to any measured quantities and work as analogue, pulse length (PWM) or pulse frequency controllers using the analogue current outputs or the relay outputs of the controller module, respectively. Prior to using the controller module for the first time, enable the latter (only if this function has been added subsequently) by a password. For this purpose, proceed as follows:

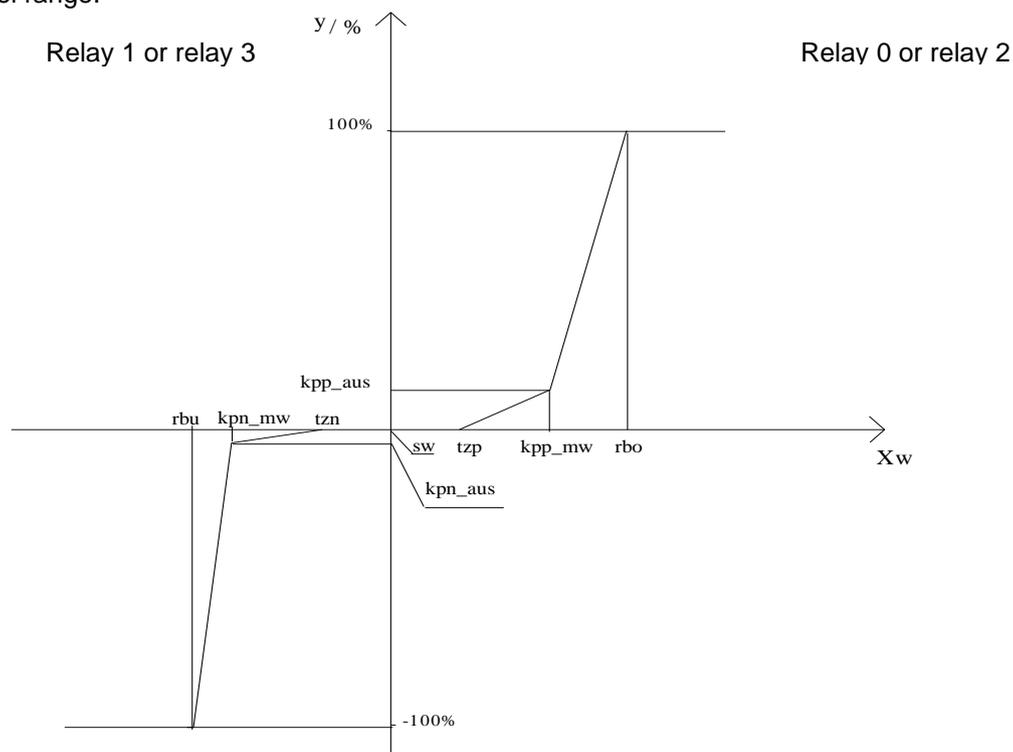
1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the "Controller" button.



4. Now, you will be prompted to enter the password to enable the controller module. Your dealer will give you this password after indicating your company data and your unit's serial number. Please note that each unit has its own password.
5. Having entered the password, you can now configure the controller module (refer to paras. 11.1 to 11.4).

Controller1 is assigned to relays 0 and 1, and controller2 to relays 2 and 3. Both devices must be used as quasi-continuous controllers. For simple control tasks, the integrated controller can be set as single proportional controller. You can also set a controller with a differential and/or integral portion. If you define an integral action time of 0 the controller will be used without an integral portion. The same applies to differential time.

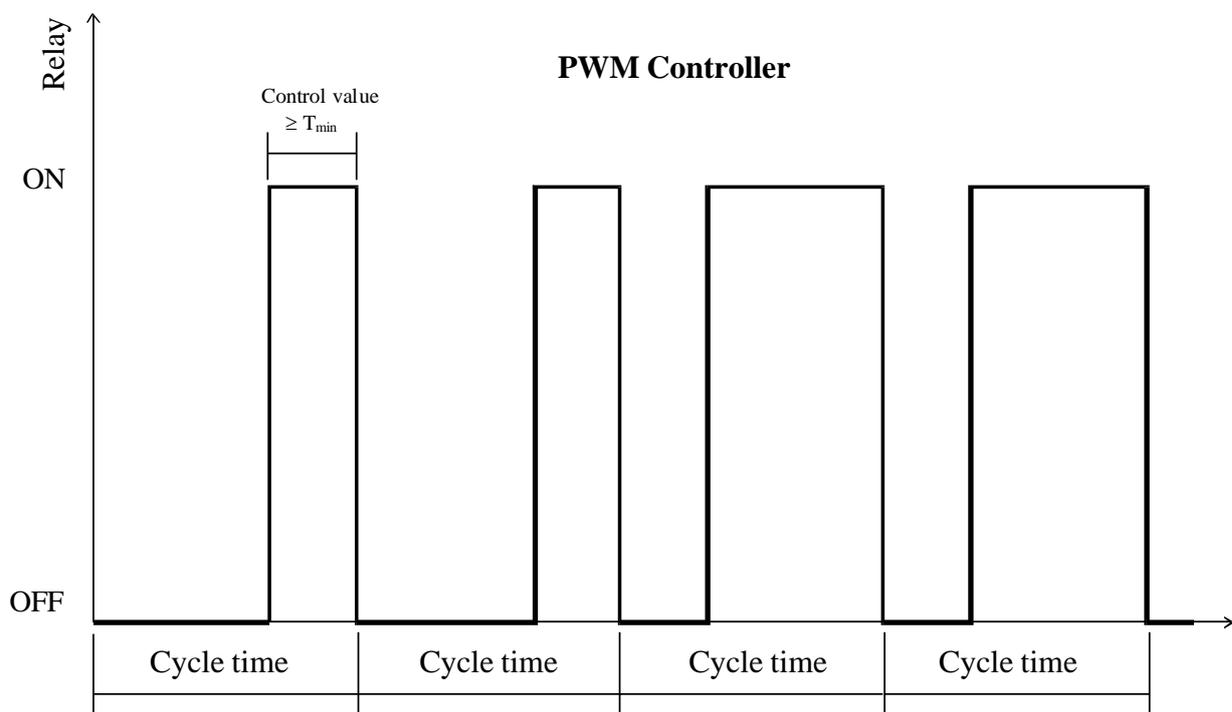
Processes for controlling the pH value are non-linear. The transmission constant of the system in the set point value range is often higher by some orders of magnitude as at the limits of the control range. The use of a controller with fixed setting values will result either in an instability of the control loop near the set point value or in extremely long settling times (for batch processes), or in high deviations (for continuous processes with greater disturbance variations), respectively. The controller integrated in the KM 3000 can be matched to such distinctive features of the process. The general static characteristic curve of the controller is shown below. It facilitates the realisation of different transmission responses for certain parts of the control range.



