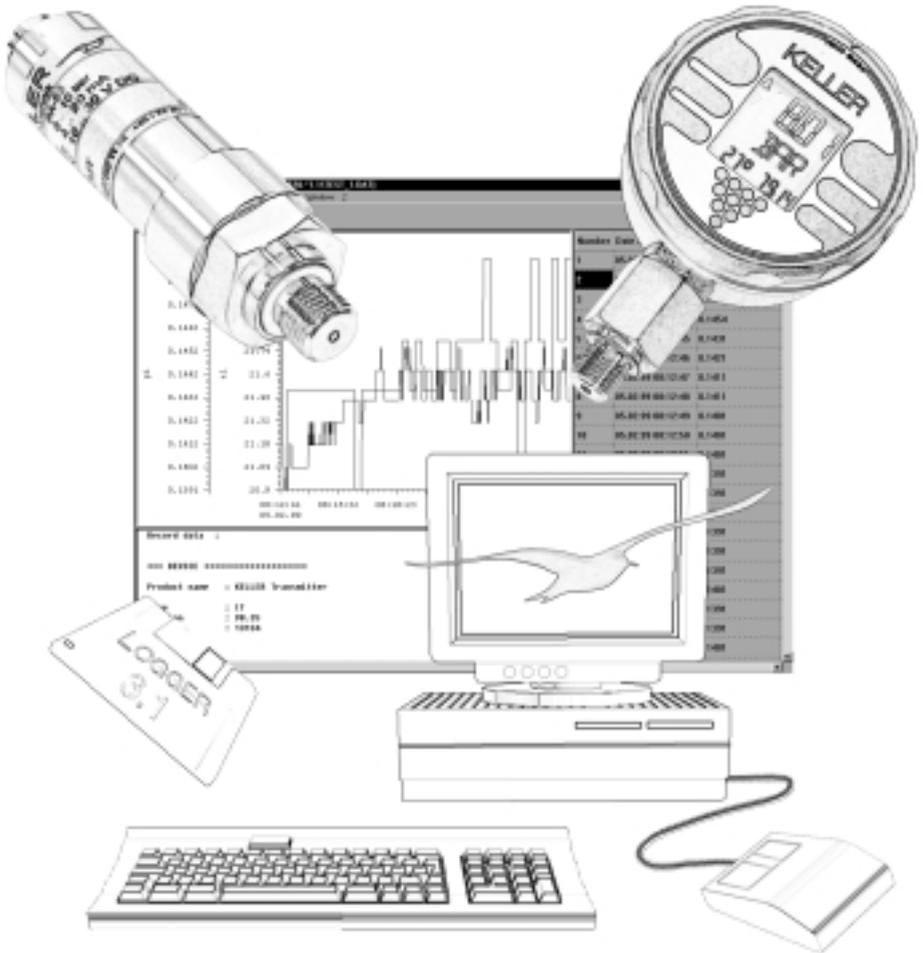


OPERATING MANUAL

LOGGER 3.1 FOR WINDOWS



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Please read these instructions carefully before working with the Logger Program. They contain important information and explain the operation of the program. This manual is written for various applications. It is possible that not all functions which are described here are available in the software which you have.

Currently available applications:

- Standard Standard Logger
- Waterlevel Logger for water level sensors

Information on the current application can be found in the program under ? ➔ **Info**.

STANDARD LOGGER

INTRODUCTION/GENERAL INFORMATION

The Logger program enables the initialization and read out of the data memory from intelligent KELLER transmitters and manometers via a serial interface or bus. The data can be visualized (in tabular form and graphically), saved and printed.

The current Logger initializes and reads data (so-called records) from the following KELLER products:

- Intelligent Transmitters IT (e.g. Series 53, 55, 56, DC-25)
- Intelligent Manometers IM (e.g. MR2, COOL)

Installing the Logger Program

Insert diskette in drive A: Call up the Setup program setup.exe.

A directory (C:\Keller) is created automatically. The program, Logger.exe, and the corresponding initialization file, Log*.ini, which determines the application are stored in this directory.

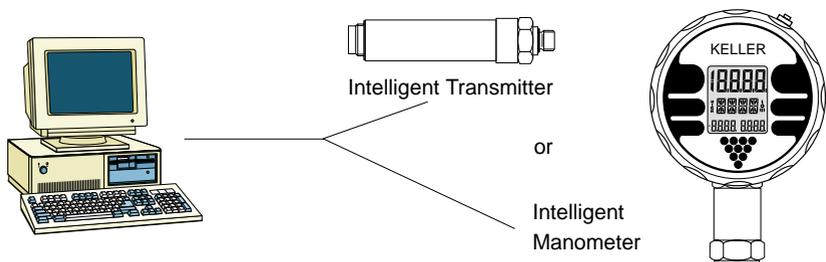
Windows 3.1x A separate program group "KELLER" is created with the programs "Logger 3.1 Standard" and "Logger 3.1 Waterlevel" in the Program Manager.

Windows 95 A separate group "KELLER" is created with the program "Logger 3.1" in the Start bar. After installation, the program can also be started via the desktop.

This Logger is a Windows 3.1 application. Please use only 8-character names for directories and files.

Connection

Connection schematic for individual devices



The device is connected to a free COM port of the PC with the appropriate KELLER converter cable (e.g. K-101...K-103).

The maximum cable lengths are dependent on the type of converter used. This information can be taken from each converter description.

An external supply for the interface cable is not necessary as the power is supplied by the PC.

INITIAL STEPS

Starting the Program

Start the Logger program.

Windows 3.1x Start the program via the Program Manager

Windows 95 Start the program via the Start bar or

 Start the program directly after installation via the desktop.

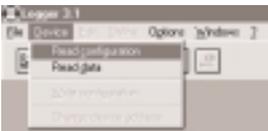
After starting, the main window of the Logger 3.1 for Windows appears. The normal Windows features are available. Functions which are not available in the current condition are labelled in gray and can not be clicked on.

On-line Mode

In on-line mode, the current measurement data can be displayed on-line on the screen.

The first prerequisite for the on-line mode is the recognition of the connected device. This recognition is achieved by loading the device configuration.

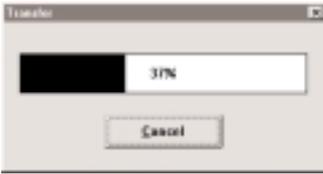
To do this, select **Device** and then the function **Read configuration** in order to read the configuration from the device.



In the **Read from Device** window, specify the COM port of the PC to which the device is connected.

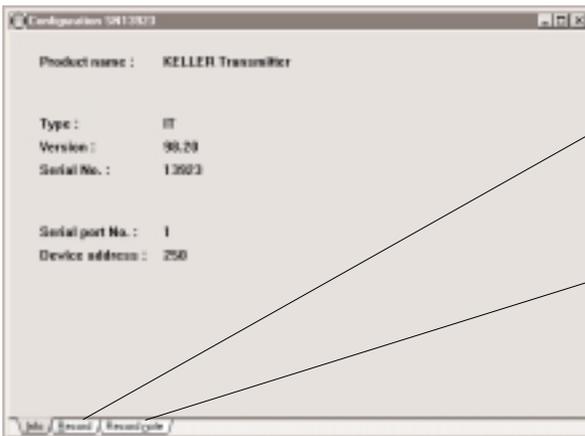


If the progress bar in the **Transfer** window has not changed, then the connection from the PC to the connected device should be checked (*Fault Rectification / General Information* on page 21).



