

Draft

# Operating Instructions Manual

## Intelligent Measuring Transmitters

for pH, redox (ORP), ISE, conductivity, oxygen, chlorine

**MV 3010**

**MV 4010**

**MV 3015**

**MV 4015**

**MV 3016**

**MV 4016**

**MV 3020**

**MV 4020**

**MV 3025**

**MV 4025**

**MV 3030**

**MV 4030**

**MV 3060**

**MV 4060**

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## 1 Overview

The intelligent transmitters are housed in a modular plastic case front 22.5 mm for mounting on top-hat rails. They are excellently suited for continuous measurement of several parameters in connection with central process control PLC instrumentation. The separated self sufficient transmitters work in conjunction with electrochemical sensors and transform their signals to analogue or digital output interfaces. Because of the integrated microprocessor technology the transmitters feature easy basic configuration (kind of output signal current or voltage, output signal scaling, limit etc.) in accordance with the application-specific measuring task by means of the USB-interface and the software program „DinModule“. The manufacturer already does a basic factory adjustment. The user itself can realize changes and further customized adaptations of the basic adjustment before starting or during the measurement. Once the transmitter is pre-adjusted it works with fast calibration buttons on the front of the transmitter. The 3 buttons, one status LED and the LC-Display allow easy calibration by pre-adjustable points for without PC. If the corresponding sensor is influenced by the standard (i. e. pH buffer solution, redox (ORP) buffer solution, conductivity calibration solution, ambient air etc.) pre-adjusted as the corresponding calibration point, the transmitter determines the characteristic sensor data automatically and adjusts the transmission characteristic accordingly.


In addition a more sufficient calibration of the sensor and the corresponding adjustment of the transmitter can be realized by means of a connected PC and the software program „DinModule“.

Each transmitter features measurement of the corresponding parameter and the temperature, if a sensor with integrated temperature probe or a separated temperature sensor is used, two isolated outputs for current 0(4)...20 mA or voltage 0...5 V DC, one floating limit or alarm relay output as well as a USB interface almost for configuration purposes. pH, redox potential (ORP) and ISE (ion selective electrodes) transmitters are suitable for direct connection with combination electrodes and separated measuring chains. Conductivity cells and membrane covered amperometric oxygen sensors for connection with the accompanying conductivity and oxygen transmitter should be equipped with an integrated temperature sensor. The transmitters accept temperature sensors Pt 1000. The chlorine transmitter is suitable for direct connection with sensors for measurement of disinfectants (free and total chlorine, chlorine dioxide, ozone) if these sensors feature a 2-wire analogue current output.

## 2 Safety



This Operating Instructions Manual contains fundamental information that should be observed in connection with the installation, start-up, operation and maintenance of the transmitters. Therefore, it is absolutely vital for the user to read this Manual completely prior to working with it.

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

### User qualification



The transmitters and the entire measuring system have been designed for analytical 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 transmitters come ready for operation. Opening the unit can expose live parts. The electrical connection must be carried out only by qualified personnel. The choice of cable, the installation, and the electrical connection must conform to the requirements of VDE 0100 "Regulations on the Installation of High-Voltage Systems with Nominal Voltages below 1000 V" or the appropriate local regulations. To protect the device from static electrical discharge the user must be electrostatically discharged before touching the instrument! Operates only on SELV or PELV circuits. Fluctuations in supply voltages are only permitted within specified tolerances. The power supply must be fed into the instrument by means of a separate branch. Do not connect any additional loads to the screw terminals for the power supply of the instrument. Any electrical connection deviating from the connection diagram may destroy the instrument. The connection of the power supply and the relay outputs must be done without power connection and with attention to the safety instructions. The load circuit must be fused for the maximum relay current, in order to prevent the output relay contacts from becoming welded in the event of a short circuit. The instrument must not be mounted or dismounted unless it is in dead state and/or the lines are not connected. Lay the input, output, and supply lines so that they are physically separated from each other and are not parallel. Apart from faulty installa-

tion, incorrect settings on the instrument may also affect the proper functioning of the subsequent process or lead to damage. Safety devices should always be provided that are independent of the instrument and only capable of adjustment by specialist personnel. Please observe the relevant safety regulations for such matters. Lay probe cables only as continuous lines, shielded and twisted (**not** via series terminals or similar arrangements). A skilled person who is familiar with the hazards associated therewith should do such work. Electromagnetic compatibility conforms to the standards and regulations cited in the technical data. The instrument is **not** suitable for installation in areas with an explosion hazard. Intervention into the unit will result in expiration of the warranty.

### Installation and getting started



Install the transmitters so that the conditions specified under 'Specifications' will be kept under any circumstances. The necessary top-hat rail for the mounting must be connected correctly with the protective earth – PE. The transmitters cannot be used under outdoor conditions without additional protection enclosure. Do not use any sensor and interface cables other than re-commended by the manufacturer. For the sensors and accessories, the instructions and regulations in the respective operating instructions manuals and specification sheets shall apply.

### Proper usage



The transmitters are 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 8, 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



The transmitters 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 unit may be repaired only by proprietary service points.

The proper functioning and the operational reliability of the transmitters 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.

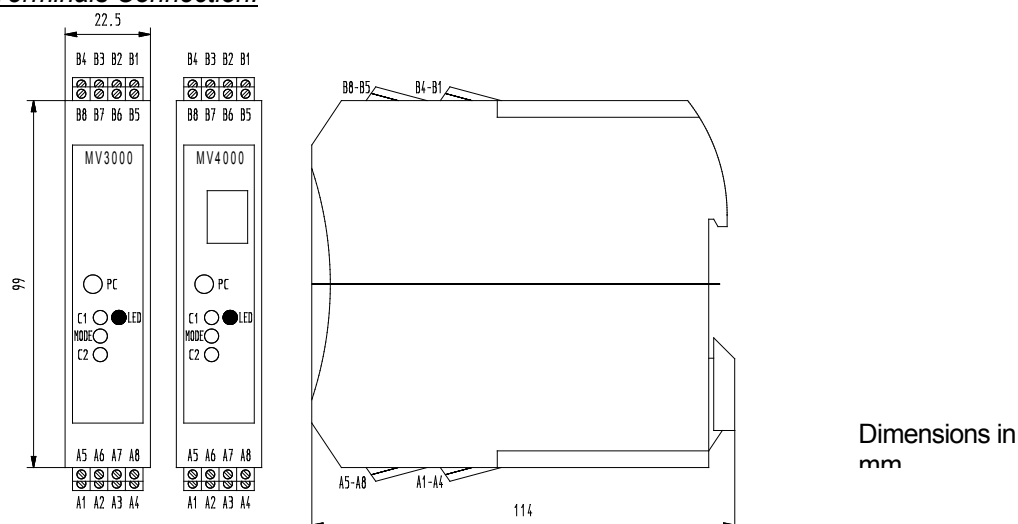
If it is assumed that safe operation of the unit or of its components is no longer possible, remove the unit and its components from service and protect it against unintentional operation. Safe operation will no longer be possible if the unit or its components:

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

If in doubt, please contact your supplier.