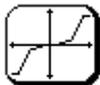
- rbo - lower range limit
- rbo - upper range limit
- sw - set-point
- tzn - dead band, negative range
- tzp - dead band, positive range
- kpp_mw - break point + x(input value)
- kpp_au - break point + y(output value)
- kpn_mw - break point - x(input value)
- kpn_au - break point - y(output value)

11.2 Configuring a Pulse Length Controller

Within the cycle time, a switching pulse that intervenes into the control process is calculated, depending on the deviation from the set point. The control value is re-calculated at the beginning of each cycle time. The minimum time - the shortest period of a control action - can be set for adaptation to different active modules. It is to prevent switching processes that are too fast for the active module. If it is undercut, and if the controlled quantity is out of the dead band, the active module will be triggered with the minimum time. If the turn-off time is shorter than the minimum time the relay will continuously stay turned on.



1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the "Controller" button.



4. Now, touch the corresponding area to select **Controller 1** or **Controller 2**. You will be given an overview of the current settings of the controller selected.
5. At first, select the measured value you wish to control. Touch the **1st Slave** button for this purpose. Now, you will be given an overview of all measuring points connected to the bus. Touch the area that displays the slave you wish to use. In the subsequent dialogue, you must take the choice which value of the slave you wish to output. Value1 is the main quantity and Value2 the secondary quantity (refer to para. 5.2, 'Display Elements').
6. Touch the **Time Setup** button to change the time response of the controller. Use the individual buttons to enter the values according to your requirements Touch the symbol below to exit this dialogue.



- Touch the **Parameters** button to change the control parameters. Use the individual buttons to enter the values according to your requirements Always make one of your entries after the other, as the input limits always refer to the previous value and are matched. Touch the symbol below to exit this dialogue.



- Now, touch the **Analog/PWM/Frequency** button as many times as are necessary to set it to **PWM**.
- At the end, enable the controller. For this purpose, the **Disable** or **Enable** button must read **Enable**.



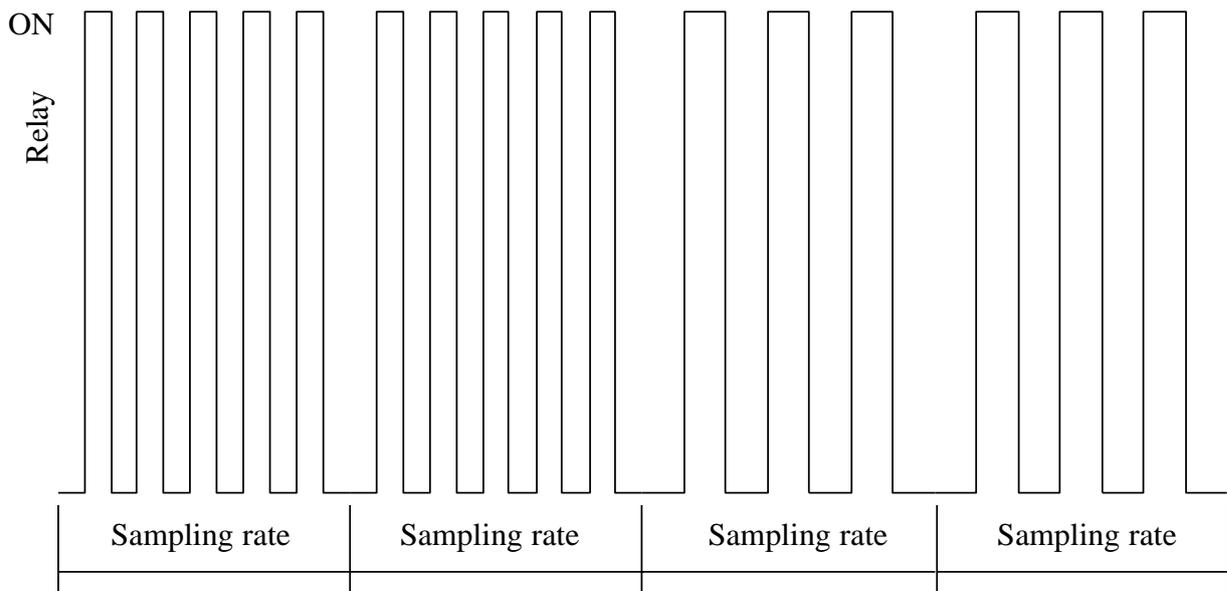
Touch the symbol above to accept your settings or cancel them by touching the symbol below.



11.3 Configuring a Pulse Frequency Controller

Within the cycle time, a constant pulse train that intervenes into the control process is calculated, depending on the deviation from the set point. The controller is re-calculated at the beginning of each cycle time. The maximum number of strokes indicates the maximum of pulse trains (per minute) triggered for the control action.

Frequency-Controller



- Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
- Enter your correct password.
- Touch the "Controller" button.



- Now, touch the corresponding area to select **Controller 1** or **Controller 2**. You will be given an overview of the current settings of the controller selected.
- At first, select the measured value you wish to control. Touch the **1st Slave** button for this purpose. Now, you will be given an overview of all measuring points connected to the bus. Touch the area that displays the slave you wish to use. In the subsequent dialogue, you must take the choice which value of the slave you wish to output. Value1 is the main quantity and Value2 the secondary quantity (refer to para. 5.2, 'Display Elements').
- Touch the **Time Setup** button to change the time response of the controller. Use the individual buttons to enter the values according to your requirements Touch the symbol below to exit this dialogue.



7. Touch the **Parameters** button to change the control parameters. Use the individual buttons to enter the values according to your requirements Always make one of your entries after the other, as the input limits always refer to the previous value and are matched. Touch the symbol below to exit this dialogue.



8. Now, touch the **Analog/PWM/Frequency** button as many times as are necessary to set it to **Frequency**.
9. At the end, enable the controller. For this purpose, the **Disable** or **Enable** button must read **Enable**.



Touch the symbol above to accept your settings or cancel them by touching the symbol below.



11.4 Configuring an Analogue Controller

The analogue controller is firmly linked with two current outputs each (refer to the characteristic curve). After the sampling rate has elapsed, the controller is re-calculated and the resulting current provided at the output. This current will then be kept constant for the period of the sampling rate.

1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the "Controller" button.



4. Now, touch the corresponding area to select **Controller 1** or **Controller 2**. You will be given an overview of the current settings of the controller selected.
5. At first, select the measured value you wish to control. Touch the **1st Slave** button for this purpose. Now, you will be given an overview of all measuring points connected to the bus. Touch the area that displays the slave you wish to use. In the subsequent dialogue, you must take the choice which value of the slave you wish to output. Value1 is the main quantity and Value2 the secondary quantity (refer to para. 5.2, 'Display Elements').
6. Touch the **Time Setup** button to change the time response of the controller. Use the individual buttons to enter the values according to your requirements Touch the symbol below to exit this dialogue.