An information window on the record status can appear depending on the status of the connected device. The messages are described in the *Glossary* on page 23.

After reading the configuration, the following window appears with information on the device read:



Configuration of the record

Insert of a comment

Detailed explanations of **Record** and **Record note** can be taken from the following chapters.

Important!

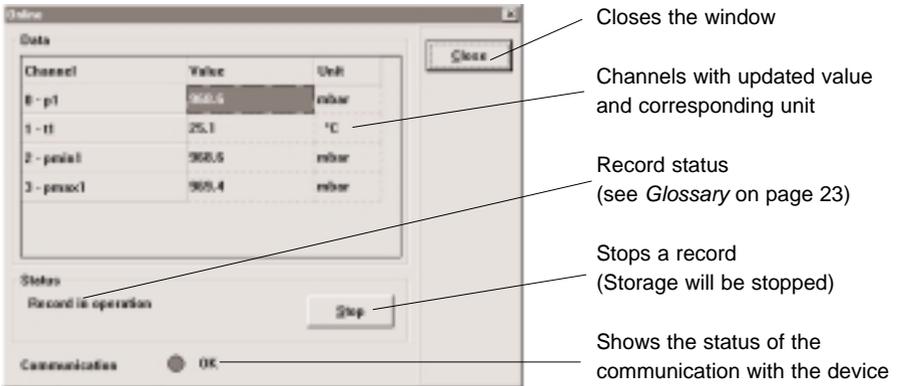
With the reading in of the configuration, the Logger automatically recognises the corresponding device type and the version. Devices of the same type can therefore be connected one after the other and the data read out without having to read the configuration again.

The list of registered and therefore automatically recognisable devices is accessible in the main menu under ? ➔ **Registered device(s)**.

Now select **Online** ➔ **Display**



Afterwards, the **Online** windows appears:



Each of the active channels is displayed with the corresponding measured values and the appropriate unit of measurement. They are continuously updated. The measuring rate of the on-line function amounts to 1 measured value/second.

The values are displayed in the following units:

Intelligent Transmitter ➤ factory set unit

Intelligent Manometer ➤ the unit set on the device

The actual display by means of Online is only possible for one device at a time.

CREATING DEVICE CONFIGURATION AND STARTING A RECORD

Two important points should be observed for the combination between the Logger program and the devices:

- 1.) Always read the configuration of the actual device first! Because the Logger works with various devices, identification of the device must always take place.
- 2.) Except via the Online function, you are never connected with the device on-line! If you make changes, they must be communicated to the device via **Write configuration**.

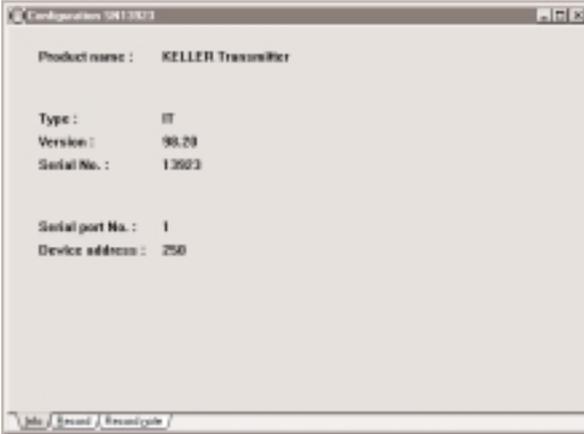
If not already done, carry out **Device ➤ Read configuration** in order to read a configuration from the device.

Indicate the appropriate COM-Port in the **Read from Device** window.

After confirmation, the available configuration data is read from the device. If the progress bar in the **Transfer** window does not change, then the connection from the PC to the connected device should be checked (*Fault Rectification / General Information* on page 21).

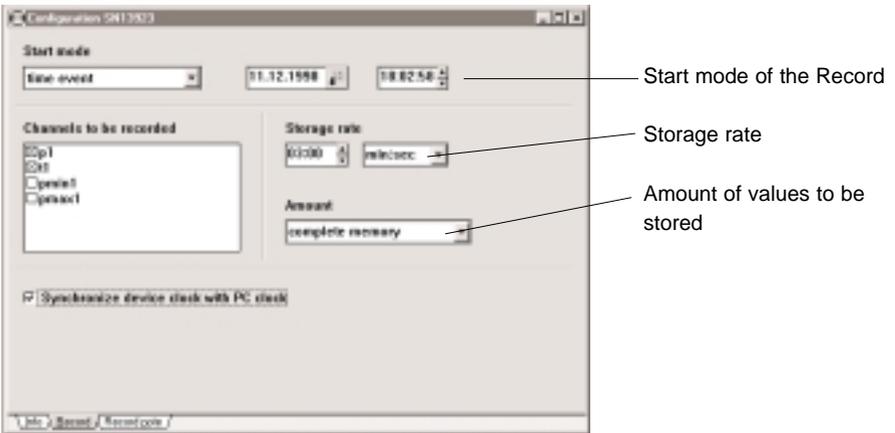
An information window for the Record Status can appear depending on the status of the connected device. The messages are described in the *Glossary* on page 23.

After reading the configuration, the following window reappears for the configuration of the device read:



Caution! For various special applications, it may be necessary to make further entries in the **Configuration** window. More detailed information can be taken from the special chapters for each application.

Now switch from the **Info** tab card to the **Record** tab card in the **Configuration** window. In the **Record** tab card you can enter the information relating to the record:



Record Start Mode

Device independent:

- at "write configuration" Starts Record immediately after **Write configuration**
- time event Starts Record at a determined date and time

Device dependent:

- trigger event Starts and stops Record at specific measured values
- manual Starts Record via the front operating key on the device

Variables (Channels) to be Stored

Under Channels to be recorded, select the channels which are to be recorded with the next record. All available channels are displayed here.

Storage Rate

- min:sec	Minutes:Seconds	00:01...59:59
- hr:min	Hours:Minutes	00:01...59:59
- days	Days	1...9

Amount of Measured Values

- per value The amount of measured values must be determined.
- complete memory The amount of measured values is only limited by the memory capacity. The record stops, at the latest, when the maximum memory capacity has been used up.
- endless (circular memory) Overwrites the oldest measured values when the memory is full.

Approximately 32 000 values (the exact amount is device dependent) can be stored in the memory. The amount of values per channel is reduced depending on the number of channels to be stored.

*Example: 4 channels are to be recorded.
 Amount of measured values: complete memory
 Therefore, a maximum of approx. 8 000 values can be recorded per channel.*

Synchronize Internal Device Clock with the PC Clock

This function sets the clock in the connected device to the time of the PC. If, for example, a device has been disconnected from its battery, then *Synchronize device clock with PC clock* must be selected. The switch from Summer time to Winter time can also require this.

Important! Check the date and time on your PC. On selection of *Synchronize device clock with PC clock* the device is synchronized with the corresponding PC time.

In the **Record note** tab card, comments and notes (approximately 240 characters) can be recorded. These are written to the memory of the connected device. Such comments can be of great assistance with many different measuring sites. Comments can not be read back into the configuration window.

Caution! All settings made in this window are only communicated to the connected device when the function **Device ➤ Write configuration** is selected. The settings made are only transmitted to the device after this function has been carried out successfully.