### 3 Terminals connection, short operating instruction, factory adjustment

#### Terminals Connection:



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

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

Terminal	pH / redox(ORP) / ISE*	conductivity 2-electrode-cell	conductivity 4-electrode-cell	oxygen	chlorine
A1	guard	screen	measuring electrode	anode	signal input +
A2	measuring electrode	signal wire	supplying electrode	cathode	signal input -
A3	guard	screen	supplying electrode	anode	signal input +
A4	screen/reference electrode		measuring electrode		
A5	temp. sensor Pt 1000-1	Pt 1000-1	Pt 1000-1	Pt 1000-1	Pt 1000-1
A6	temp. sensor Pt 1000-1	Pt 1000-1	Pt 1000-1	Pt 1000-1	Pt 1000-1
A7	temp. sensor Pt 1000-2	Pt 1000-2	Pt 1000-2	Pt 1000-2	Pt 1000-2
A8	temp. sensor Pt 1000-2	Pt 1000-2	Pt 1000-2	Pt 1000-2	Pt 1000-2

\* ISE: ion concentration measurement with an ion-selective electrode

Terminal	Description
B1	power 15...24 V AC/DC
B2	power GND
B3	power GND
B4	power 15...24 V AC/DC
B5	output 1: 0...5 V or 0/4...20 mA refer to GND*
B6	output 0: 0...5 V or 0/4...20 mA refer to GND*
B7	relay closing contact (24 V AC/DC, max. 1 A)
B8	relay closing contact (24 V AC/DC, max. 1 A)

#### Note!

<sup>1)</sup> There is recommended to install a separate power supply unit for supplying of transmitters. With it the stability of electrochemical measuring system can be ensured.

A fit powers supply unit 24V DC / 1A for DIN rail mounting ( for supply of max. 10 transmitters) can be delivered up on request (see 10 Accessories).



The control and regulating outputs must not be used for protective or safety circuits.

\* GND is used as ground connection for the outputs (current or voltage). Switching from current to voltage needs manual change of a jumper inside the transmitter and in addition change in the software configuration program „DinModule“. All transmitters are delivered already pre-adjusted in accordance with your specification.

#### Display (only MV 40xx):



The transmitters of the MV 4000-Series have got a small display in the front panel. It displays the measurement value category 1, the measurement value category 2 and the temperature. Additionally the status of the relays is displayed.

☞ **The display change after 20 minutes automatically in an energy-save-mode / screen-save-mode. By pressing any button of the respective transmitter the display is switched on for 20 minutes again.**

#### Short Operating Instruction for Calibration:

- Change to calibration mode (LED will flash orange / yellow) by pressing MODE. Flashing frequency of the LED is used as an indicator for measuring value stability. Fast and non-rhythmical flashing shows a changing value. Slow and regular flashing indicates a stabilizing measuring value on the input.
- For calibration the sensor/electrode connected with the accompanying transmitter has to be immersed or influenced by the standard solutions or calibration mediums agreed for these calibration points. Pressing button C1 calibrates to calibration point 1 (sensor/electrode in standard solution or calibration medium accordance calibration point 1) and C2 calibrates to calibration point 2 (sensor/electrode in standard solution or calibration medium accordance calibration point 2). The buttons to the calibration points and the corresponding standards can be adapted by means of the configuration software program.
  - pH and ISE transmitter

A two-point calibration with two different standards (including the expected measuring values) is necessary. Because of this each button has to be adjusted to one of these standards. For this the calibration is finished after calibration of the transmitter with the connected sensor in both standard solutions and one pressing of each of the corresponding buttons.
  - Redox potential (ORP), oxygen and conductivity transmitter

A single-point calibration in a standard or test solution or any other suitable calibration medium is sufficient. Thus selectable, both buttons can be adjusted to the same or different standards and only one button has to be pressed for calibration.
  - Chlorine transmitter

The calibration has to be done by a comparison or reference measurement (see point 5.5) because there is no suitable calibration standard available. The concentration of the disinfectants in the measured medium is determined by an independent measuring or laboratory method (i. e. photometric method). The output signal of the transmitter or a display connected with the output signal has to be adjusted by means of the buttons on the transmitter to the reference value. The button C1 increase (0.01mg/l per button press) and the button C2 decrease (0.01mg/l per button press) the output signal or the displayed value. So it is very easy to adjust the output of the transmitter to the current measured value, determined by a comparison or reference method, of the medium where the sensor is immerse in.
- Leave the calibration mode by pressing the button MODE (LED flashes green again, corresponding to measurement mode).

If after pressing button C1 or C2 (for pH after pressing the second button) the LED changes to red a calibration error is occurred (sensor male function or characteristic sensor data outside defined limits, defect cable, failure during calibration etc.). A green LED indicates a correct and valid calibration, means characteristic sensor data are within the defined limits and the transmission characteristic of the transmitter has been adapted to the sensor data. Also for this the transmitter MV 4060 is an exception. The LED indicates a correct and valid calibration only after pressing the mode button (finishing of calibration).

Pre-adjustments of the calibration points buttons C1 and C2 at delivery (factory adjustment):

Button	pH	conductivity 2-electrode-cell	conductivity 4-electrode-cell	Oxygen	Redox (ORP)
C1	pH Buffer Solution acc. NBS pH = 6.87 at 25 °C	Conductivity Stand- ard Solution 0.1 N KCl (12.9 mS/cm at 25 °C)	Conductivity Stand- ard Solution 0.1 N KCl (12.9 mS/cm at 25 °C)	ambient air = 100 % air saturation for oxygen measure- ments in gases	Redox Buffer Solu- tion $U_H = 427$ mV (Pt-Ag/AgCl: 220 mV at 25 °C)
C2	pH Buffer Solution acc. NBS pH = 4.0 at 25 °C	Conductivity Stand- ard Solution 0.01 N KCl (1413 $\mu$ S/cm at 25 °C)	Conductivity Stand- ard Solution 0.01 N KCl (1413 $\mu$ S/cm at 25 °C)	ambient air = 102 % air saturation for dissolved oxygen measurements in water	Redox Buffer Solu- tion $U_H = 675$ mV (Pt-Ag/AgCl: 468 mV at 25 °C)

Measurement categories:

In addition to the main measurement category (i. e. pH, conductivity, etc.) each transmitter delivers several so-called secondary measuring categories determined or calculated from the main measurement category and the temperature as measurement category. The configuration program makes possible to put the following measurement categories to the outputs of the relevant transmitters.

