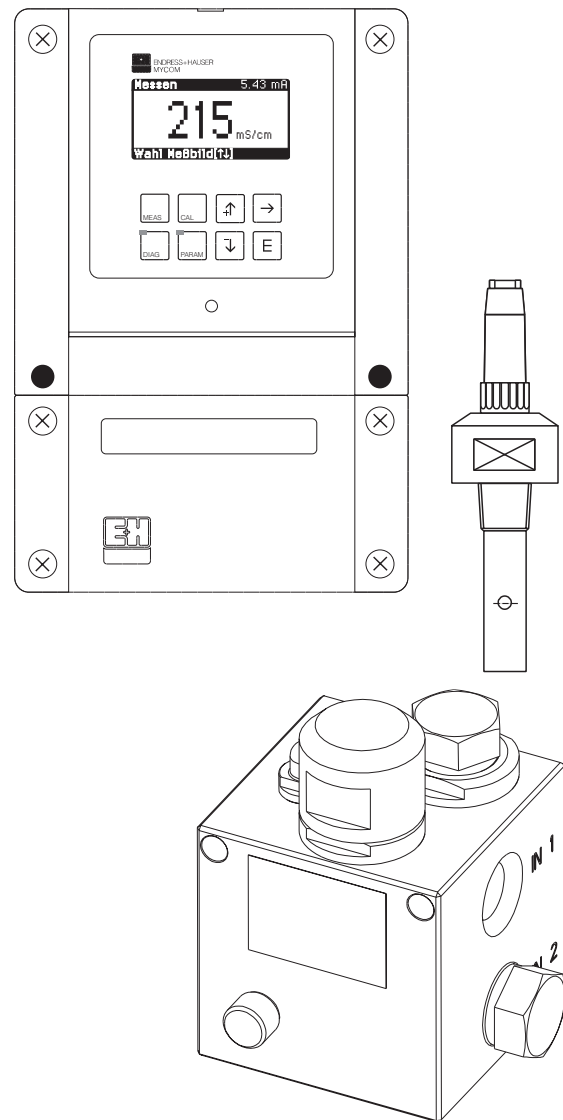
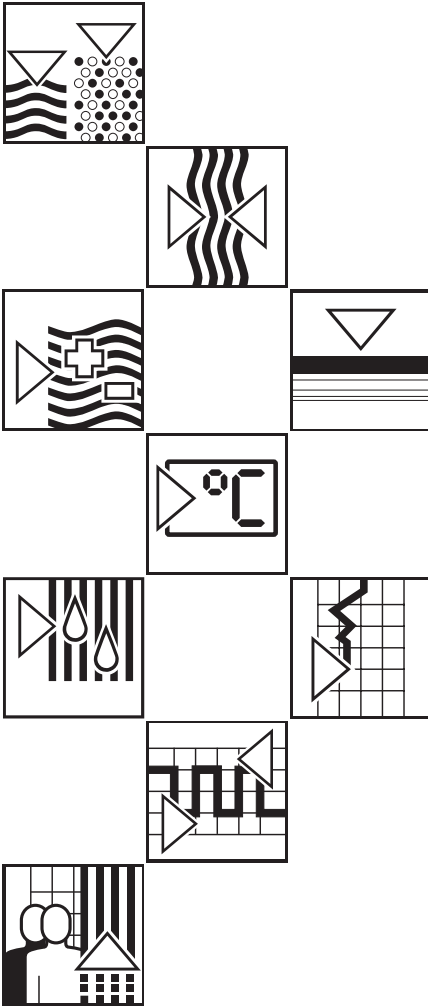


ConCal Conductivity Calibration Set for Ultrapure Water Applications

Operating Instructions



You would like to familiarise yourself with the instrument. Everything you need to know can be found in these chapters:



1

General Information



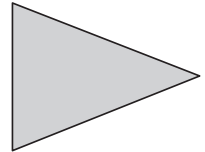
2

Safety



3

Description



You want to install the instrument and operate it to carry out measurements. The operating concept is explained in these chapters:



4

Installation



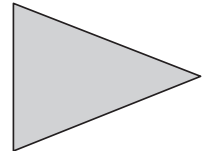
5

Operation



6

Setting up and Measuring



If you encounter problems or when the instrument needs maintenance, please refer to this chapter:



7

Maintenance and Service

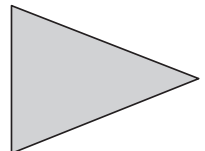


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1 General Information

1.1 Symbols used

**Warning!**

This symbol draws your attention to dangers. Failure to follow the instructions may lead to serious injury or damage to property.