7. Touch the **Parameters** button to change the control parameters. Use the individual buttons to enter the values according to your requirements Always make one of your entries after the other, as the input limits always refer to the previous value and are matched. Touch the symbol below to exit this dialogue.



8. Now, touch the **Analog/PWM/Frequency** button as many times as are necessary to set it to **Analog**.
9. At the end, enable the controller. For this purpose, the **Disable** or **Enable** button must read **Enable**.



Touch the symbol above to accept your settings or cancel them by touching the symbol below.



12 Determining Virtual Measured Values

The KM 3000 Multi-Parameter System features determination, display and evaluation of up to four virtual measured values. Virtual measured values arise from a mathematical linkage (addition or subtraction) between two real measured values, which are measured by the KM 3000 in the actual configuration. Each measuring channel which measuring values should be connected to a virtual measured value must be configured and calibrated before in accordance with the description for this real measured value. These virtual measured values are displayed on screen page 5. If you touch the display value area you will get through a password entry menu item directly to the option for setting up the display as well as the serial output and the data logger. The individual settings can be made in the same way as those for a single measuring channel; only for the linkage another measured value is required which must be entered.

12.1 Calculation of Virtual Measured Values by Sum/Difference

The calculation of the difference between two conductivity measuring points for control of the efficiency of filters for water treatment as well as the calculation of the difference of two pH measurements for increasing of the reliability and/or for generating a maintenance signal or for monitoring of a cooling water circulation are excellent examples for successful application of virtual measured values by sum or difference. In addition to the standard difference calculation it is possible to select the absolute difference calculation. That means if value1 is lower than value 2 the normal difference calculation results in a negative value. But with absolute difference calculation, the results are positive all the time.

As much as it is possible for real measured values, all output units such as current outputs; limit relays, controllers and the data logger can be used for virtual linkages. For this purpose, a second measured value must be chosen via a mathematical linkage (addition or subtraction) instead of only one. The procedure is always the same and is explained by the example of limit monitoring.

The objective is the linkage of the measured values of two slaves and the monitoring of the difference between the two values.

1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the "limit val." button.



4. Touch the **Setup limit** button.
5. To configure an internal relay, touch the **internal relay** button.
6. Now, you can touch the corresponding area to select your desired relay. You will be given an overview of the current settings of the relay selected.
7. At first, select the first measured value you wish to output. Touch the **1st Slave** button for this purpose. Now, you will be given an overview of all measuring points connected to the bus. Touch the area that displays the slave you wish to use. In the subsequent dialogue, you must take the choice which value of the slave you wish to output. Value1 is the main quantity and Value2 the secondary quantity (refer to para. 5.2, Display Elements).
8. Touch the **Virtual** button to select the second measured value for the virtual linkage.
9. Then touch the **2nd Slave** button to select the slave and its associated measured value similar to the first measured value.
10. Now, setting up the type of the virtual calculation with the button **disable / Operation**.



Save the done settings by touching the button:



11. Change the values for the limit and the hysteresis. (refer to para. 10.1 Configuring of a Relay Output), Touch the respective button and enter your desired values.
12. Use the **MINIMUM** or **MAXIMUM** buttons to set the type of limit.
13. At the end, enable the relay. For this purpose, the **Disable** or **Enable** button must read **Enable**.



Touch the symbol above to accept your settings or cancel them by touching the symbol below.



12.2 Determining Free Chlorine as an Virtual Measured Value

The rules for determination of virtual measured values can be used to calculate the free chlorine content on the basis of the measurement of HOCl acid in the water and automatic correction of the pH-dependency of the equilibrium HOCl / OCl⁻ in the water by a simultaneous pH measurement. This method features direct readings of the free chlorine content in conformity with the photometrical DPD method without strong pH regulation and is most common in swimming pool water treatment and drinking water monitoring. This method should be used if a chlorine sensor without internal pH compensation for HOCl measurement is used only.

12.2.1 Chlorine Measurement with Automatic Compensation of pH

The virtual measured value „free chlorine“ is determined from the concentration of the dissociation product of chlorine in water HOCl and the actual pH in the same water. The controller KM 3000 should be equipped with a measuring module for pH measurement (MVM 2210 or MV 2210) as well as a measuring module for chlorine measurement (MVM 2260 Cl or MV 2260 Cl). The measured signal of the chlorine module in conjunction with a chlorine measuring sensor for measurement of HOCl (i. e. Chlorine Measuring Sensor Cl 4) is mathematical linked with the measured signal of the pH module in conjunction with a pH electrode in the same measuring medium, so that the defined virtual measured value free chlorine with automatic pH compensation could be calculated. The given automatic temperature compensation of the pH and chlorine measurement features a virtual measured value free chlorine automatically compensated by temperature and pH. Configuration, calibration and adjustment of the temperature compensation of each real measured channel, which should be linked to the virtual measured channel, must be done before connection. For specification, measurement principle, function and calibration of the sensors/electrodes please refer to the accompanying operating manuals and data sheets.

For the calibration of the measuring module with linear characteristic for determination of acid HOCl in conjunction with the suitable measuring sensor (i. e. Cl 4) a single point calibration at one point using a defined calibration solution or a known value determined means of a photometric field or laboratory meter is recommended (refer to para. 9.2.1). These photometric instruments determine the content of free chlorine in the sample water after adding a DPD reagent. This reagent changes his colour in accordance with the content of free chlorine but in addition the reagent adjusts a stable pH in the sample in the range pH 6.2...6.5, so that about 94 % of the complete free chlorine exists as the dissociation product HOCl. Because of this the photometric value cannot be used directly for calibration of the chlorine measuring channel. The concentration of HOCl with reference to the actual pH in the measured medium must be calculated from the photometric measurement result of the sample water. With known pH in the medium at the time of calibration a factor corrects the displayed values from the photometer.

Calculate the calibration value for adjustment of the chlorine channel from the photometer result and the actual pH:

$$\text{Calibration value} = \text{free chlorine}(\text{photometric unit}) \bullet \text{factor}[\text{pH}]$$

pH value	6.5	6.6	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8
Factor	0.92	0.90	0.87	0.85	0.81	0.78	0.73	0.69	0.63	0.58	0.52	0.47	0.41	0.35

Example:

The photometer shows 0.8 mg/l free chlorine and the pH in the measuring medium at the same time is pH 7.0. So you can calculate a calibration value or set point for single point calibration of the chlorine (HOCl) channel KM 3000.

$$0.8 \text{ mg/l} \bullet 0.78 = 0.624 \text{ mg/l}$$

For calculation of the concentration of free chlorine as a virtual measured value from the real measured value of HOCl and the actual pH, the pH-dependency of the equilibrium HOCl / OCl⁻ is compensated automatically. The correction factor is in accordance with the dissociation curve of the chlorine dissociation products in the water.