	Measurement category 1	Measurement category 2	Measurement category 3	Measurement category 4	Measurement category 5
<b>MV 3010</b> <b>MV 4010</b>	pH value	electrode voltage in mV			
<b>MV 3015</b> <b>MV 4015</b>	redox potential (ORP) as abso- lute voltage in mV	redox potential (ORP) referred to the standard hy- drogen electrode in mV			
<b>MV 3016</b> <b>MV 4016</b>	ISE voltage in mV	ion concentration in concentration units			
<b>MV 3020</b> <b>MV 4020</b> <b>MV 3025</b> <b>MV 4025</b>	conductivity in mS/cm or $\mu$ S/cm	resistance in ohms	salinity in g/kg*		
<b>MV 3030</b> <b>MV 4030</b>	oxygen saturation index in %	oxygen concentration in mg/l or ppm	sensor current in nA	oxygen partial pressure in kPa	air pressure **
<b>MV 3060</b> <b>MV 4060</b>	concentration in mg/l	sensor output current in mA			

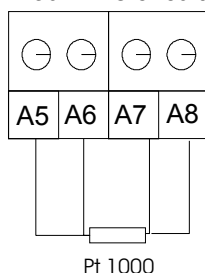
\* The salinity is a sum parameter specifically for seawater. Table values from the National Institute of Oceanography of Great Britain and UNESCO define a salinity range of 2 to 42 g/kg. These table values are the basis for the calculation of the salinity referred to the measured conductivity. Because of the limited range of 2 ... 42 g/kg a calculation of salinity is only possible in the conductivity measuring ranges of 0...20 mS/cm and 0...100 mS/cm.

\*\* Only the model MV 4030-LK measures the current air pressure.

## 4 Sensor Connection Diagrams

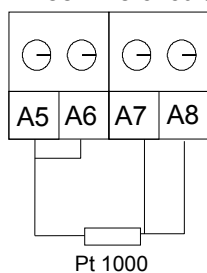
### 4.1 Temperature Sensor

Four-wire circuit

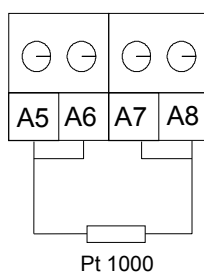


	<b>A5</b> PT1000-1	<b>A6</b> PT1000-1	<b>A7</b> PT1000-2	<b>A8</b> PT1000-2
measuring cable K 43-PT/...	cable core	cable core	shield	shield

Three-wire circuit

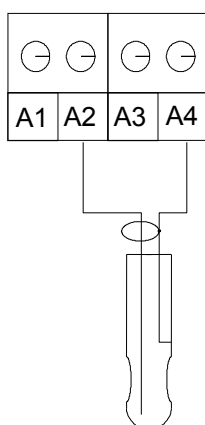


Two-wire circuit



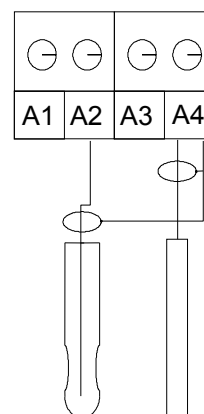
## 4.2 pH/redox (ORP) and Ion-Selective (ISE) Electrode

Combination electrode



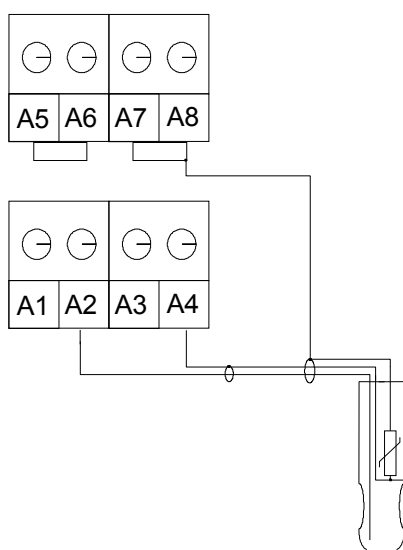
	<b>A1</b> guard	<b>A2</b> pH-signal	<b>A3</b> guard	<b>A4</b> reference
measuring cable K 43/...	-	cable core	-	shield

Separated measuring  
and reference electrode

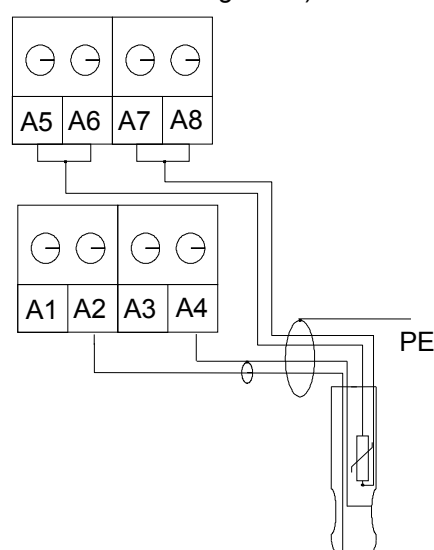


	<b>A1</b> guard	<b>A2</b> pH-signal	<b>A3</b> guard	<b>A4</b> reference
pH sensor	-	cable core	-	shield
reference electrode	-	-	-	cable core

pH combination electrode  
with integrated temperature  
sensor



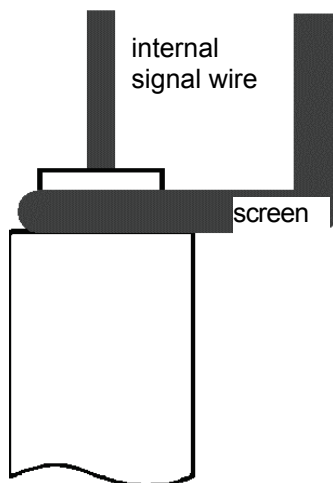
pH combination electrode with  
integrated temperature sensor  
(K 19 multi wire measuring cable)





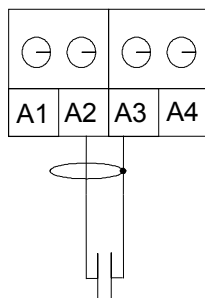
	<b>A1</b> gu- ard	<b>A2</b> pH-signal	<b>A3</b> gu- ard	<b>A4</b> reference	<b>A5</b> PT1000-1	<b>A6</b> PT1000-1	<b>A7</b> PT1000-2	<b>A8</b> PT1000-2
measuring cable K 54/...	-	cable core (bl)	-	inner shield (rt)	bridge circuit to A.6	bridge circuit to A.5	bridge circuit to A.8	outer shield (grey)
measuring cable K 19/...	-	cable core	-	shield	green	brown	yellow	white
measuring cable K-VP	-	cable core	-	red	gray	white	green	pink

Especially for connection of the measuring cable and triaxial cable for pH, redox and ISE measuring electrode on the high resistive input of the transmitter pay attention that the internal signal wire is as short as possible and remains coated as far as possible by the screen.