**Caution!**

This symbol draws your attention to possible faults due to operator errors.

**Note!**

This symbol draws your attention to important items of information.

1.2 Conformity statement

The conductivity calibration set ConCal has been developed and manufactured in accordance with current European standards and directives.

**Note:**

An EC conformity statement for the Mycom CLM 152 can be obtained from Endress+Hauser.

2 Safety

2.1 Intended use

The ConCal calibration set with the microprocessor-controlled conductivity measuring transmitter Mycom CLM 152 is intended for testing and calibration of process and conductivity measurements in the pure and ultrapure water sector.

The ConCal calibration set permits calibration and testing of process measuring instruments without the need for calibration solutions.

The calibration set ConCal determines only the specific conductivity or the specific resistance of the water.

2.2 General safety instructions



Warning:

Operating this instrument in any way other than described in these operating instructions may compromise the safety and function of the measuring system and is therefore not allowed.

Installation, start-up, operation

The ConCal calibration set has been constructed in accordance with the state-of-the-art for safe operation and complies with the relevant regulations and EC directives (see "Technical data"). However, if it is used improperly or for other than its intended purpose, it may be hazardous due, for example, to incorrect connection.

Installation, electrical connection, start-up, operation and maintenance of the measuring system must therefore be performed exclusively by trained specialist personnel properly authorised by the system operator for such work (see BA CLM 152). The specialist personnel must be familiar with the operating instructions for the ConCal calibration set and for the Mycom CLM 152 and must adhere to the instructions therein.

2.3 Safety functions

- **Access codes:** Unauthorised access to the calibration and configuration data of the transmitter is effectively prevented by access codes if these are entered by the user.
- **Alarm function:** The fault contact is activated in the case of a system fault, failure of the temperature sensor or serious defects. The fault contact is designed for fail-safe operation, i.e. an alarm is also generated immediately if the power fails (of a signalling device with a separate supply voltage is connected).
- **Data integrity:** The programmed configuration remains stored even in the case of a power failure.
- **Electromagnetic compatibility:** The Mycom CLM 152 instrument is protected against interference such as pulse-shaped transients, high frequency and electrostatic discharges in accordance with the current European standards. This applies, however, only to instruments connected as described in these installation and operating instructions.

3 Description

3.1 Application areas

The ConCal calibration set is intended for measuring tasks in the following areas:

- Calibration of quality-relevant process measurements in the ultrapure water sector up to 20 $\mu\text{S} / \text{cm}$ (or 20 $\text{M}\Omega * \text{cm}$)
- Checking in-line measurements in processes after, for example, inspection work or shutdown periods
- Checking of conductivity measuring equipment, particularly in the pharmaceuticals and foodstuffs industries
- Checking and calibration in order to ensure product quality in, for example semiconductor production or other technically sensitive areas

3.2 Features

- Factory calibration based on SRM of NIST and DKD
- Conforms with international standards: procedure for factory calibration of the ConCal system in accordance with ASTM 5391-93
- Practical flow assembly with setting and monitoring functions in accordance with ASTM 5391
- Bypass arrangement without removal of the process measuring cell

3.3 Contents of the ConCal calibration set

- Aluminium carrying case with padding
- Mycom CLM 152
- Flow assembly
- Reference measuring cell CLS 15
- Individually produced calibration certificate
- Operating Instructions for Mycom CLM 152
- Operating Instructions for ConCal

3.4 Mycom CLM 152

The Mycom CLM 152 measuring transmitter used in the system is designed specially for calibration in ultrapure water applications. The settings for the cell constant and the temperature offset have already been made in the factory. The procedure for calibration is

described in chapter 6.3. All operating elements and structures of the Mycom CLM 152 measuring transmitter are described in the enclosed operating instructions.