Writing the Configuration to the Device

With **Write configuration**, new (or existing) settings are transmitted to the connected device. The **Transfer** window with the progress bar also appears here.

Example: With the Start mode "at write configuration" the device immediately begins recording after successful transmission of the configuration data.

Caution! Write configuration always overwrites an existing configuration in the device, stops a running recording and deletes the data for all records in the device!

An interrupted record can not be restarted. In this case, please save the stopped record and start a new record.

Configure Several Devices One After the Other

Create a configuration as described above or load it with **File** ➤ **Open configuration file**. Now configure one device after the other with **Write configuration** without each time having to previously carry out **Read configuration**.

READ OUT THE DATA MEMORY

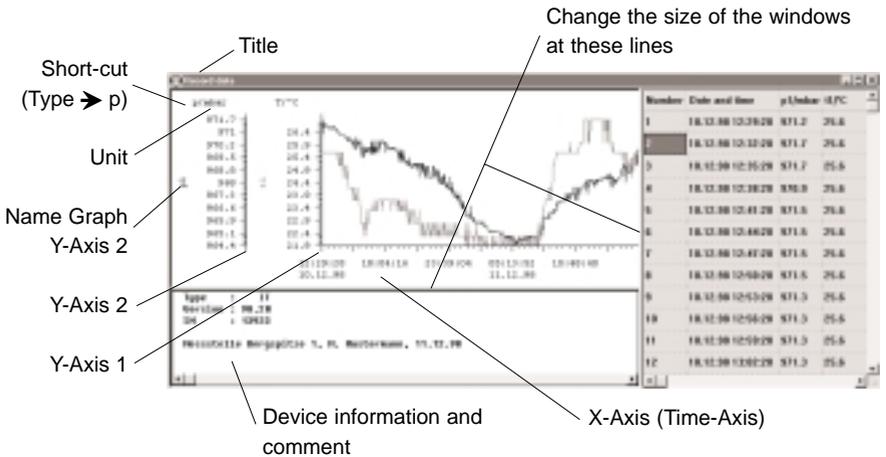
Via **Device** ➤ **Read data** all data sets stored in the device are read out.

Depending on the status of the connected device, an information window for the record status can appear. The messages are described in the *Glossary* on page 23.

Reading out a record can take place while a record is running in the device. This is neither influenced nor interrupted by reading out. However, the information appears that a record is running (see *Glossary* on page 23).

After reading out the data, the Logger displays all records read (**Available record(s)**). You can now select whether individual, several or all records are to be displayed.

After this selection, the data window appears once for each selected record with graph, comment and value table.



Please note that in graphs, a maximum of only four axes can be presented. For more than four recorded channels, the desired channels must be selected under **Axes settings** ➤ **Y-Axis**.

Altering the Presentation

The size of the individual windows can be varied by moving the borderlines by the mouse. The width of the table columns can be altered.

Comment

The comment can be altered directly in the data window.

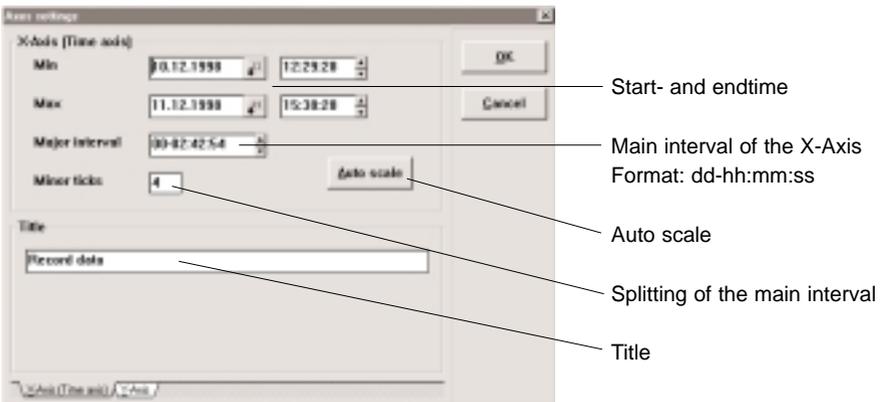
Via **Edit** ➔ **Window** the individual components of the window (*graph*, *comment* and *table*) can be inserted or removed in the **Data Window**. If the mouse pointer is inside the data window, then **Edit Window** can also be selected by clicking with the right-hand mouse button.



The settings made in the graphs and tables will also be taken into consideration later when printing and saving.

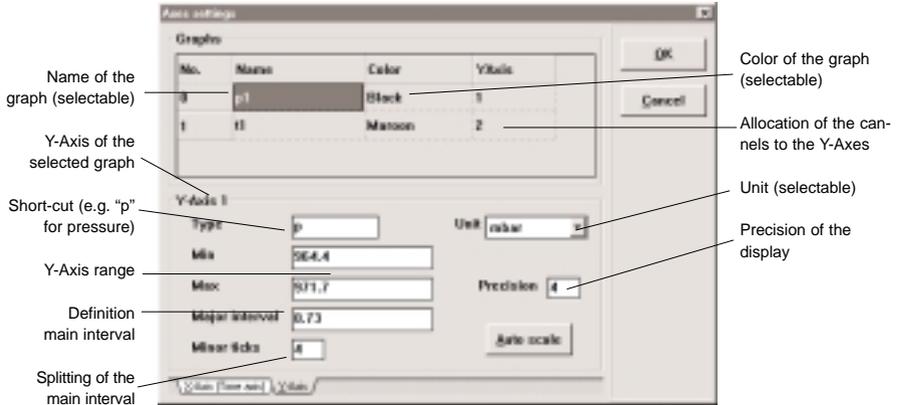
Graph

Via the menu **Edit** ➔ **Graph/Table data** or the right-hand mouse button, the graph and the table can be scaled accordingly. The scaling takes place separately for the X-axis and the various Y-axes.



Axis settings for X-Axis (time axis) tab card

By means of **Auto scale** the scaling of the graph can be orientated to the recorded measured values.



Axes settings for **Y-Axis** tab card

Under **Y-Axis** the channels can be allocated to the **Y-Axes 1...4** or removed with none. The **Y-Axes 1 and 2** are arranged to the left of the graph and the **Y-Axes 3 and 4** to the right. An automatic scaling (identical to the **Auto scale** button) takes place for each new allocation of a channel to a new axis.

The accuracy of the display (*Precision*) indicates the number of given digits of the floating decimal number. A higher precision can not be achieved than that read out from the device.

<i>Example</i>	<i>Value measured and read out: 967.4 mbar</i>	
	<i>Precision 2</i>	<i>9.7E2 mbar</i>
	<i>Precision 3</i>	<i>967 mbar</i>
	<i>Precision 4</i>	<i>967.4 mbar</i>
	<i>Precision 5</i>	<i>967.4 mbar</i>

Changes made via **Edit Graph/Table data** always also effect the content of the table.

Read out data sets can be presented with the currently available units. Also, please note the selection of the appropriate units (see *Logger Units* on page 15).

SPECIAL CALCULATION FROM DATA SETS

In the main window, under the menu **Special**, three possibilities are given for calculating together, filtering or lining up the recorded data sets (measured pressure or temperature):

Calculation Difference between different series of measured values or
Difference from series of measurements with a constant (Y-axis)

Resampling Extract of specific measured values from a series of measurements

Concatenate Linking of several series of measurements after each other (X-axis)

The calculations can only be carried out with the data window open. To do this, activate the first data set to be processed. The calculated values are displayed in a new window which is similar to a data window.