Free chlorine can be calculated in the range pH 6.5 – 7.8 with the following equation:

$$\text{free chlorine} = \frac{\text{HOCl (measuring value HOCl channel)}}{\text{factor[pH]}}$$

The determined virtual measured channel for free chlorine follows exactly this equation and shows the content of free chlorine fully identical with the result from a sample measured by the photometric DPD-method. For pH < 6.5 the displayed value of the chlorine (HOCl) channel is nearly identical with the free chlorine content.

Please refer to the operating manual of the chlorine measuring sensor or ask for detailed literature for more information about the dissociation curve of the chlorine products in water and the activity of chlorine dissociation products as disinfects of water.

12.2.2 Configuring a virtual channel for free chlorine

For setting the display, configuring a switching or current output, data storage in the data logger or using a serial interface the virtual channel features the same procedures like a real measured channel. The procedure is always the same and is explained by the example of configuring the display for the virtual channel of “free chlorine”.

1. Select the virtual measured value with the buttons << or >> on the page of the virtual channels.
2. Touch the display value area, at the position the value should be displayed.
3. Enter your password.
4. Touch the **1st Slave** button and select the slave used as HOCl measuring channel (measuring module for chlorine measurement in conjunction with a chlorine measuring cell suitable for measurement of HOCl i. e. Chlorine Measuring Cell CL 4).
5. Then touch the **2nd Slave** button and select the slave used as pH measuring channel (measuring module for pH measurement in conjunction with the pH electrode located in the same measuring medium like the chlorine cell) for automatic compensation of pH to determine free chlorine.
6. Now, use the **disable / Operation** button to set the type of linkage and select the type **free chlorine**.



Touch the symbol above to accept your settings or cancel them by touching the symbol below.



Always make sure that the configuration of the virtual channel for measurement of free chlorine with automatic compensation of pH must be done in the following turn:

First configure as the 1st slave the HOCl measuring channel (measuring module for chlorine measurement in conjunction with a chlorine measuring sensor for HOCl i. e. Measuring Sensor CL 4),

Secondly configure the 2nd Slave as the accompanying pH measuring channel for determination and automatic compensation of pH.

12.3 Calculation of Virtual Measured Values by Polynomial

The integrated polynomial calculation allows a wide application range of the KM 3000 especially to calculate non-linear functions of various parameters. Individual sensor curves don't need absolutely to be linearised by ordinary 2-point calibration. With it the non-linear measuring character of sensors is also available at the ends of the measuring range. The decrease of slope of ions-selective electrodes in low ion concentrations or polarisation effects of conductivity measurements in higher concentrations are some examples. The polynomial has the form $y = a + bx + cx^2 + dx^3$. Any sensors which output a measurable parameter (value “x”) can be connected on the KM 3000. The value „y“ is calculated and displayed as a separate virtual measuring value. The coefficients a...d of the typical sensor curve have to be known or

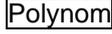
have to be determined by means of special software tools (MSEExcel-Regression, CurveExpert, ... etc.). The degree of polynomial is determined by selection of coefficients. For example the sensor curve would be linear if the coefficients c and d are zero.

The number of parameters increases by using the measuring modules MV2260A/B whether parameters will be transformed into usable standard output current/voltage (0(4)...20 mA / 0...10 V). Typical sensors with non-linear curves are optical sensors like turbidity and solid content probes with analog output, gas sensors, conductivity sensors and more.

A simple multiplication can be done with the factor b for example to convert a measured parameter in a more user friendly value or in another scale. The following procedure shows an example for conversion of unit mol/l to mg/l:

1. Select the screen page of virtual slaves (0...3). Use keys  or .



2. Touch the virtual measuring point (e. g. „virtual 0“) to be displayed.
3. Type in your correct password and press  to confirm.
4. Touch the  button for purpose of slave selection. You get a summary of all on bus connected measuring points. Touch the area that displays the slave you wish to use for calculation. In the subsequent dialogue, you must take the choice which value of the slave you want to calculate.
5. Select the right value . This value is the basic measuring value unit mol/l.
→ The area  is not relevant for the polynomial function.
6. Now you can setup if the calculated virtual value have to be output serial or saved in data logger. Touch the follow areas  and .
7. With touching of  you go to the summery of kind of calculations.
8. Select . In the following window the selection of polynomials 0...3 has to input. The better overview matters the number of polynomial should the same like above (2.) actually selected virtual slave.
9. For example select polynomial 0 for virtual slave 0. In the next step you set the coefficients a...d.
10. Set $b = \text{molar mass} * 1000$ und a, c, d = 0. Touch the symbol above to accept your settings:



or cancel them by touching the symbol below:



Now the setup is finished. A conversion from mol/l to mg/l is done by a parameterised polynomial 0, which can also be used for current outputs, relay contacts or controller. Now the converted value is displayed on the screen at the measuring point „virtual 0“.

13 System Information

13.1 Information

From the "service" menu item, you can get information on the system such as unit's serial number, software version, data logger state and log-book entries. You can call this menu as follows:

1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the "Service" button.



Behind the "Information" heading, you will see the serial number and below the software version of your unit. For any other information, select the corresponding menu items.

13.2 Changing the Slave Number (ID)

This menu item serves for setting or changing a slave (measuring module) identification number. You will see this number in the upper left corner of each display channel. This number is important for the communication of the KM 3000 with the bus devices (slaves, internal and external active modules). Besides, this number prescribes the display position. So the slave having number 0 is displayed on the top left side of the first page and, for example, slave 5 on the top right of the second page.

It is extremely important that this number is assigned on the bus only once. Otherwise conflicts are possible and the correct function of the whole system cannot be guaranteed. You can use this menu item only to change this number into a different number still vacant, changing into a number already existing is not being possible.

1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the **Info** button.



4. Touch the **change id** button. For the active modules DAC3000CAN and REL2000CAN touch the **change id DAC/REL** button.
5. Touch the **Select Slave** button for this purpose.
6. Select the slave whose number you wish to change.
7. Type in your new number (0...15) and press **ENTER** to confirm.
8. To be on the safe side, you will be asked once more whether you really want to save the new number if it has not been assigned yet.
9. After the new number has been saved, you will be prompted to make a reset. Press **OK** to confirm. Now, the slaves will be re-sorted when being read in and displayed with their new numbers. Any other data has been preserved. Please note that the settings concerning the controller, current output, limit value, data logger and the serial output would not be matched automatically. You will still have to make these settings for the slave you have changed.

13.3 Log-book

The log-book records all settings concerning the measuring system. Up to 200 of such entries can be stored. These entries are output together with the date, the time and with a code that represents the operator notes or errors of the unit, respectively.