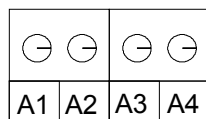
#### 4.3 Conductivity Measuring Cell, Oxygen and Chlorine Sensor

conductivity  
2-electrode-cell



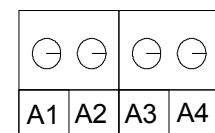
	<b>A1</b> -	<b>A2</b> measur- ing elec- trode	<b>A3</b> measur- ing elec- trode	<b>A4</b> -	<b>A5</b> PT1000-1	<b>A6</b> PT1000-1	<b>A7</b> PT1000-2	<b>A8</b> PT1000-2
measuring cable K 43/...	-	cable core	shield	-	-	-	-	-
measuring cable K 18/...	-	white	shield	-	grey	green	brown	pink
measuring cable K-VP	-	cable core	blue	-	grey	white	green	pink

conductivity  
4-electrode-cell



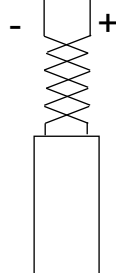
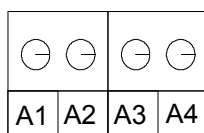
	<b>A1</b> measuring elec- trode	<b>A2</b> supply- ing elec- trode	<b>A3</b> supply- ing elec- trode	<b>A4</b> measuring elec- trode	<b>A5</b> PT1000-1	<b>A6</b> PT1000-1	<b>A7</b> PT1000-2	<b>A8</b> PT1000-2
measuring cable K 17/...	pink	brown	green	grey	shield	white	yellow	blue
measuring cable K-VP	core	red	blue	grey	white	white	green	pink

Membrane covered amperometric oxygen sensor



	<b>A1</b> -	<b>A2</b> Cathode	<b>A3</b> Anode	<b>A4</b> -	<b>A5</b> PT1000-1	<b>A6</b> PT1000-1	<b>A7</b> PT1000-2	<b>A8</b> PT1000-2
measuring cable K 39/...	-	white	shield	-	grey	brown	green	pink
MF 41-N, MF 441 fix cable	-	white	shield	-	grey	green	brown	yellow
measuring cable K-VP	-	Cable core	rot	-	grey	white	green	pink

Sensor for disinfectants  
(chlorine, chlorine dioxide,



An integrated or separated temperature sensor connected as per para. 4.1.

## 5 Calibration by Buttons

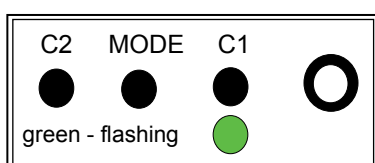
### 5.1 pH Transmitter Calibration (ISE Transmitter)

For an easy and simple “during operation” calibration of a transmitter connected with the accompanying electrode use the three buttons on the front of the transmitter. Buttons C1 and C2 define calibration points, which correspond to standard solutions including the estimated measuring range. If the connected electrode is immersed into the standards (i. e. pH buffer solution) accordance to the calibration points, the transmitter calculates automatically the characteristic data of the sensor and adjusts the transmission function in accordance with these data.

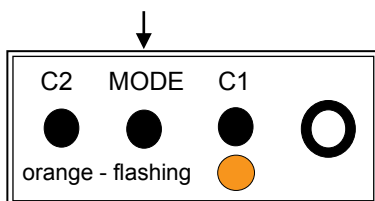
As an example the calibration of a pH transmitter with the factory adjustment acc. para. 3 is described. The configuration software program makes possible to change these values to other buffer solutions. This feature automatically use of the correct pH value acc. actual temperature for measurements and calibrations with connected temperature sensor (pay attention to the temperature equilibrium of electrode and temperature sensor). It is equal which buffer solution is used first for calibration; only the use of the correct button for the accompanying buffer solution is necessary for a correct calibration.

#### Operation:

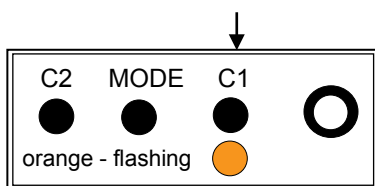
- The transmitter is in the normal measuring mode, indicated by the green flashing LED.



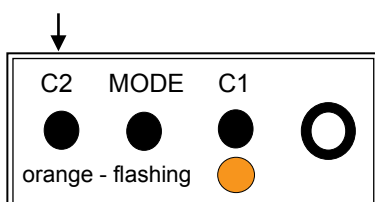
- Change to the calibration mode by pressing the button MODE. The LED is changing the colour to orange.



- Immerse the ready to measure electrode/sensor into the first pH buffer solution. A fast non-rhythmical flashing of the orange LED indicates the changing measuring value. If the measuring value is stabilising, the flashing will be slowly and rhythmical.
- Now press the button C1 in accordance with the first buffer solution (first calibration point i. e. pH 6.87).



- Rinse the electrode/sensor with distilled / deionised water and immerse it into the second buffer solution. The orange LED indicates a stabilising measuring value, by flashing slowly and rhythmical.
- Now press the button C2 in accordance with the adjusted second buffer solution (second calibration point i. e. pH 4.01).

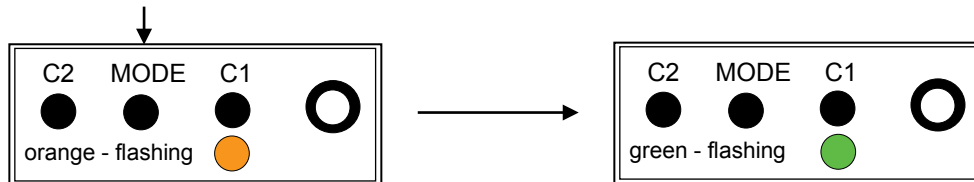


- The calibration is correct finished if after pressing the button for the second buffer the LED changes to green. All characteristic data of the electrode/sensor are within acceptable limits and the transmission characteristic of the transmitter is adjusted in accordance with these data. If the LED changes for a short time to red a calibration error is occurred or the characteristic sensor da-

ta are outside defined limits. The calibration data determined during this calibration are not accepted and not stored in this case. Pay attention that a calibration error is shown after use of the second standard solution only.



- To finish the calibration change to the normal measuring mode by pressing the button MODE. Now the LED is flashing green again.



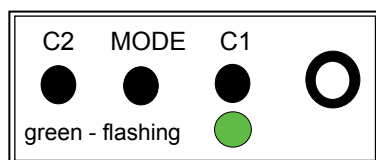
The calibration of an ion-selective measuring chain (ISE combination electrode or separated ion-selective measuring electrode and reference electrode) in connection with an ISE Transmitter is nearly identical to the pH calibration. It is a two-point calibration with corresponding standard solutions for the kind of ions to be determined. The used standard solutions with their concentration unit (i. e. mg/l, ppm etc.) determine the measuring range and the concentration unit for the measuring output. Use the buttons C1 and C2 for an easy “during operation” calibration with defined standards as well. Adjust the buttons in accordance with the standards, which should include the estimated measuring range. Because of the different value of the ions a check of the characteristic data of the sensor is not possible. A correct calibration needs that always one calibration point (accompanying standard) should be located in the above third part and one calibration point is located in the below third part of the measuring range. Pay attention to the temperature dependence of the standard solutions. Calibration needs special experiences and attendance like always the application of ion-selective electrodes (ISE).

## 5.2 Conductivity Transmitters Calibration

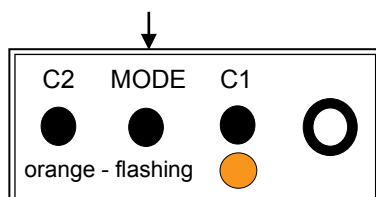
For conductivity measurement a single-point calibration is sufficient. By means of the three buttons and the definition of a correct calibration point the calibration of the transmitter with the accompanying measuring cell “during operation” is very easy and simple. Use the calibration points defined by the factory adjustment acc. para. 3 in accordance with the estimated measuring range. The temperature dependence of the conductivity of these standards is stored within the transmitter and is calculated in accordance with the actual temperature given by the temperature sensor integrated in the measuring cell (pay attention to the necessary time for temperature equilibrium of medium and temperature sensor). Other calibration points can be adjusted by means of the configuration software program. Always a correct calibration based on use of the stored calibration standard solutions accordance the accompanying buttons.