Please note that the measured values are linearly interpolated on calculation.

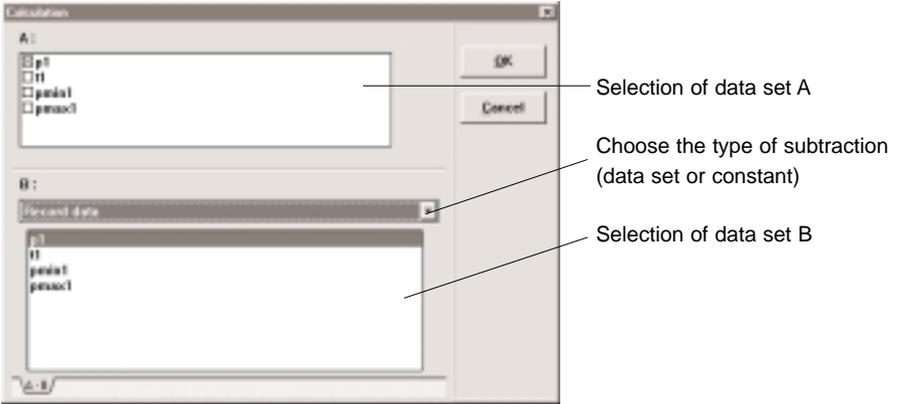
Caution! In the application *Waterlevel*, the *measured* pressures are calculated together and not the *calculated* distances in the unit of length.

Difference between Two Data Sets (Calculation)

Under **Calculation** the subtraction is carried out between the data sets A and B (A - B). Data set A is always the series of measurements of the active window.

Data set B can be selected: a constant, or a different series of measurements

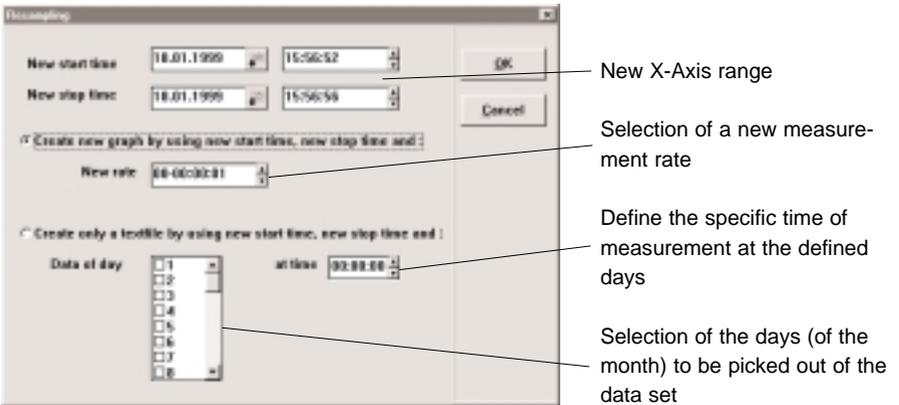
It should be noted thereby, that with differing time axes the time axis from A dominates. The time axis from B is suppressed.



The main application of the subtraction is the barometric compensation of the measured values of an absolute pressure transmitter with that of an additional barometer. More detailed information can be found in the Chapter *Barometric Compensation* on page 28.

Extracting Measurement Data from a Data Set (Resampling)

Here, the recorded measurement data can be subsequently filtered.



Create new graph by using new start time, new stop time and:

Creating a new data window by processing the available measured values with a new measurement rate.

Create only a textfile by using new start time, new stop time and:

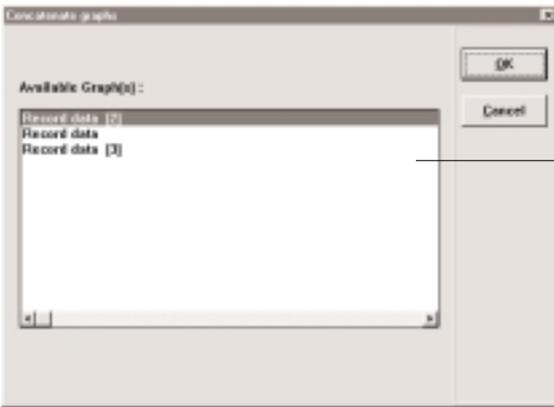
The data can also be selected according to specific days and a certain time at these days. Several days can be given but only one time.

Caution! In this case, no new data window is created, only a text file!

Linking Data Sets Together (Concatenate)

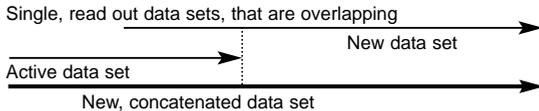
The main application for the linking of series of measurements is the generation of a large data set out of different, regularly read data sets from a continuous measurement. Overlapping data sets can therefore be easily linked to a new data set. The linked data set can therefore be larger than the maximum possible memory capacity of the device.

Recommended is only the joining together of data sets which follow each other in time without interval or which overlap.



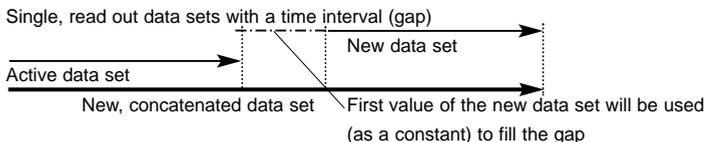
Selection of the data set to be connected (to the already active data set)

Condition for the linking of data sets is always the same number of measured channels.



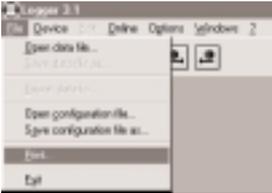
Data following in time at the end of the previous data set (active window) is linked to the next data set whereby the assignment in time is maintained. Please pay attention to the sequence of the data sets. When more than two data sets are to be linked, then the procedure must be repeated accordingly with the new data sets.

If the occasion does arise where data sets with a time interval between the data sets are to be linked, it must be observed that the first value of each following data set is inserted as a constant value between the two data sets.

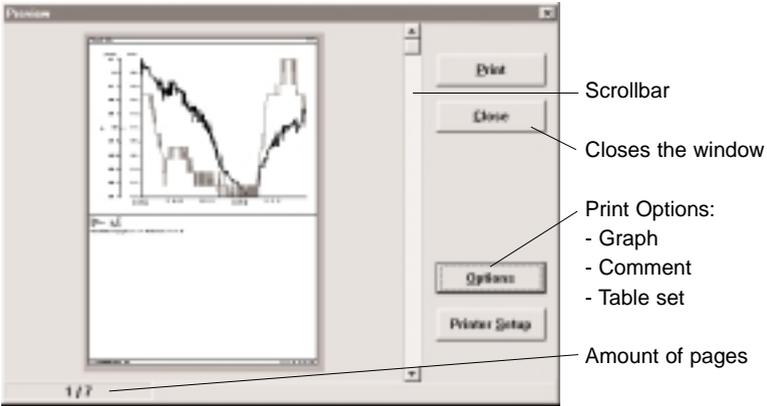


PRINTING

Printing out the graph, the comment and the value table is possible via **File** ➔ **Print...**



A **Preview** always appears before printing.



The data to be printed can now be selected via **Options**:



Only the graph and comment are printed out as standard.

The printer can be set up via **Printer Setup**. By switching from portrait to landscape format, the whole page can be used for printing out the graph.