Code	Function
CAL Sxx	Calibrating slave xx.
M slaveMV2	Changing secondary measuring parameter type of conductivity
M slaveLim	Changing the measurement range values
M slaveOut	Changing the data output of a slave.
M slaveDis	Changing the display of a slave (measured value output, name).
M slaveTmp	Changing the temperature compensation.
M relayLim	Limit relay configured.
M control	Controller configured.
M dataLogg	Data logger set.
M dataTran	Serial data output set.
M cur.outp	Internal current output set.
M pe curr.	External current output set.
M clock	Clock set.
M virtual	Virtual display channel changed.
M relay M	Relay manual set
M timer	Timer adjusted
M MODBUS	Changing the MODBUS settings
M Basic	Changing the basic settings of the unit
M Polynom	Changing the polynomials
M modem	Changing the modem settings
M cond ran	Changing the measuring range of the conductivity module
SMS1OUT MW	SMS message to number 1 is done
SMS2OUT MW	SMS message to number 2 is done
SMS1 Limit	Limit SMS to number 1 is done
SMS2 Limit	Limit SMS to number 2 is done
Setup Chan	Actual setup data via data transfer or USB stick received
E SMS Err	Error at SMS transfer
E CAN Init	Problems during initialising of the CAN Bus
M hold man	Manual hold (hold function activated)
E1 slavexx	Slave xx response error. Measuring amplifier no longer connected to bus.
E1 dac xx	External current slave xx response error.
Modem Reset	New initialisation of the modem
WD-RESET	Reset by the software.
POWER ON	Mains supply interruption.

Entries to calibration procedures are also logged with date and time. Additionally the new calibration values are saved in the log-book.

1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the "Service" button.



4. Now, touch the **Log Book** button.

You can copy the log-book as text file on your USB stick or you can transfer it with the software MVremote to the PC.

13.4 General Adjustments

This menu point describes general adjustments of the KM 3000 system, which result to different menu points. You can generate your own password, you can define if during calibration of a module only this channel is frozen by the hold function or if all channels are frozen by the hold function, and you can adjust time, date and user language. Furthermore it is possible to assume a device setup which is saved on an USB stick. You can also save the actual device setup on the stick and you can edit the setup with the software MVremote.

1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the "Service" button.



4. Touch the button **basic setup**.
5. Now, you can change the adjustments to the detailed points.

device setup

Copy the complete device configuration on the USB stick or assume a configuration which is saved on the stick into device.

hold calibr.

Select if during calibration only the actual calibrated channel (display shows "channel") is frozen (hold function) or if all measuring channels (display shows "all") are frozen during calibration.

pass word

Create your own password.

RESET

Re-start KM 3000

Deutsch/english

Change the user language.

Use the relevant fields to adjust date and time.



Touch the symbol above to accept your settings or cancel them by touching the symbol below.



13.5 Hold

The KM 3000 realises automatic change into the hold function if you activate the calibration menu or if the timer relay output switches on. The unit terminates the hold function automatically and goes back to the actual measuring mode if you leave the calibration menu or if the timer relay output switches off. In addition to these automatic hold functions a manual hold function is available to adjust or check requested functions and to avoid data transmission or unintentionally activation of relay and controller outputs during this operation. If the hold function is active all outputs (analogue current outputs, limit outputs, controller outputs) are frozen and the data transmission of the serial interface is interrupted. The outputs remain in the last stage upon the hold function will be cancelled or enabled. Only the display of the KM 3000 shows the actual measuring values or the activated function or menu. In addition the data logging system as well as the log-book are not influenced by the hold function. The active hold function is signalled by the sign "Hold" in the display field of the relay outputs in the below right corner (see para. 5.2 'Display Elements'). For the automatic activation of the hold function during calibration in accordance with para. 13.5 'General Adjustments' you can select if during calibration of a module only this channel is frozen by the hold function or if all channels are frozen by the hold function. Activation of the hold function only for the channel to be calibrated features continuous data outputs for non-influenced channels i. e. for use of separated measuring points.

During activation of the timer relay output (relay is switched on) i. e. for control of an automatic cleaning system (see para. 10.1.3 'Configuring of a Timer Relay') the hold function for all channels will be activated, because the cleaning function influences normally all sensors/electrodes in one measuring point. The actual readings in the display of the KM 3000 feature an easy check of the cleaning function and the influence to the different channels. You can expand the time for the hold function by an additional delay

time for the timer relay function (look at para. 13.5 'General Adjustments') to adapt this to the response time of the sensors/electrodes.

1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the "HOLD" button.



The actual status is displayed in the upper line of the dialogue field: either "Device in normal mode!" or "Device in manual HOLD mode!". By touching the button "HOLD" the status changed.

Now you can realise all changes or tests on the KM 3000 without results of the changes to the outputs. The data transmission via serial interface is interrupted.

To leave this function, the adjustments you have to do are identical to those described above.

13.6 Update device software

Because of its modern structure it is possible to update the device software. This is realised via USB stick. Copy the actual device software on the USB stick. Pay attention that the new firmware is listed in the register root/Update-SM/. Copy the register with the including files on your USB-stick. Start with updating:

1. Via the **MENU** key field on the measured value output side, you will get to the password entry menu item.
2. Enter your correct password.
3. Touch the "Update" button.



4. The update software is started.



5. Follow the advice and put the USB stick with the necessary data in the USB port.
6. Touch the "Update" button. Now data will be updated. Don't remove USB stick during updating. If all data is copied successfully an automatic re-start of the KM 3000 will be realised. After re-starting the USB stick can be removed. Test the successful updating by checking the version number of the new update version.

14 Maintenance, Disposal

The controller is almost maintenance-free. For maintenance and storage of the sensors / electrodes please observe the corresponding manuals of the sensors / electrodes.