### Operation:

- The transmitter is in the normal measuring mode, indicated by the green flashing LED.



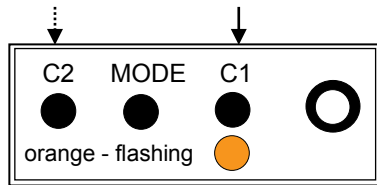
- Change to the calibration mode by pressing the button MODE. The LED is changing the colour to orange.



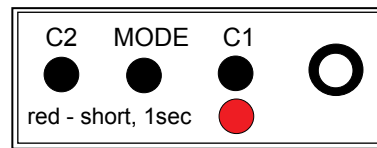
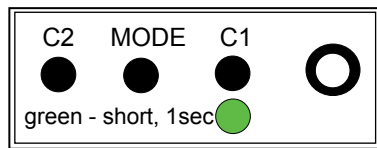
- Now immerse the ready to measure conductivity cell (before calibration rinse with distilled / deionised water) into the conductivity standard solution in accordance with the programmed button C1

or C2. A fast non-rhythmical flashing of the orange LED indicates the changing measuring value. If the measuring value is stabilising, the flashing will be slowly and rhythmical.

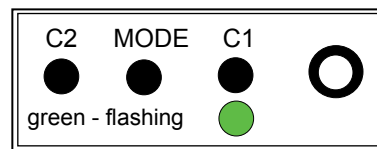
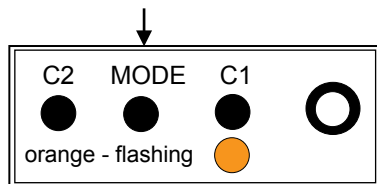
- Now press the button in accordance with the used conductivity standard solution (calibration point).



- The calibration is now correct finished if after pressing the button the LED changes to green. The characteristic data of the cell (cell constant) is within acceptable limits and the transmission characteristic of the transmitter is adjusted in accordance with this data. If the LED changes for a short time to red a calibration error is occurred or the characteristic cell data is outside defined limits. The determined calibration data are not accepted and not stored in this case.



- To finish the calibration change to the normal measuring mode by pressing the button MODE. Now the LED is flashing green again.



### 5.3 Oxygen Transmitter Calibration

Calibration and adjustment of an oxygen transmitter in conjunction with the accompanying sensor are completely identical to the calibration of a conductivity transmitter because that is a single-point calibration too. The factory adjustment acc. para. 3 for the buttons C1 and C2 define calibration points, which correspond to an easy calibration of the sensor in air for different applications. For both applications, measurement of the oxygen content in air (i. e. for composting technology or air supervision within buildings) and measurement of the dissolved oxygen in water or liquids, always ambient with as an average value 20.9 Vol.-% oxygen is used as calibration medium (like a standard). Pay attention to the necessary time for temperature equilibrium of medium and temperature probe integrated into the sensor. Other calibration points can be adjusted by means of the configuration software program. Always a correct calibration for oxygen is based on use of the pre-defined calibration point accordance the accompanying buttons. In addition pay attention to give the sensor the necessary time for temperature equilibrium especially for rapid temperature changes by putting the sensor from water into air.

### 5.4 Redox (ORP) Transmitter Calibration

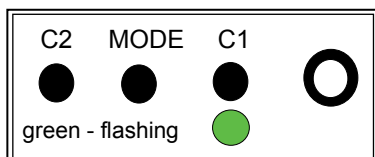
Redox potential (ORP) measurement is the measurement of the potential between platinum measuring electrode and the reference electrode, mostly combined as a common unit, the redox or ORP combination electrode. The output of the transmitters follows this potential proportionally. Usual a calibration is not necessary and mostly not requested. Anyway, the correct function of the redox measuring system can be checked by means of redox (ORP) calibration solutions. Thus if requested and/or necessary the adaptation of the transmitter characteristic to the calibration result is possible as a linear transformation so that the measuring output is identical to the potential of the given redox (ORP) standard solution (calibration and adjustment). The calibration of a redox (ORP) transmitter is completely identical to the calibration of a conductivity transmitter as a single-point calibration. In accordance with the estimated measuring range two different redox standard solutions are defined for the buttons 1 and 2 as calibration points in the factory adjustment acc. para. 3. The temperature dependence of the redox potential of these standards is stored within the transmitter but can be used if a temperature sensor is connected only (pay attention to the necessary time for temperature equilibrium of medium and temperature sensor). Other calibration points can be adjusted by means of the configuration software program. Basis for a correct calibration is always to use the stored calibration standard solution in accordance with the accompanying button.

## 5.5 Chlorine Transmitter Calibration

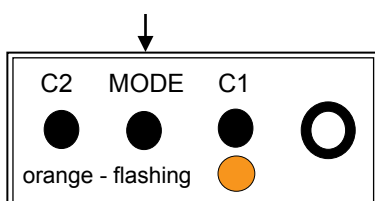
The calibration of the chlorine transmitter is a single-point calibration. At this the current chlorine value of the medium where the sensor is immersed in has to be measured by a reference or comparison measurement (e.g. DPD-method). The transmitter's output value (analogue output signal, display connected with the analogue output, display on the display unit) has to be adjusted to the so determined current value if the sensor is immersed in the same medium.

### Operation:

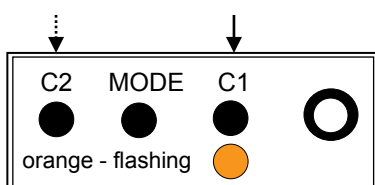
- The transmitter is in the normal measuring mode, indicated by the green flashing LED.



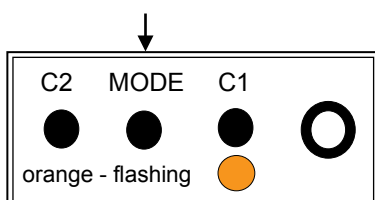
- Change to the calibration mode by pressing the button MODE. The LED is changing the colour to orange.



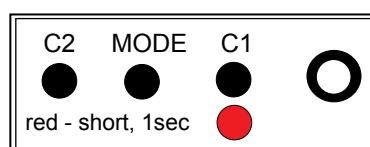
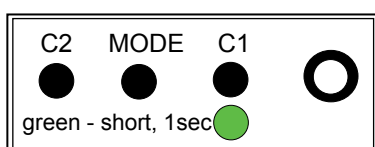
- Now adjust with C1 (value increases with each single button press at 0.01 mg/l) and C2 (value decreases with each single button press at 0.01 mg/l) the exact chlorine value measured by reference measurement. (e.g. DPD). For a great difference the buttons can be pressed a longer time. Important for this calibration is the visual check of the output signal given by the transmitter. This can be done either by means of the software "DinModule", the displayed value on the display unit AZ 3000 or via the analogue output signal. By using an analogue output signal for checking the adjustment it is important to switch off the "HOLD" function during calibration (software "DinModule", button configuration). Otherwise the analogue output signals are frozen during the calibration (see also para. 6.3 Configuration) and you cannot check any adjustment.