3.5 Reference measuring cell CLS 15

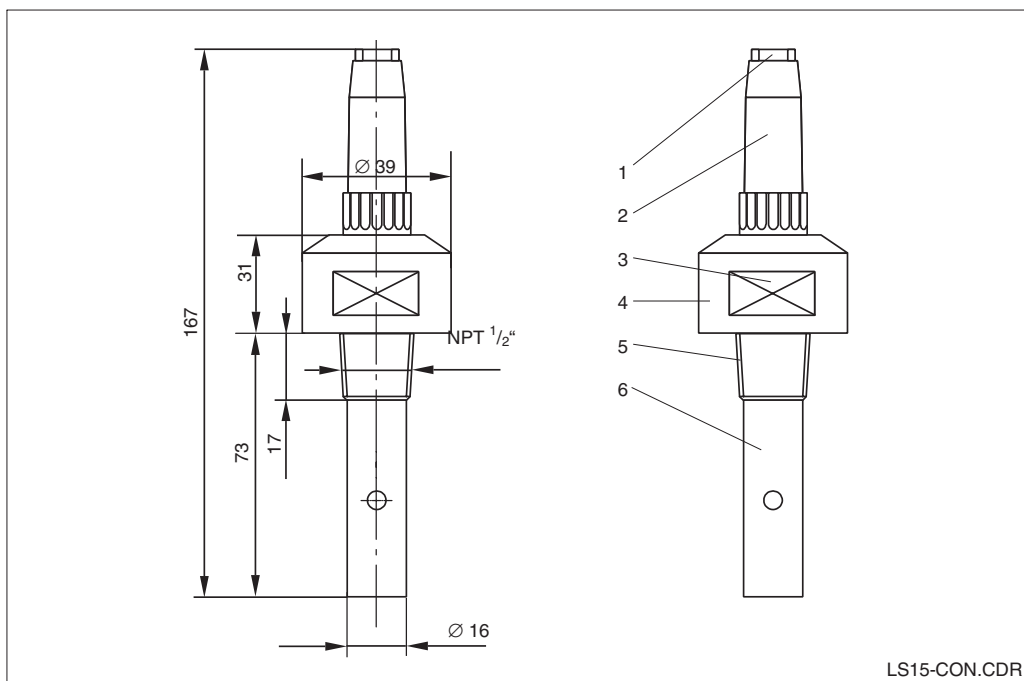
The compact conductivity measuring cell CLS 15 is designed specially for measurements in the pure and ultrapure water. The measuring range for cells with a cell constant $k = 0.01/\text{cm}$ extends from $0.02 \mu\text{S}/\text{cm}$ to $20 \mu\text{S}/\text{cm}$.

The measuring cell has a Pt 100 temperature sensor and is used together with the conductivity measuring transmitter Mycom CLM 152 with automatic temperature compensation.

The two-electrode measuring cell CLS 15 is supplied with an alternating voltage by the

conductivity measuring transmitter. The alternating current flowing through the measuring electrodes and the medium is determined by the conductivity of this medium.

The coaxially arranged measuring surfaces are made of polished stainless steel (1.4571) and the cell shaft is made of PES. The cells are connected via a four-pin round plug. The measuring cell can be used at temperatures of up to $120 \text{ }^\circ\text{C}$. It is easily screwed in and withstands pressures of up to 12 bar (see 8.3 "Technical data").



Screw-in version of the CLS 15
 1 Measuring cable outlet
 2 Connector
 3 SW 32
 4 PES shaft
 5 1/2" NPT thread
 6 Coaxial measuring electrode, stainless steel

Fig. 3.1

3.6 Flow assembly

The ConCal calibration set is equipped with a special flow assembly for the measuring cell CLS 15. This ensures that the measuring setup operates with precisely defined measuring conditions.