Please send us the old measuring instruments and sensors for disposal. Sensortechnik Meinsberg GmbH takes it back free of charge and recycles/disposes the electronic scrap in a competent way. Do not dispose your old measuring instruments in household refuse, this is illegal. Please avoid the disposal at public collecting points. For more information: <http://www.meinsberg.de/en/weee.pdf>

15 Specifications

15.1 KM 3000 Multi-Parameter Controller

Power supply	115 / 230 V AC (-15/+10 %); 48...63 Hz, ca. 25 VA (optional 24 V DC)
Fix wired power supply	Cable outer diameter depending on the cable gland used (clamping range); Rubber cable type H07RN-F, 3G1.0 The external circuit capacity of the power supply in a hard-wiring should not exceed 10 A (slow).
Ambient temperature	-10...+55 °C
Display	touch screen display 320x240 pixels, 256 colors, back-lighted
Menu languages	German, English
Data transmission	serial interface RS-232 and RS-485, GSM modem can be integrated, USB port (USB stick with FAT format), Ethernet interface, Modbus RTU, Modbus TCP/IP
Controller outputs	4x floating relay outputs max. 230 V AC, 5 A (Relay 0 to 3) 1x floating relay output 24 V AC/DC 0.3 A (fault relay, relay 4) To prevent relay damage, the load circuit must be fused for the maximum permissible current. The cable cross-section (max. 2.5 mm ²) must be adapted to the maximum output current (DIN VDE 0298 Part 4, 2013-0). integrated data logging system for approx. 100.000 values incl. date and time
Data storage	integrated data logging system for approx. 100.000 values incl. date and time
Log-book	approx. 200 activities incl. date and time
Enclosure	extremely rugged aluminum case for wall mounting with separated strip compartment, protection IP 65; weight about 5 kg; dimensions look at drawings
Electrical connections	terminal block for wires cross section 0.2 ... 2.5 mm ² screw-terminals (sensor) for wires cross section 0.2 ... 1.5 mm ² Cable gland M16x1,5 - max. torque 7 Nm - cable cross-section 4.5...10 mm Cable gland M20x1,5 - max. torque 12 Nm - cable cross-section 7...13 mm
EMC	2004/108/EC, EN 61326 class B
Safety test	EN 61010-1
Measuring modules	four internal measuring modules in any combination; inputs isolated; storage of calibration data, sensor supervision by individually adjustable limit bands; manual and automatic temperature compensation; detailed specification see table
Active modules	Analogue Current Output Module DAC 3000 plug able: 4 current outputs 0(4)...20 mA, scalable, resolution 10 bit Controller Module PID 3000: 2 adjustable PID controllers with analogue, pulse or frequency output (by using the analogue or relay outputs)

15.2 External Measuring and Active Modules

Power supply	12...24 V AC/DC (supplied by the controller KM 3000)
Ambient temperature	-10...+55 °C
Cable connection	power and data transmission between the modules and to the controller KM 3000 via screened 4-wires bus cable; max. 1,000 m (depends from the number of nodes and their arrangement)
Enclosure	aluminium profile case, protection IP 65; dimensions look at drawings
Electrical connections	internal screw terminals, plug able
Electromagnetic compatibility	2004/108/EC, EN 61326 class B
Measuring modules	up to 12 external measuring modules in any combination; inputs isolated; storage of calibration data, sensor supervision by individually adjustable limit bands; manual and automatic temperature compensation; detailed specification see table
Active modules	Analogue Current Output Module DAC 3000 CAN: 4 current outputs 0(4)...20 mA, scaleable, resolution 10 bit Relay Module REL 2000 CAN: 4 floating relay outputs; $I < 3 \text{ A}$, $U < 250 \text{ V AC}$ or 30 V DC resistive load for limit or alarm functions

15.3 Measuring Modules

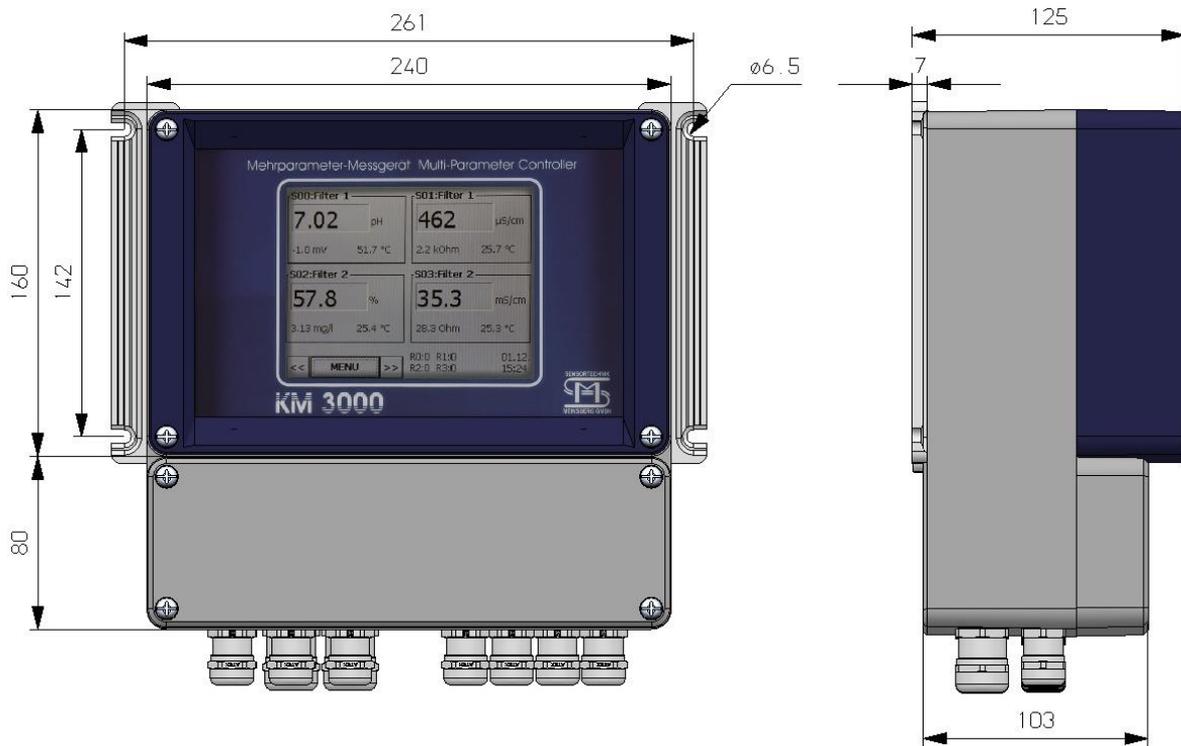
Internal Module	External Module	Main Measuring Parameter range resolution	Secondary Measuring Parameters	Temperature range / resolution	Electrodes / Sensors
MVM 2210	MV 2210	pH value pH 0...14 pH 0.01	electrode voltage in mV	-10...130 °C 0.1 °C	pH combination & separated electrodes, temperature sensor Pt 1000
MVM 2215	MV 2215	redox potential (ORP) -2000...+2000 mV 1 mV	redox(ORP) voltage in relation to the standard hydrogen electrode	-10...130 °C 0.1 °C	redox(ORP) combination & separated electrodes, temperature sensor Pt 1000
MVM 2216	MV 2216	ion concentration acc. sensor specification (ISE) and calibration	electrode voltage in mV	-10...130 °C 0.1 °C	ion selective combination & separated electrodes ISE), Pt 1000
MVM 2220	MV 2220	conductivity (2-pol) 0...200 µS/cm 0...2 mS/cm 0...20 mS/cm 0...100 mS/cm automatic range selection	salinity 2...42 g/kg resistance	-10...130 °C 0.1 °C	conductive 2-electrode sensor; temperature sensor Pt 1000
MVM 2225	MV 2220	conductivity (4-pol) 0...200 µS/cm 0...2 mS/cm 0...20 mS/cm 0...500 mS/cm automatic range selection	salinity 2...42 g/kg resistance	-10...130 °C 0.1 °C	conductive 4-electrode sensor; temperature sensor Pt 1000
MVM 2230	MV 2230	O ₂ saturation 0...120 % 0.1 %	O ₂ concentration 0...20 mg/l	-10...130 °C 0.1 °C	membrane covered amperometric O ₂ sensor, temperature sensor Pt 1000
MVM 2260 A	MV 2260 A	DC voltage input signal linear characteristic 0...5 V DC		-10...130 °C 0.1 °C	instrument or sensor with DC voltage output
MVM 2260 B	MV 2260 B	DC current input signal linear characteristic 0(4)...20 mA		-10...130 °C 0.1 °C	instrument or sensor with DC current output
MVM 2260 C	MV 2260 C	DC current input signal i. e. concentration (chlorine, chlorine dioxide etc.) 0...2 (10) mg/l 0.01 mg/l	sensor current in mA	-10...130 °C 0.1 °C	instrument or sensor with passive DC current output (i. e. chlorine)
MVM 2270	MV 2270	TTL-counter 0...5kHz/U _{min} =2V over voltage protection Flow-through (paddle-wheel sensor) 0...100 l/h 0.1 l/h	frequency in Hz		vane flow sensor