For printing out several similarly formed curves, we recommend printing individual curves one after the other or the use of a colour printer (better differentiation of the individual curves).

MANAGING THE DATA ON THE PC

Data:

With the Logger, the measurement data (records) can be saved as well as read:

Save data file as Save as *.dat file.

Open data file Open a *.dat file.



Export data to Exporting the measurement data into any program (e.g. Excel) is possible via the ASCII format. The data or column separator is a semi-colon (;).

Configurations:

Configurations can also be saved and re-loaded later.

This Logger is a Windows 3.1 application. Please only use a maximum of 8 characters for the names of directories and files.

LOGGER-OPTIONS

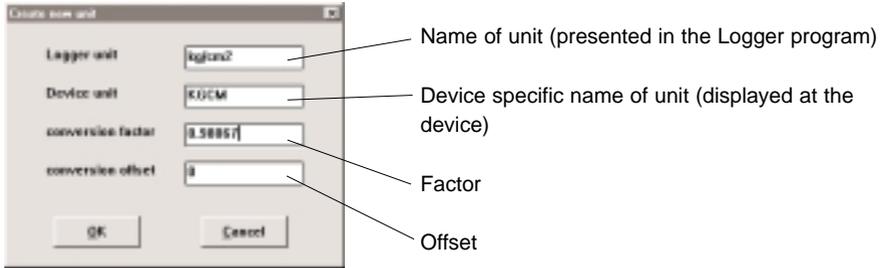
Logger Units

The Logger can display the units set in the devices, or it also enables the display of the read-in data in different units. Predefined units are already available to the Logger for this purpose. The selection and entry of units is done via **Options** ➤ **Logger units** and is only possible when all other windows are closed.

Unimportant units can be deactivated in the selection field thereby limiting the possibilities for unit selection at the scaling of the axes (**Edit** ➤ **Graph/Table data**).

If a unit which has been deactivated is read from a device, then it is automatically reactivated on read-out.

Now define the conversion factor and the offset of the new unit to the reference unit.



Conversion Factors to the Reference Units

conversion factor
conversion offset

multiplicative conversion factor to reference unit
 additive conversion factor to reference unit
 suitable for:

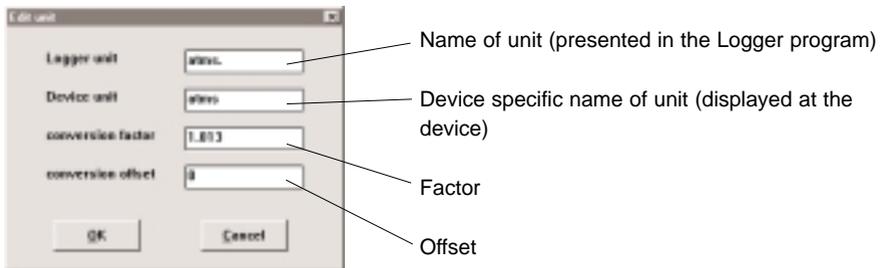
Converting °C to °F

In consideration of a specific base pressure (e.g. air pressure)

Example: *The reference unit is bar. The selected unit is kPa.*
 conversion factor = 0.01
 conversion offset = 0
 1 kPa therefore corresponds to 0.01 bar.

Changing a Unit

Select the unit to be changed in the selection field, press **Edit** and make the appropriate changes in the fields. The change is then active when **OK** has been pressed in the **Logger unit(s)** window.

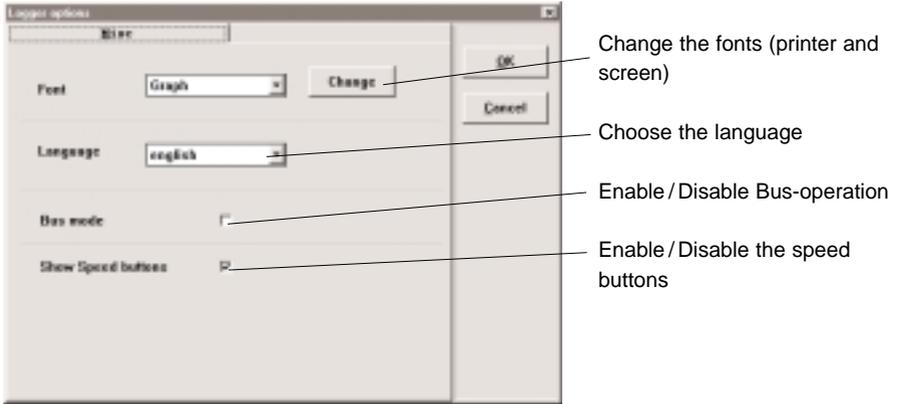


Unknown Units

With some devices, the *device unit* can be freely selected and changed. If the Logger does not recognise such a unit (e.g. if the unit has not yet been registered), then you will be requested to make the registration after data set read-out.

Logger Settings

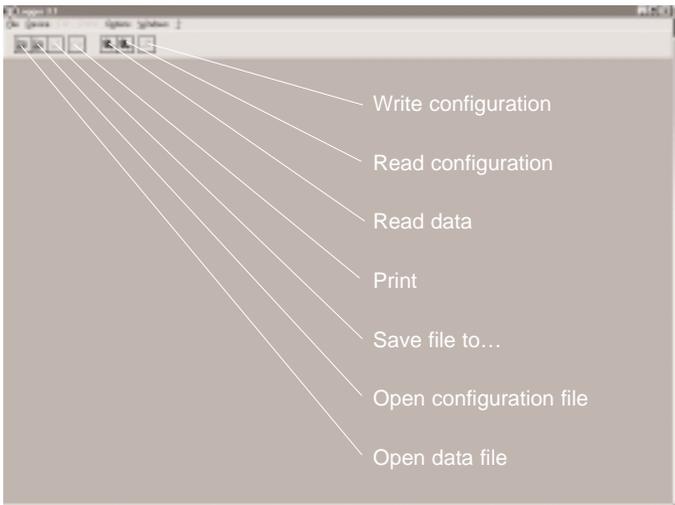
The general Logger settings such as language, font and Logger behaviour can be selected under **Options** ➔ **Logger options**.



Caution!

Only select the *Bus mode* when several devices have really been connected together in a Bus System (see *BUS Mode* on page 19).

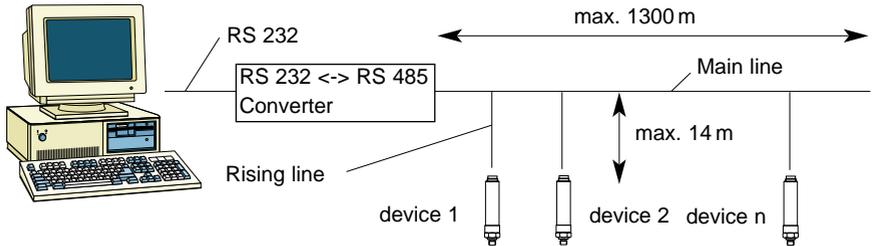
The Speed buttons can be superimposed or suppressed via the Logger Configuration. They are suitable for working more quickly with the Logger as they can be used to directly select the most important parts of the program.



BUS MODE

Building up a Network

Various devices from KELLER AG für Druckmesstechnik can be operated in a network. Up to 32 devices can be connected to a COM port via a 4-wire line and must be addressed with the corresponding device address. Prerequisite for this BUS mode is that all devices involved are equipped with the RS 485 serial interface (EIA standard).