These measuring conditions depend on the selected installation variant:

- Measuring setup for direct comparison measurement (see chapter 3.6)
- Measuring setup for comparison measurement in a sampling line (see chapter 4.3.2)

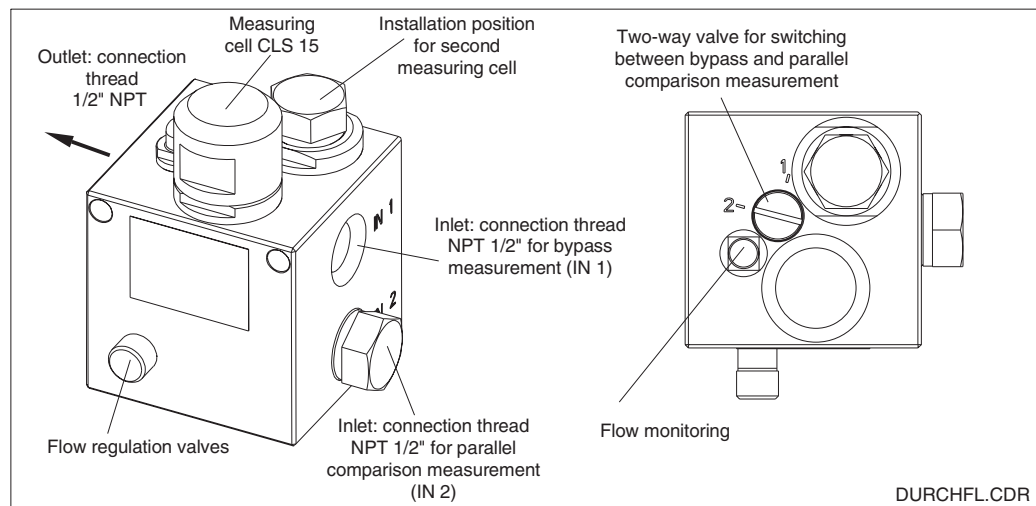


Fig. 3.2 Flow assembly for ConCal

3.7 Instrument versions

Conductivity calibration set ConCal (complete)	
Version for 230 VAC	Order No. 50083777
Version for 115 VAC	Order No. 50083778

3.8 Recalibration and accessories

Recalibration

Depending on the operating conditions, the ConCal calibration must be recalibrated regularly. We recommend that a factory

calibration be carried out annually at Endress+Hauser.

Flow assembly

Complete flow assembly
 Order No.: 50082322

Flow assembly for installation of a measuring cell with clamp connection

Order No.: Not available at the time of printing.

3.9 Certificates

The ConCal calibration set is calibrated in the factory (see the certificates). The reference measuring cell CLS 15 is precisely calibrated in accordance with the ASTM Standard D 5391-93 with the aid of a reference system. This procedure determines the cell constant and the temperature offset of the sensor, and these are recorded in the factory calibration certificate.

The certificate produced individually for each ConCal system is enclosed with the calibration set.

The factory calibration certificate thus contains details of the calibration for the measuring transmitter Mycom CLM 152 with cables and plugs (Enclosure 1/3), of the calibration of the conductivity measurement together with the Pt 100 offset (Enclosure 2/3) and of the temperature measurements with the Pt 100 sensor of the CLS 15 cell (Enclosure 3/3).

An example of such a certificate is shown in the Appendix (the values may vary, depending on the system).



Note:

The values determined for your system have been preset in the Mycom CLM 152 in the factory!

4 Installation

4.1 Storage and transport

The complete ConCal calibration set is dispatched in an aluminium case with padding to protect it from shocks. For this

reason, the set should be stored and transported only in this case.

4.2 Unpacking

Make sure that the contents are not damaged in any way. In the case of damage, inform the post company or the freight carrier and also notify the supplier.

- Instrument type and version as shown on the rating plate
- Accessories (see chapter 3.8)
- Operating instructions
- Instrument identification card(s)

Check the scope of delivery against your order and the shipping documents for:

- Correct quantity

If you have any questions, please contact your supplier or the Endress+Hauser sales office in your area (see the back of these operating instructions).

4.3 Measuring setup

The ConCal calibration set can be installed in two different ways to suit the requirements of the system to be calibrated.