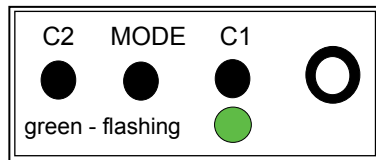
- To finish the calibration change to the normal measuring mode by pressing the button MODE.



- Now the LED is flashing green again. The calibration is correct finished, all characteristic data of the electrode/sensor are within acceptable limits and the transmission characteristic of the transmitter is adjusted in accordance with these data. The transmitter is working in measurement mode again. If the LED changes for a short time to red a calibration error is occurred or the characteristic sensor data are outside defined limits. The calibration data determined during this calibration are not accepted and not stored in this case.



- The transmitter is in the normal measuring mode again, indicated by the green flashing LED.



## 6 PC Software Program „DinModule“

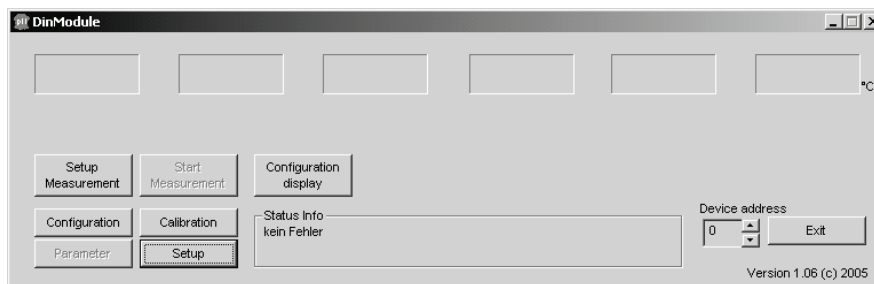
### MV 3025/4025:

Precondition for a successful communication between 4-electrodes-measuring-transmitters MV 3025/4025 and the PC-software „DinModule“ is the software version „DinModule 1.07“ or higher.

### 6.1 Installation and Setting into work

The software program „DinModule“ features at first configuration of the transmitters. In addition the simultaneous evaluation of the measured values on the PC independent to the analogue output signals is possible (on-line measurement). If the program „DinModule“ is already not installed on your PC, please use the delivered CD-ROM / disk and install the program following the installation guide. You can also download the actual version of PC-Software „DinModule“ on <http://download.meinsberg.de/en/>.

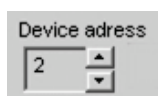
Connect the transmitter to the PC (Windows 98 or higher required) via cable connection with the phone plug between the connection socket RS-232 on the front of the transmitter and the RS-232 connector and start the program.



Before initial use of the software set the button „Setup“ to the correct data interface board COM and select your most convenient language.



First to allow the communication between the transmitter and the PC the correct address of the transmitter to be configured should be adjusted. Factory adjustment of all transmitters if they are not combined to a complete measuring system is the address 0.



If the address of the transmitter is unknown, you should use the address 255 and so check the adjustment and configuration of the transmitter. In this case please pay attention that it is not possible to connect several transmitters to a network because these also react to the same address 255 (see also para 0).

Device address

255

## 6.2 On-line Measurement

If a simultaneous measurement, storing and evaluation of the measured parameters on the PC are requested please adjust the interval time with the button "Setup Measurement". "Start Measurement" will be activated and the evaluation will start after pressing this button.

Setup Measurement Start Measurement

The interval time is the scan rate and defines the time between the measured values are stored in the file „daten.txt“.

Date	Time	Conductivity	Temperature	x	x	Resistance	x
26/01/2004	13:36	0.93	25.0	0	0	1079.63	0
26/01/2004	13:36	0.93	25.0	0	0	1080.72	0

In accordance with the kind of measured values the actual sensor characteristic data (calibration values) are shown.

**DinModule**

cond. value: 5330  $\mu\text{S/cm}$  resistivity: 0.2  $\text{k}\Omega\text{cm}$  salinity: 0.0  $\text{g/kg}$  temperature: 25.0  $^{\circ}\text{C}$

Logging file: test.txt cell const.: 1.00 temp. coef.: 1.88 cable offset: 0.00

Setup Measurement End Measurement Configuration display

Configuration Calibration Status Info: no error

Device address: 2 Exit

Version 1.06 (c) 2005

### i. e. Conductivity Transmitter

**DinModule**

saturation: 100.6 % concentration: 8.77  $\text{mg/l}$  sensor current: 123  $\text{nA}$  partial pressur: 208  $\text{hPa}$  air pressur: 1013  $\text{hPa}$  temperature: 22.1  $^{\circ}\text{C}$

Logging file: test.txt slope: 113.4  $\text{B} < 20^{\circ}\text{C}$ ; 2900  $\text{B} > 20^{\circ}\text{C}$ ; 2800

Setup Measurement End Measurement Configuration display

Configuration Calibration Status Info: no error

Device address: 1 Exit

Version 1.06 (c) 2005

### i. e. Oxygen Transmitter

The measured values are shown within the small display windows in accordance with the kind of transmitter and parameter. So it is possible and easy to check each parameter and the development. The measurement and the evaluation of the parameters can be finished if all measuring tasks are realised.

## 6.3 Configuration

Konfiguration

By pressing the button "Configuration" all the actual configuration data of the measuring transmitter are picked up and displayed. Now it is possible to change the configuration parameters in accordance with the individual needs. DAC1 resp. DAC2 are the two analogue outputs. Determine the measured parameter for the outputs in accordance with the model of transmitter and scale them within the given limits. For this configuration it is important to define the kind of output parameter (current or voltage) and if you select current you should define the range (current type 0...20 mA or 4...20 mA).



The control and regulating outputs must not be used for protective or safety circuits.



The transmitter comes pre-adjusted in accordance with your order. If it is necessary to change the kind of the output parameter (current to voltage or reverse) please contact the manufacturer because in addition to the software adjustment a change of a jumper on the electronic board is necessary (see para. 3).

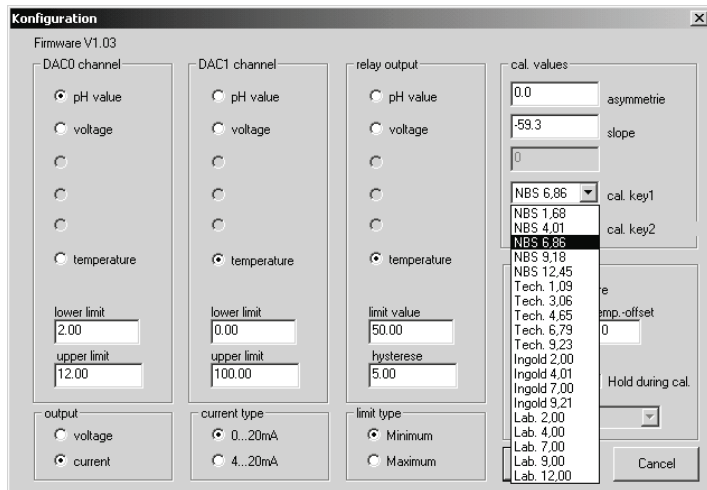
e.g. Conductivity Transmitter

e.g. Oxygen Transmitter

Configure the alarm / limit relay in accordance with the output configuration. In addition adjustment of the limits and the hysteresis as well as the kind of contact (minimum or maximum) are necessary.