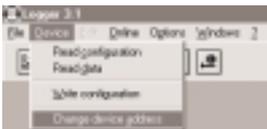
KELLER converters suitable for Bus mode: K-102, ADAM452

The maximum line length for the main line amounts to 1300 m, whereby the rising lines should be as short as possible (max. 14 m).

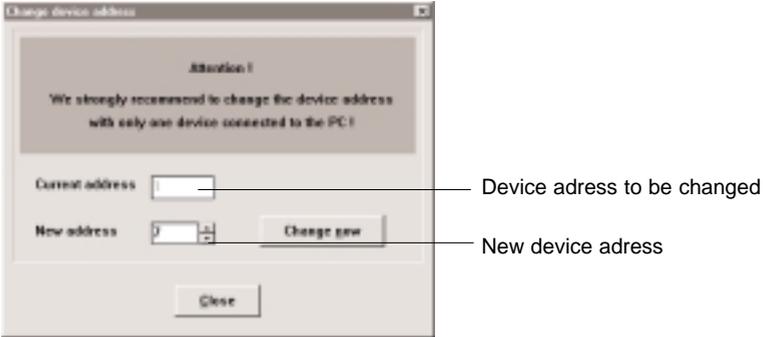
For long lines (total of more than 100 m), the main line must be concluded at the start and the end with a resistor which corresponds to the line impedance (typically 110Ω). In this case, the converter K-102 must be supplied externally. In addition, for long lines, a suitable cable with twisted-pair conductors should be used.

Changing Device Address

Before connecting the devices to the Bus, each device must be allocated its own address (valid range 1...249) with **Device** ➔ **Change device address**. Never connect several devices with the same address to the same bus (network)!



After confirming, the request to **Change device address** appears:



Caution!

Never carry out device address changes in the Bus! The danger exists that more than one device receives the same address.

Before a device address can be changed, a configuration corresponding to the device must be loaded or an appropriate configuration file opened. Address 250 is provided for single operation (only one device on a PC). Via this address, every device, including the bus-compatible ones, can always be addressed. In this way, an emergency access is guaranteed should the device address no longer be known.

Working with the Logger in a Bus-System

Set the Logger to Bus mode via **Options** ➔ **Logger options** ➔ *Bus mode*. In this way, there is the possibility of selecting and, if necessary, changing the device address on communication with the devices. Connect the devices in accordance with *Building up a Network* on page 19.

Once this setting has been made, device configurations can be created and records started as for single operation. In addition, the respective device address must be given on reading out the configuration or the measuring data (record) or on starting a record.



Factory Setting of the Bus Address

All bus-compatible devices from KELLER AG für Druckmesstechnik are delivered with factory set address 1.

REGISTERED DEVICES

The list of devices supported by the Logger can be called up in the main menu under **? ➤ Registered device(s)**.

Type:	The Info tab card appears
Version:	Software version
	- Intelligent Transmitter: appears in the Info tab card
	- Intelligent Manometer: appears on start-up on the manometer display

This list is updated with every new issue of the Logger.

<i>Examples</i>	<i>Type: IT</i>	<i>Version: 98.20</i>	<i>Intelligent Transmitter</i>
	<i>Type: MR2</i>	<i>Version: 98.12</i>	<i>ManoRecord Version 2</i>
	<i>Type: COOL</i>	<i>Version: 98.24</i>	<i>Cooling Manometer</i>

APPENDIX

Fault Rectification / General Information

Logger

Demo Mode: If the ini file is missing, the Logger is operated in the Demo mode. This is indicated on starting the Logger by means of a message text.

Only the following functions are then available:

- Reading data and configuration data from a file
- Changing Logger units and Logger options

Communication with a device is not possible in Demo mode.

This Logger is prepared for various customer-specific applications. If you are working with one of these special Logger versions, then minor changes and deviations are possible.

Information on the corresponding Logger version (application) can be found under **? ➤ Info**.

Communication

If communication with the device is not possible, please check the following:

- Connection between device and PC
- COM Port No.
- Bus address (optional: only in BUS mode)
- Device power supply
- Intelligent Manometer switched on?
- Logger possibly in Demo mode (Log*.ini file missing)

In Bus mode, make sure that the device is addressed with the right address and that no device addresses have been allocated in duplicate.

Date and Time

Problems with the date format:

We recommend the synchronization of the device clock with the PC clock as described in the chapter *Synchronize Internal Device Clock with the PC Clock* on page 8.

The data to be read must not have been written before 01.01.1996, otherwise it can lead to incorrect information in the date format. Please check your PC clock.

The Logger 3.1 for Windows is "Year 2000 compliant". Conditional for this is the correct date and time information on your PC. Please check your PC for year 2000 compatibility.

Graph

If the graph displays unexpected values, then check the selected unit and the corresponding conversion factors for correctness.

Please note that in the application Waterlevel, no pressures can be brought to the display, only the calculated linear dimensions.

The Devices

Do not change a battery while a record is running!

If a device battery is however changed during a data recording, then the following happens:

- With Intelligent Manometers:

The recording is interrupted. The data up to the battery change however remain intact and can be read out.

- With Intelligent Transmitters:

The recording is only interrupted for as long as no battery is inserted. In the course of a power cut however, the time information in the transmitter is deleted. On later read-out of the data memory, several records can be read out because after the end of the power cut a new record is started with a new start time (00:00 from 01.01.96).

In this case, only the first data set will have a correct time allocation! Several power cuts can result in several records without correct time allocation. The time sequence of the read records is however guaranteed in the **Available record(s)** window.

Any calculation of such recorded data sets is not possible with the functions under **Special** because of the missing time information. Restoration of the data sets is only possible at the factory.

System Prerequisites

The following software and hardware is necessary in order to run the Logger program and to read data from the devices:

Software: Microsoft Windows 3.1, Windows 95 or Windows 98

Hardware: IBM-compatible PC

free COM port on the PC

special converter cable:

- K-101 (Standard converter with cable)
- K-102 (converter without cable)
- K-103 (special converter cable for water level transmitters)
- ADAM-452 (converter with electrical isolation via optocoupler)

Only these converter cables marketed by KELLER AG can be used.

Glossary

Record	- Function of the intelligent devices for saving measured values - Saved data set after carrying out a save procedure (RECORDing)
Converter cable	Special cable with integrated interface converter for communication with the intelligent KELLER devices
Pressure transmitter	Electronic measuring device for the recording of pressures and conversion into a normalized electrical signal
Level sensor	Pressure transmitter for recording liquid levels via the hydrostatic pressure
Sealed Gauge	Pressure measurement against vacuum
Vented Gauge	Pressure measurement against environmental pressure

Pressure Conversion Table

		bar	kPa	mH ₂ O	inchH ₂ O	mmHg (Torr)	inchHg	psi
bar	=	1	100	10.1972	401.463	750.062	29.530	14.5038
kPa	=	0.01	1	0.101972	4.01463	7.50062	0.29530	0.145038
mH₂O	=	9.8067 *10 ⁻²	9.8067	1	39.3701	73.5559	2.8959	1.42233
inchH₂O	=	2.49089 *10 ⁻³	0.249089	2.540 *10 ⁻²	1	1.86832	7.35559 *10 ⁻²	3.613 *10 ⁻²
mmHg (Torr)	=	1.33322 *10 ⁻³	0.133322	1.35951 *10 ⁻²	0.535240	1	3.9370 *10 ⁻²	1.9337 *10 ⁻²
inchHg	=	3.38639 *10 ⁻²	3.38639	0.345316	13.5951	25.40	1	0.491154
psi	=	6.89476 *10 ⁻²	6.89476	0.70307	27.68	51.7149	2.03602	1

Message Text

Message text	Remarks
Record in operation	The device is recording measurement data.
Record done	The measurement recording is finished.
Record prepared	Measurement recording is prepared.
Level trigger on	Level trigger mode is activated.
No records in device memory	The device has not yet recorded any data. The measurement data memory is empty.
Device memory has completed filled	The measurement data memory is completely filled up with data.
Record in operation and device memory has completed filled	The device is recording measurement data and the measurement data memory is completely filled up with data.
Demo mode	Logger only works in the Demo mode. Not all functions are available.
This Logger version does not support the connected device	Logger does not support the connected device. Cancel. Please contact the manufacturer or distributor.