4.3.1 Parallel comparison measurement

The flow assembly included in the calibration set has two installation positions for conductivity sensors with 1/2" NPT threads. The direct comparison measurement at the same installation point is the ideal measuring method, since the important parameters of the measuring point are in this case identical:

- Temperature
- Identical Medium
- Flow conditions
- Conductivity

An additional fitting is required for process measuring cells with clamp adapters (see accessories, page 6)

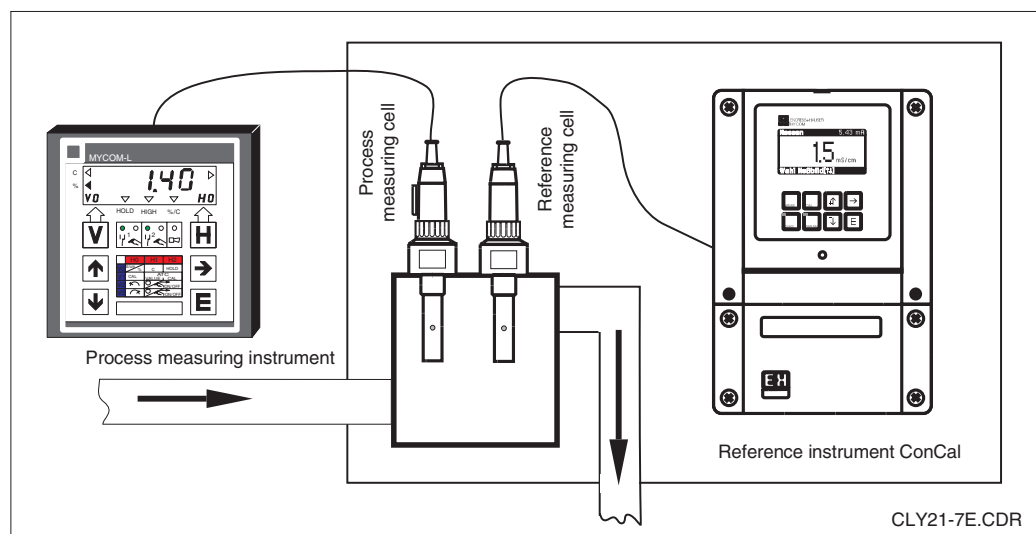


Fig 4.1 Setup for parallel comparison measurement

4.3.2 Comparison measurement with bypass

For hygienic reasons, it is not always possible to remove the measuring cell from the process. In such cases, a comparison measurement can be made in a bypass (separate sampling line). When using this setup, care must be taken that the water composition and the temperature are the same at the process measuring point and the comparison measuring point.

The following basic prerequisites are necessary to ensure this:

- Short hose connections
- Wait for the flow assembly to settle at the process temperature
- Set the flow rate correctly



Caution:

The temperature of the fluid at the measuring point must be the same as that in the process!