The measuring inputs must be potential-free and must have no connection to mains voltage potentials.

All inputs must be operated with the appropriate sensors only. Connect directly from foreign signals is not allowed.

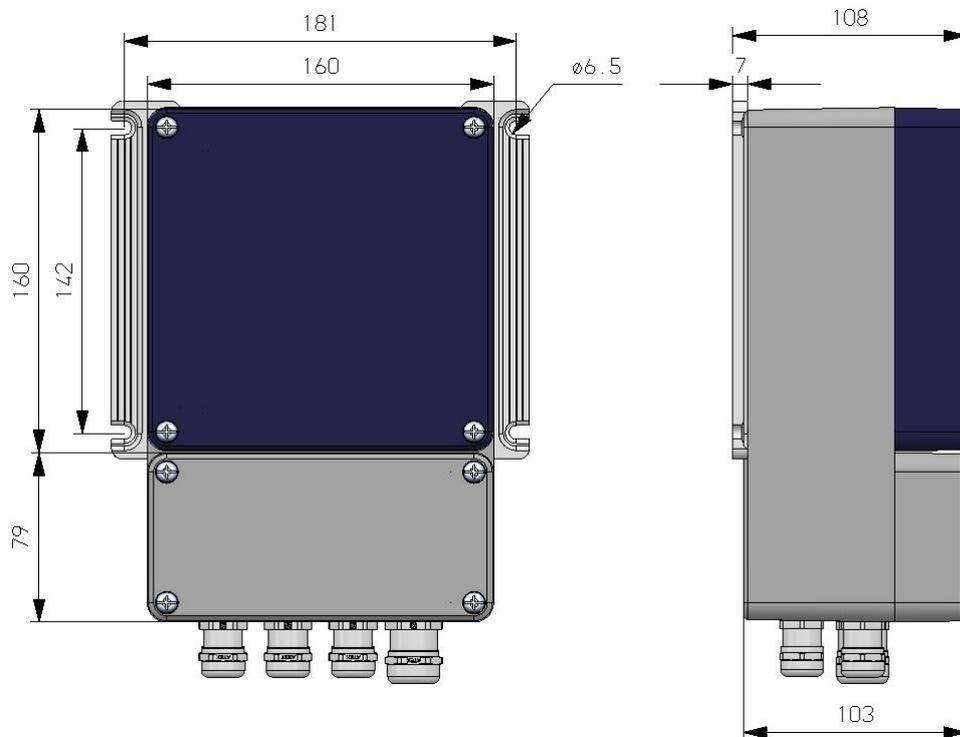
15.4 Dimensioned Enclosure Drawings

KM 3000 Multi-Parameter Controller

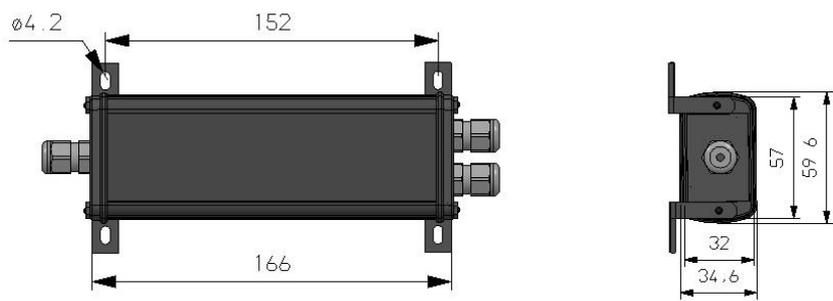


Housing / cover screws (max. tightening torque 4.0 Nm)

External measuring and active modules



Housing / cover screws (max. tightening torque 4.0 Nm)



Dimension in mm

16 Unit Configuration

Unit serial number:

Date:

Internal measuring module positions

Position	Measured Quantity	Slave Number
0		
1		
2		
3		

Limit relays

Relay	Measured Quantity	Lower Limit	Upper Limit
0			
1			
2			
3			

Controllers

Controller	Measured Quantity
1	
2	

External measuring modules (slaves)

Slave Number	Measured Quantity
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

External current outputs (DAC 3000 CAN)

	Measured Quantity	Lower Limit	Upper Limit
Slave 64			
Output 0			
Output 1			
Output 2			
Output 3			
Slave 65			
Output 0			
Output 1			
Output 2			
Output 3			
Slave 66			
Output 0			
Output 1			
Output 2			
Output 3			
Slave 67			
Output 0			
Output 1			
Output 2			
Output 3			

Characteristic features:

Cable assignment bus-cable (CAN-bus) from metrofunk cable-union

cable-type: Li2YC11Y 3x3-222

shield ground (will be transmit over the box to the next module)