#### Calibration data:

All actual characteristic sensor data determined for the individual connected sensor (i. e. slope, zero point, cell constant) which defines the transmission function of the transmitter (calibration data) as well as both calibration points with their accompanying standards and buttons are shown here (compare with para. 5.). To use the feature of the stored temperature relation of the standards it is necessary to select applicable standards from defined sets (i. e. pH Buffer Solution acc. NBS) by selecting the nominal values at 25 °C. In addition it is possible to select and define individual standards but thus the temperature relation cannot be recognized. Pay attention to give the calibration points for the conductivity transmitter in the correct unit (mS/cm or µS/cm) depending on the adjusted measuring range.



Selection of the standard solutions e.g. pH buffer solutions

### General adjustments:

If the transmitter works without temperature sensor a fixed temperature can be adjusted. Insert the adequate temperature. In addition it is possible to adjust a linear change of the measured temperature in relation to a reference value as temperature offset so that the measured temperature is identical to a comparable measurement may be with higher accuracy.

To define the address of the transmitter unit is an important point. If several uniform or different transmitters are connected within a network, each transmitter should have his own device address. It is important that this address is unique per system so that each transmitter can be clearly selected. (see also para 6.1).

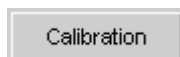
With firmware V 1.05:

*The function "Hold during calibration" has to be activated if the analogue output signals during the calibration time should be frozen (at the current value before pressing the button MODE). Otherwise both outputs show the current values during calibration mode with the adjusted calibration parameters too. "Hold during cal." has to be not activated for calibration of a chlorine transmitter by comparison measurement and adaptation of the analogue output signals (see para. 5.5).*

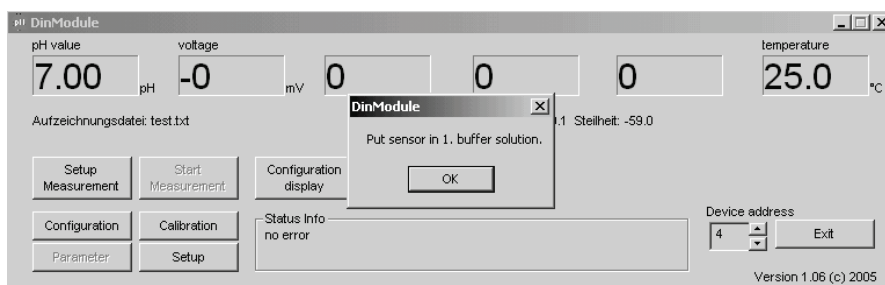
## 6.4 Calibration

By pressing the button "Calibration" the menu-guided calibration in accordance with the kind of transmitter starts. In addition to the calibration with pre-defined standards (see para 3. and 5) a calibration of the transmitter made by a comparison measurement is possible (i. e. comparison measurement with a laboratory or pocket meter in the same medium, laboratory analysis etc.). The user is guided step by step through the process.

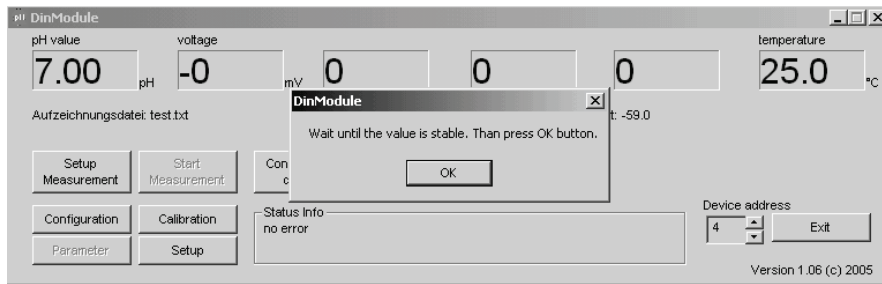
As an example the following shows the calibration of a pH transmitter. All the configuration and calibration work based on the correct input of the accompanying device address of the transmitter to be calibrated.



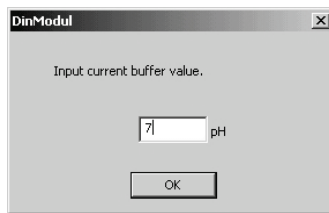
After pressing the button „Calibration“ you will be requested to immerse the ready to use pH electrode into the buffer solution. Simultaneously the actual measured values will be shown in the measurement windows.



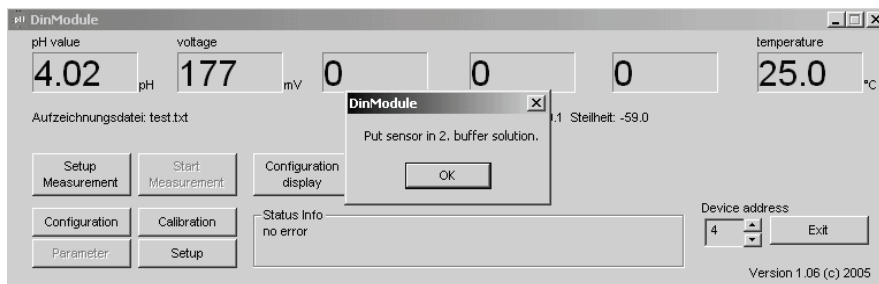
Confirm the immersion of the electrode in the buffer solution with „OK“.



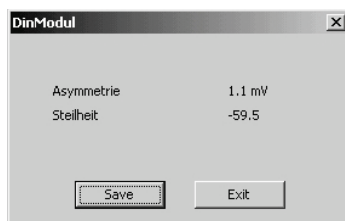
If the shown value is stabilizing (pay attention to the necessary response time and temperature equilibrium) confirm this with „OK“ too. The following dialog window requests you to give the pH value of the used standard (at the actual temperature) or to select the nominal value of the buffer solution at 25 °C of stored buffer sets.



After rinsing the electrode with deionised /distilled water and immersion into the second buffer or standard solution repeat these steps for this second buffer solution.



After successful finish of the calibration a dialog window appears with the new calculated characteristic sensor data (calibration data). Now you can decide if you want to store and use these new data or not.



The calibration of the other transmitters by means of the software program is nearly identical to the shown example of the pH transmitter and also menu-guided. The two-point calibration of the ISE transmitter depends from the kind of the ion concentration to be measured, the used ISE and the standard solutions. The standard solutions define the measuring range and the concentration unit. A single-point calibration is sufficient for conductivity, redox (ORP) and oxygen.