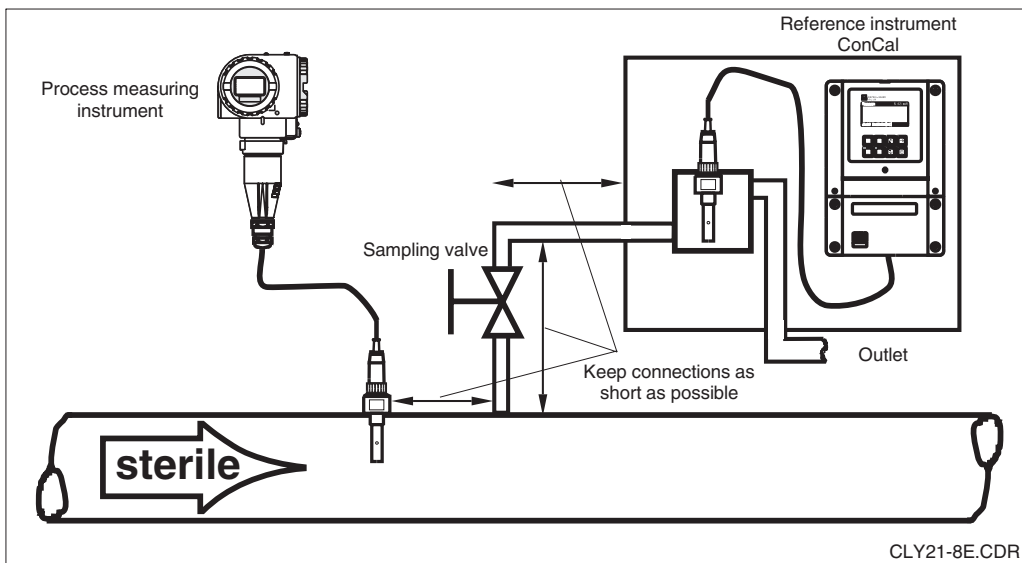


Fig. 4.2 Setup for bypass comparison measurement

4.3.3 Bubble trap

In order to avoid incorrect conductivity measurements, the fluid must be free of bubbles. Degassing can occur, in particular, where the pressure on the fluid is relieved, i.e. also in the bypass arrangement described here. This is taken into account to an increased degree by the calibration assembly in the ConCal set: in the bypass position of the calibration assembly, the second installation position is used as a hydrocyclone. The water enters this tangentially, causing a turbulent flow and permitting the bubbles to escape through the vent opening at the top. The water to be measured passes through a hole on the side at the base of the cyclone to the actual

measuring chamber. Furthermore, the pressure on the water is relieved only after the cell and the rate of flow is regulated.

Note: There may be bubbles present in the lines because the air was not excluded when the connections were made. Venting for parallel comparison measurement can be done in one of two ways. In the first case, large air bubbles are carried along in the water and no separate venting is necessary. In the second case, the reference measuring cell can be unscrewed slightly to permit the air bubbles to escape. Screw it down tight again when the escaping water is free of bubbles.

4.3.4 Controlled conditions with flow monitoring

When carrying out calibration with the ConCal calibration set, ASTM 5391 specifies that a minimum flow rate specified by the manufacturer of the measuring cell must be maintained (30 l/h). For this reason, the calibration assembly is equipped, in accordance with the standards for conductivity calibration, with:

- a bubble trap (for bypass measurement, see above),
- a Rotameter flow monitor,
- an adjusting valve for regulation of the flow.

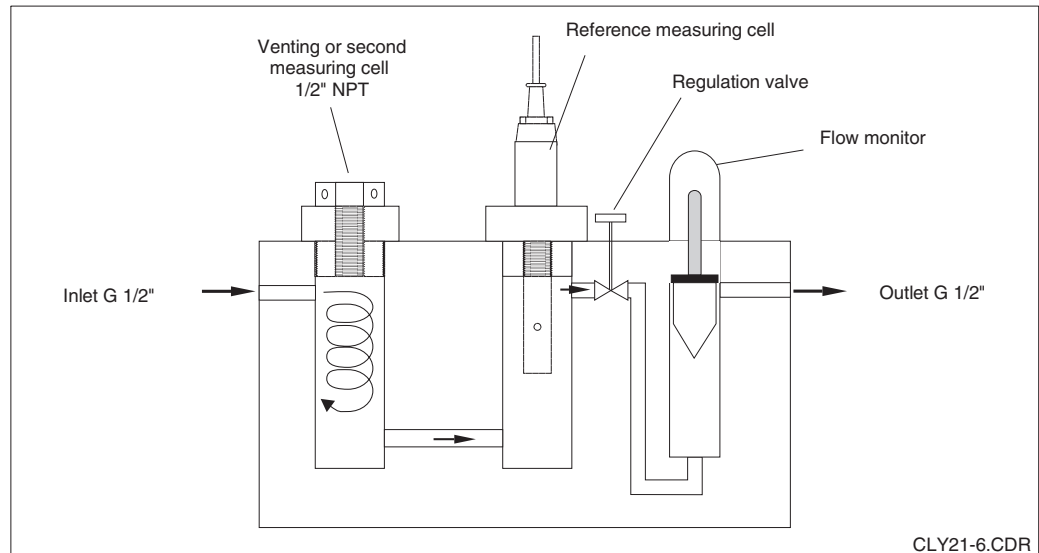


Fig. 4.3 Connections for bypass arrangement with flow monitoring



Caution:

The screw connection for flow monitoring may not be tightened excessively, since it could otherwise break at high temperatures.