APPLICATION WATERLEVEL

This chapter explains the special information for the application Waterlevel. General information can be taken from the previous chapter *Standard Logger*.

LEVEL MEASUREMENT WITH WATER LEVEL SENSORS

For level measurement with water level sensors the measured hydrostatic pressures are converted to a linear dimension (standard: metre) with the values given in the configuration.

Overview of Level Sensor Types

Two types of level sensor can be differentiated according to their relationship to the respective air pressure.

Absolute Pressure Level Sensors (SG - sealed gauge) measure the pressure consisting of the water column and the air pressure at the water surface. Therefore, for this type of measurement, the air pressure must subsequently be subtracted.

This barometric compensation can be carried out with this Logger. More detailed information can be found in the Chapter *Barometric Compensation* on page 28.

Reference Pressure Level Sensors (VG - vented gauge) equalize the air pressure via the capillary in the cable of the level sensor and therefore only measure the pressure of the water column.

Note

In the following installation schematic, please observe the orientation of the arrows and the difference between

Height (from the bottom upwards) and

Depth (from the top downwards).

This orientation is taken into consideration for calculation of the recorded values. If the orientation of depth to height and vice versa is changed, then the sign must be changed accordingly.

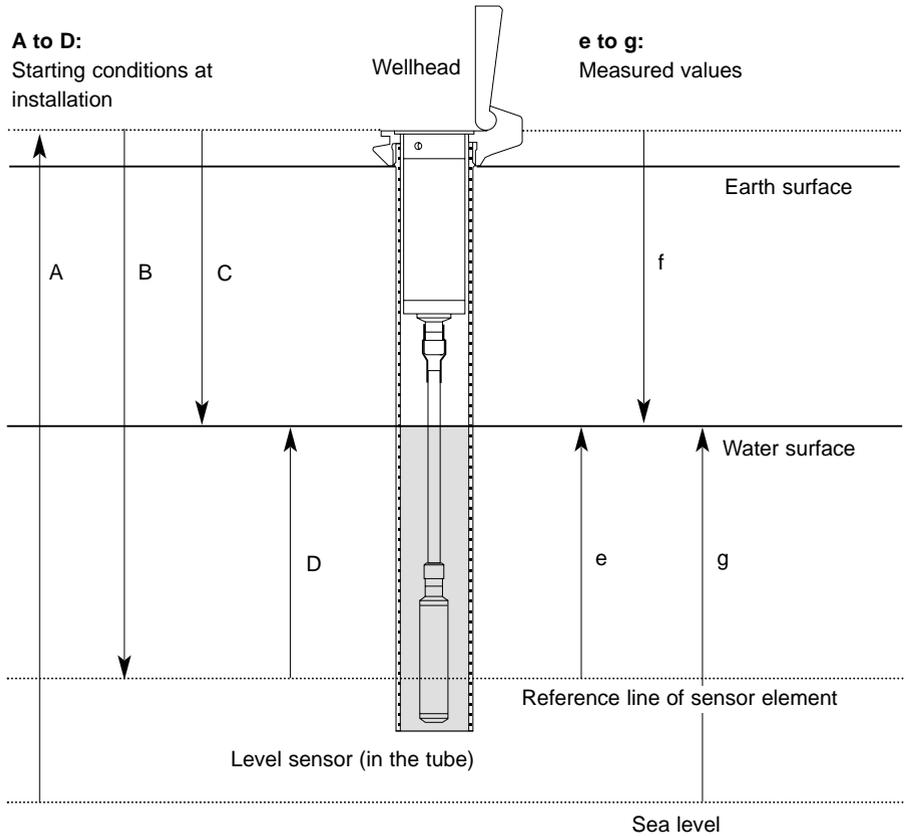
Installation Schematic Level Sensors

A to D:

Starting conditions at installation

e to g:

Measured values



Before or during installation of the level sensor

- A Height of wellhead above sea level
- B Installation depth
- C Depth to water
- D Height of water

(On **Write Configuration** the value is measured and saved internally)

During Measurement

- e Height of water
- f Depth to water
- g Height of water above sea level

The level "Sea Level" can also be any other reference height.

Calculation Basics

This Logger provides the following possibilities for calculation via the measured hydrostatic pressure (the letters always relate to the designations in the Logger program):

Height of water (e):

Linear dimension (e) from the level sensor to the water surface. The dimension (e) is directly determined from the hydrostatic pressure, the density of the medium and the acceleration due to gravity.

Depth to water (f):

Linear dimension (f) from the wellhead to the water surface.

$$f = B - e = C + D - e$$

Height of water above Sea level (g):

Linear dimension (g) from sea level to the water surface.

$$g = A - f = A - (B - e) = A - (C + D - e)$$

*Example: A = 345 m Height of the wellhead above sea level
 B = 10 m Installation depth of the level sensor
 e = 3 m Height of the water above the level sensor
 Depth to water (f) = 10 m - 3 m = 7 m
 Height of water above sea level (g) = 345 m - (10 m - 3 m) = 338 m*

SPECIAL CONFIGURATION INFORMATION

In the **Configuration** window, in addition to the information under *Creating Device Configuration and Starting a Record* on page 6, the information necessary for the Waterlevel application can be made in the **General** tab card.

The screenshot shows the 'Configuration' window with the following fields and annotations:

- Device type:** United Gauge (N) [Annotation: Type of level sensor]
- Conversion to:** Height of water (e) [Annotation: Selection of reference value to be calculated as the result]
- Start condition of installation:**
 - Installation depth (B): 10.05 m [Annotation: Selection of installation method]
 - Height of Wellhead above Sea Level (A): 100 [Annotation: Linear dimensions]
- Offset:** 0 [Annotation: Entry of the height of wellhead above sea level (optional)]
- Water density:** 998.2 kg/m³ [Annotation: Entry of an additional offset (optional)]
- [Annotation: Density of the medium to be measured]

Level Sensor Selection

In the field Device type, enter the type of level sensor used
Sealed Gauge (SG) or Vented Gauge (VG).

Conversion to...

Select the linear dimension required as the result. The Logger program then converts the measured data to the linear dimension selected here.

Starting Conditions at Installation

The installation information for *Conversion to = Depth to water (f) or Height of water above Sea Level (g)* can be selected independently of the type of level sensor:

- Absolute pressure level sensors (SG): - Installation depth (B)
- Relative pressure level sensors (VG): - Installation depth (B) or
- Depth to water (C)

If *Depth to Water (C)* is selected in the installation mode, then, on configuring the record (**Write configuration**), the sensor measures the *Height of water above the level sensor (D)* and determines the *Depth to water surface (C)* together with the *Installation depth of the level sensor (B)*.