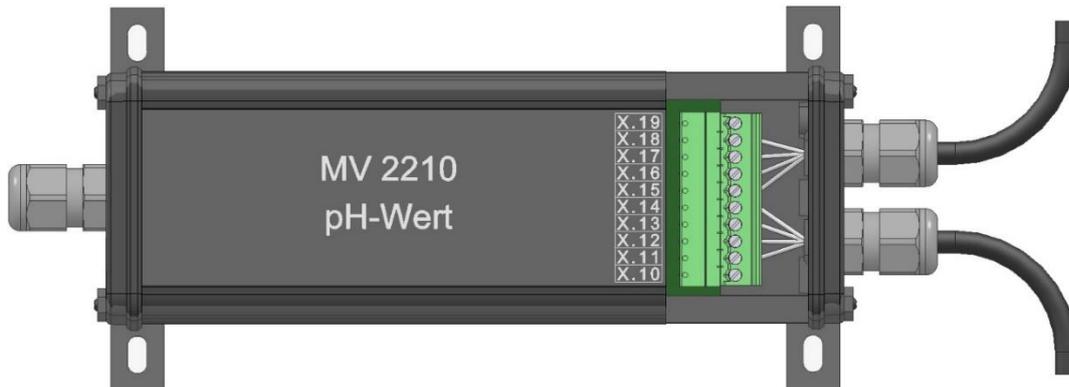
red/black +12V

brown/black -12V

orange CAN-L

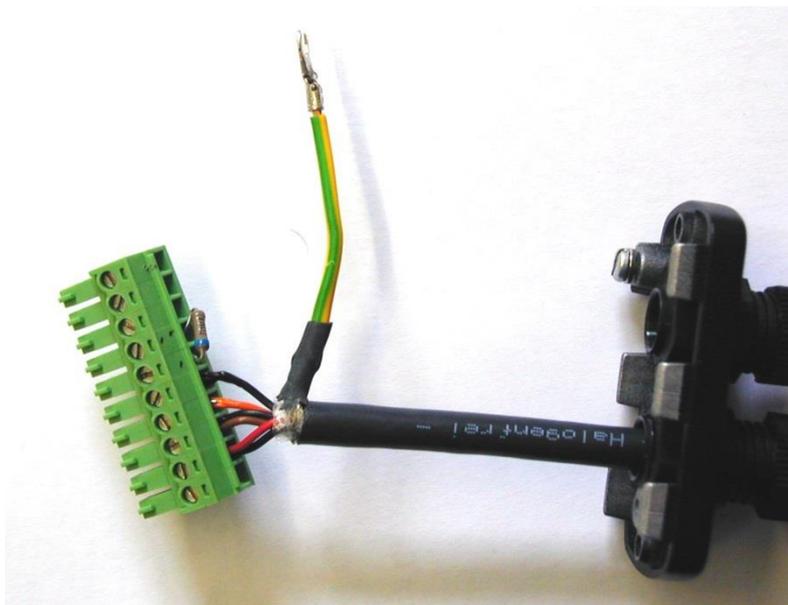
black CAN-H

Regard: Stranding wire pairs belong together, because no error free data transfer is possible. The cable contains three stranded wiring pairs, each one pair for power supply + 24 V and GND. The 3rd pair is for data communication.



Terminal	Function	Cable-colours
X.19	free	
X.18	-12V power supply CAN	brown/black
X.17	+12V power supply CAN	red/black
X.16	CAN H	black
X.15	CAN L	orange
X.14	CAN H	black
X.13	CAN L	orange
X.12	-12V power supply CAN	brown/black
X.11	+12V power supply CAN	red/black
X.10	free	

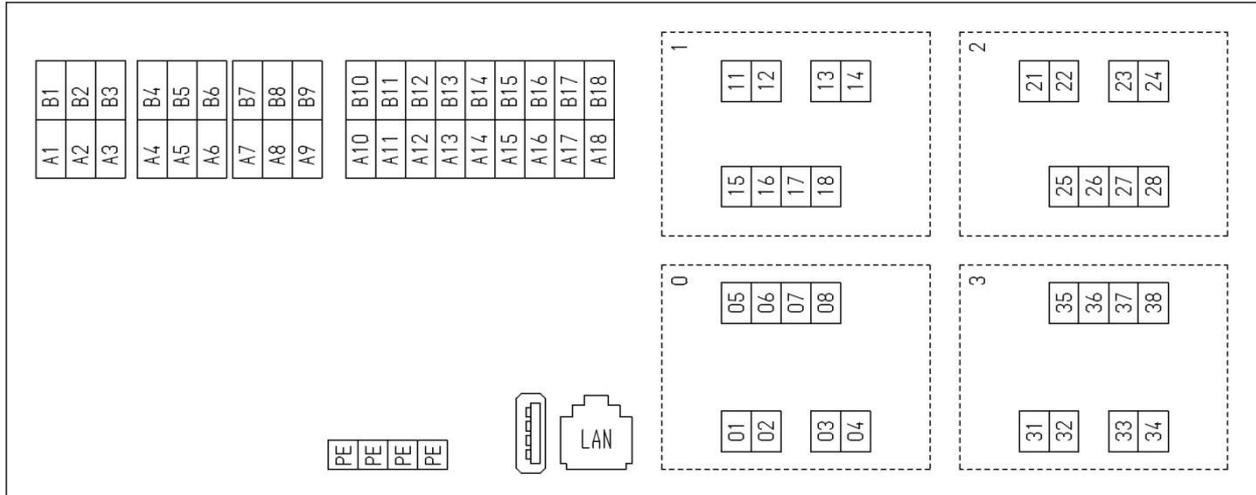
On the last module must be a terminating resistor (120 Ohm) between CAN H and CAN L.



The picture shows the CAN-bus connector with terminating resistor and ground cable connector.

17 Annex – Part of the previous user manual

Terminals Connection KM3000 – [previous hardware](#)



Terminal	Description	Terminal	Description
A1 & B1	Mains supply L1 conductor	A1 & B1	GND (only 24V version)
A2 & B2	Mains supply PE-conductor	A2 & B2	Mains supply PE-conductor
A3 & B3	Mains supply L2-conductor	A3 & B3	18...36 VDC (only 24V version)
A4	Relais 0 CO contact (max. 230 V AC, 5 A)	B4	Relay 0 NO contact
A5	Relais 0 NC contact	B5	Relay 1 CO contact (max. 230 V AC, 5 A)
A6	Relay 1 NO contact	B6	Relay 1 NC contact
A7	Relay 2 NO contact	B7	Relay 0 CO contact (max. 230 V AC, 5 A)
A8	Relay 3 NO contact	B8	Relay 2 NC contact
A9	Relay 3 NC contact	B9	Relay 0 CO contact (max. 230 V AC, 5 A)
A10	Earth – current output 0	B10	Current output 0
A11	Earth – current output 1	B11	Current output 1
A12	Earth – current output 2	B12	Current output 2
A13	Earth – current output 3	B13	Current output 3
A14	+12V CAN supply	B14	CAN L
A15	-12V CAN supply	B15	CAN H
A16	B (-) – RS485	B16	Relay 4 NC contact
A17	TX – RS232	B17	Earth - RS232/RS485
A18	A (+) – RS485	B18	RX – RS232

The earth terminals of the current outputs are all referred to the same potential.

18 Service and Returns



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Service and Returns:

Xylem Analytics Germany Sales GmbH & Co. KG



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