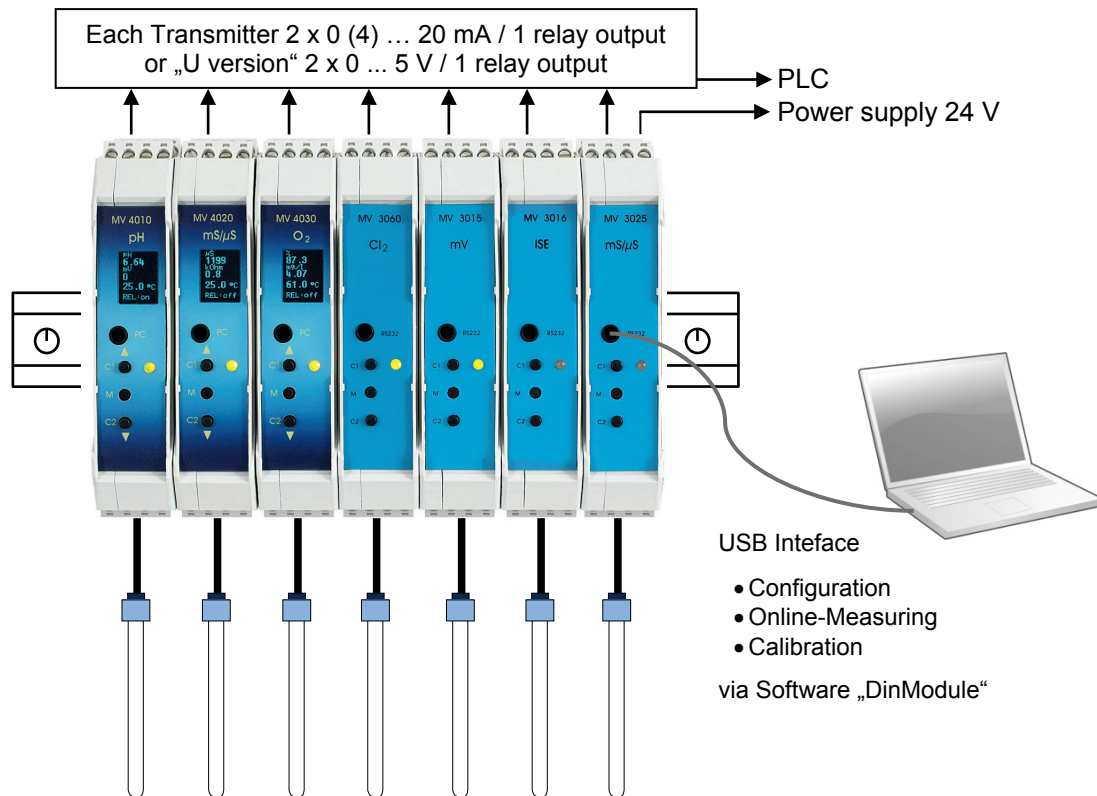
#### Adjustment of the actual air pressure and calibration of the air pressure measurement:

Adjustment of the actual air pressure is necessary for calibration of the oxygen measurement if high accuracy is required. The special version Oxygen Transmitter MV 4030-LK features an internal air pressure sensor for automatic air pressure measurement. This measurement has to be adjusted to the actual air pressure. The oxygen transmitter without internal air pressure measurement makes possible to adjust the air pressure to a known value. Information about the actual air pressure in your area you can get by an independent measurement or from the Internet or newspapers.

## 7 Connection of several transmitters to a network (multi-parameter instrumentation)

By means of the bus connection it is possible to realize a complete network between several transmitters MV 3000 and MV 4000 (uniform or different parameters).

The correct definitions of the unit addresses are most important for connection of the transmitters to a network. Up to 32 addresses are possible (0...31). Pay attention that there is no address twice within the network. It is recommended to use the addresses start with "1". So you can use the address "0" (factory adjustment) for later extension of the network with one transmitter. To change the addresses, use the configuration program "DinModule".



## 8 Maintenance, Disposal

The transmitters of the series MV 40xx are almost maintenance-free. In the case of dirtying it is only allowed to clean the outsides with a wet drapery. For this the modules must be disconnected from the power supply! Cleaning with aggressive detergent with contains solvents (e.g. acetone) is forbidden. Otherwise damaging of the ABS-case may occur.

### 8.1 Sensor / Electrode Maintenance

For maintenance and storage of the sensors / electrodes please observe the corresponding manuals of the sensors / electrodes.

### 8.2 Disposal

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>

## 9 Specifications

<b>Configuration</b>	by means of the USB interface and corresponding configuration program <ul style="list-style-type: none"><li>• Scaling and determining of the analogue output signals</li><li>• Calibration menu, definition of the calibration points</li><li>• Temperature compensation</li></ul>
<b>Display</b>	graphic LCD, 48 x 64 pixel, self-luminous, display for 3 values (value 1, value 2 and temperature value)
<b>Buttons functions</b>	MODE: Changing into calibration mode C1, C2: Calibration values (pre-adjusted configuration) or adjustment of the output signal by comparison or reference measurement (chlorine transmitter)
<b>Status Indication</b>	multi-coloured LED (stable value signalisation) LED orange: Calibration    LED green: Measurement    LED red: Calibration error
<b>Output signals</b>	2 x 0(4) ... 20 mA or 0 ... 5 V, isolated
<b>Current output signal</b>	load $\leq 500 \Omega$ , accuracy $\leq 0,2 \%$
<b>Voltage output signal</b>	load $\geq 2 \text{ k}\Omega$ , accuracy $\leq 0,2 \%$
<b>Interface</b>	USB, bus connectable to a network by RS-232
<b>Relay output</b>	closing contact 24 V AC/DC, max. 1 A
<b>Power supply</b>	15 ... 24 V AC/DC, about 1.5 VA
<b>Ambient temperature</b>	0 ... 50 °C
<b>EMC</b>	2004/108/EC, EN 61326 class B Conformity to EMC guidelines Immunity, ESD (EN 61000-6-2)  Radio frequency ,                      Air: $\pm 4\text{kV}$ , criterion A Burst                                        10V/m, criterion A Power: $\pm 2\text{kV}$ ; 5/50 ns; 5kHz I/O Signal: $\pm 1\text{kV}$ ; 5/50 ns; 5kHz, criterium B Surge                                        Power: $\pm 1\text{kV}$ ; 1,2/50 $\mu\text{s}$ , criterion A Conducted disturbance                10V, criterion A Emission standards (EN 55011) Radiated and conducted emission, Class B
<b>Enclosure</b>	plastic case for mounting on rail tracks DIN EN 50022-35, protection degree IP 40
<b>Electrical connections</b>	mountable screw-terminals for wires cross section 0.2...2.5 mm <sup>2</sup> ; 3-pins socket for RS-232 cable connector; optional rail track bus-connector

Measuring ranges, recommended electrodes/sensors suitable for connection to the transmitters and dimensional enclosure drawings in accordance with the individual detailed technical data sheets.

## 10 Accessories

<b>Interface MV USB</b>	Interface cable connection for the USB connection (3 pins stereo jack / USB connector)
<b>Rail track bus connector</b>	Connector for direct mounting on the plastic enclosure for network connection of several measuring transmitters by the RS-232 interface
<b>Power supply unit</b>	Power supply unit in an enclosure for mounting on rail tracks (input 85 ... 264 V AC; output 24 V)
<b>Protection enclosure IP 65</b>	Protection enclosure for outdoor field mounting for one or several measuring transmitters upon request