The following must thereby be strictly observed:

- The water level must not change appreciably between the measurement of the *Depth to water surface (C)* which you are to carry out and the configuration of the Record (**Write configuration**)!
- The level sensor must be exactly at the final installation depth when you carry out **Write configuration**.

Faulty information otherwise would be included in the calculation and can falsify the result.

The method with the Installation Mode *Depth to water (C)* has the advantage, above all with large installation depths, that you do not have to know the exact installation depth. The sensor can be integrated and left hanging for a while before configuring the Record (**Write configuration**) so that the level sensor can adjust itself to the final installation depth.

On *Conversion to = Height of water above Sea Level (g)* the height of the level pipe above sea level must also be given. Any other reference point can however also be used.

If the sea level, or the reference point selected instead of it, is located above the level pipe, the value for *Height of Wellhead above Sea Level (g)* must be entered with a negative sign.

The *Offset* is a freely selectable value of a linear unit which is added to the value to be calculated. As standard, this value is = 0.

For example, by giving a value for *Offset*, the distance between the wellhead and the earth's surface can be entered and therefore taken into consideration for the calculation.

*Example: The depth of the earth's surface to the water surface is to be determined. Distance wellhead to the earth's surface = 3 m
In addition, the depth to the water surface (f) should be selected and the Offset = -3 m (negative) entered.*

The density of the medium can be entered under Water density (fresh water (20 °C) = 998.2 kg/m³).

After entering these values, the record can be started via **Write configuration**.

Barometric Compensation

Measurement data which has been determined with an absolute pressure level sensor can be compensated in relation to air pressure deviations with an additional barometer (e.g. DC-25Baro). The differential function under **Special ➤ Calculation** takes over this calculation.

To do this, one record must be started simultaneously with the level sensor and an additional barometer respectively. During measurement, the barometer must be located as close as possible to the water surface.

After finishing of the measurements, the two records determined can be deducted from each other.

Note

The reference units in the application Waterlevel are °C and m. The pressures determined can not be displayed in the graph directly in a unit of pressure. They are converted into linear units together with the installation information from the **General** window. A recorded barometer record can therefore not display the real air pressure in a unit of pressure.

With the subsequent calculation, the real recorded pressures are however used and deducted from each other but, in consideration of the installation information, a linear dimension is again determined from this.

BASICS OF HYDROSTATIC PRESSURE MEASUREMENT

p - pressure F - force A - area g - acceleration due to gravity ρ - density

$$p = \frac{F}{A} = \frac{mg}{A} = \frac{\rho h A g}{A} = \rho h g \qquad h = \frac{p}{\rho g}$$

Pressure Measurement with an Absolute Level Sensor (Sealed Gauge)

Measurement of the hydrostatic pressure takes place dependent on the air pressure. The barometric air pressure can be determined with a second pressure sensor and taken into consideration.

With $\rho_{H_2O} \gg \rho_{Air}$ is valid:

$$P_{Level\ Sensor} - P_{Barometer} = (\rho_{H_2O} h_e + \rho_{Air} h_x) g \approx \rho_{H_2O} h_e g$$

h_e Height of the water above the level sensor
 h_x Height of the barometer above the water surface

Conditional for an accurate measurement is that the height of the barometer above the water surface is as low as possible ($h_x < 10m$)

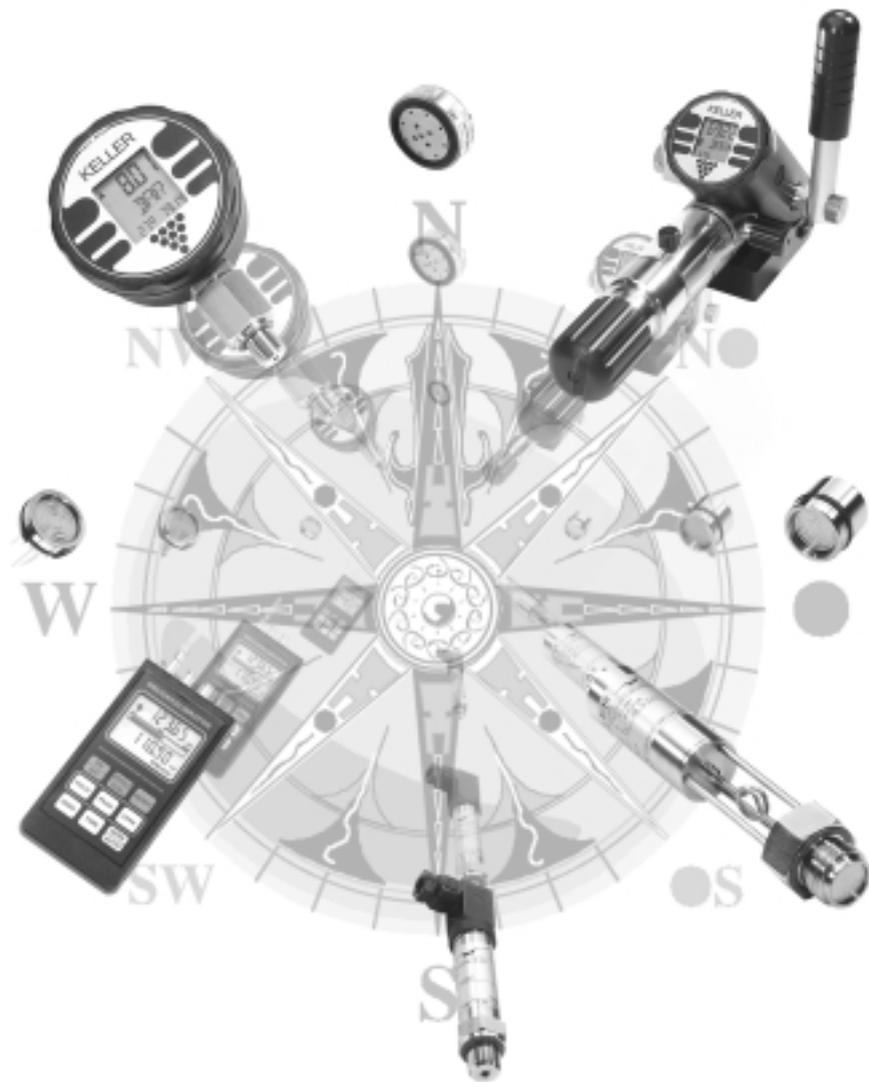
Pressure Measurement with a Relative Level Sensor (Vented Gauge)

Measurement is carried out independently of the air pressure. The reference adjustment to air pressure is done over a capillary tube in the cable (supply line to the level sensor).

With $\rho'_{H_2O} = \rho_{H_2O} - \rho_{Air}$ is valid:

$$P_{Level\ Sensor} = \rho'_{H_2O} h_e g = (\rho_{H_2O} - \rho_{Air}) h_e g$$

h_e Height of the water above the level sensor
 ρ'_{H_2O} Value entered in the Logger Program for the density of the medium
g The Logger Program calculates with a gravity of 9,80665 m/s²



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KELLER EUROPE Schwarzwaldstrasse 17 D-79798 Jestetten Tel. ++49 (0) 7745-9214-0 Fax ++49 (0) 7745-9214-50

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