4.4 Connection of assembly

Connection procedure

- Select the appropriate connection method for your system (see chapter 4.3.1 and 4.3.2).
- Connect the hose connections or process connections to the flow assembly.
- Connect the hoses: for parallel comparison measurement, use inlet "IN 2" and seal "IN 1" with a plug; for the bypass arrangement, use inlet "IN 1".
- Check the position of the two-way valve (1: bypass; 2: parallel).
- Ensure that all connections are tight and free of leaks.
- Screw in the measuring cell (for parallel comparison measurement only).
- Connect the reference measuring instrument Mycom CLM 152 to the supply voltage.



Warning

When measuring hot fluids, wear gloves and use suitable tools for venting the equipment, since there is otherwise a risk of scalding!

4.5 Connection of the Mycom CLM 152

The Mycom CLM 152 is fully wired ready for use.

Connect the plug of the measuring cable to the measuring cell.

For a supply voltage of 230 V AC, the Mycom is supplied complete with a mains cable with suitable plug connectors.



Warning:

- Only suitable trained specialist personnel may connect the equipment to the supply voltage and work on it in this condition.
- Do not operate the instrument without a suitable earth connection!
- Before connecting the instrument, ensure that the supply voltage matches the values shown on the rating plate!

4.6 Removal, packing and disposal

Repacking

The ConCal calibration set should always be stored in the aluminium case in which it was delivered.

Disposal



Note:

Electronic scrap is hazardous waste! Observe the local regulations when disposing of it!

5 Operation

5.1 Operating elements

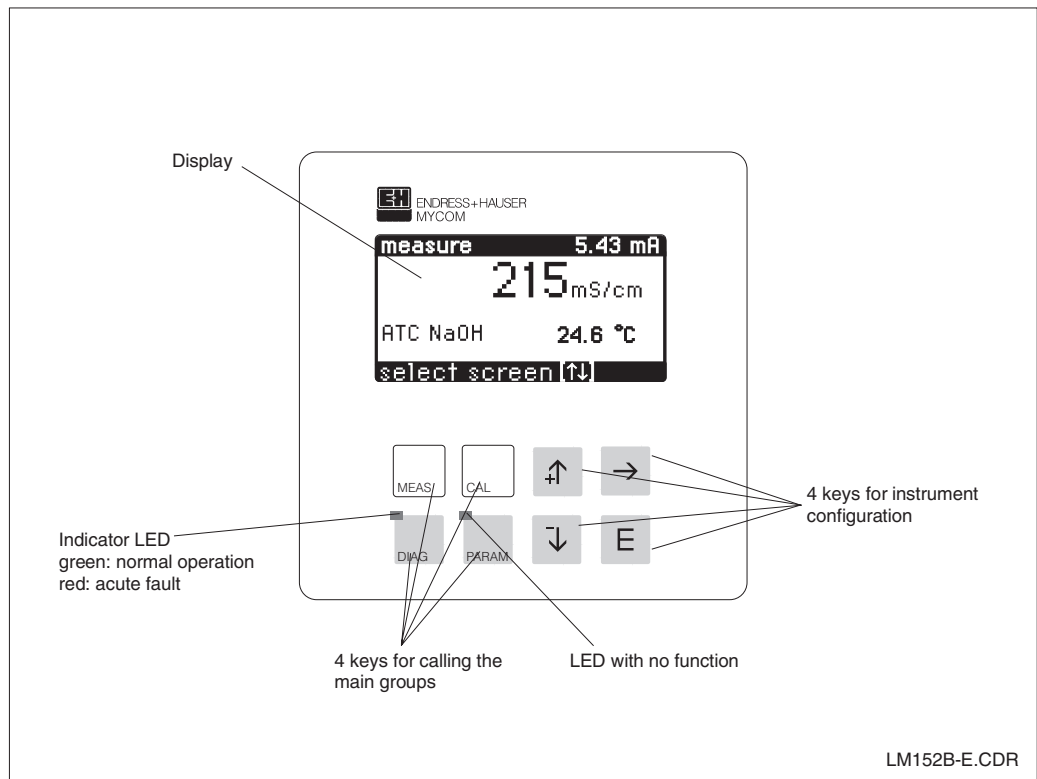


Fig. 5.1 Mycom CLM 152 operating elements

5.2 Display

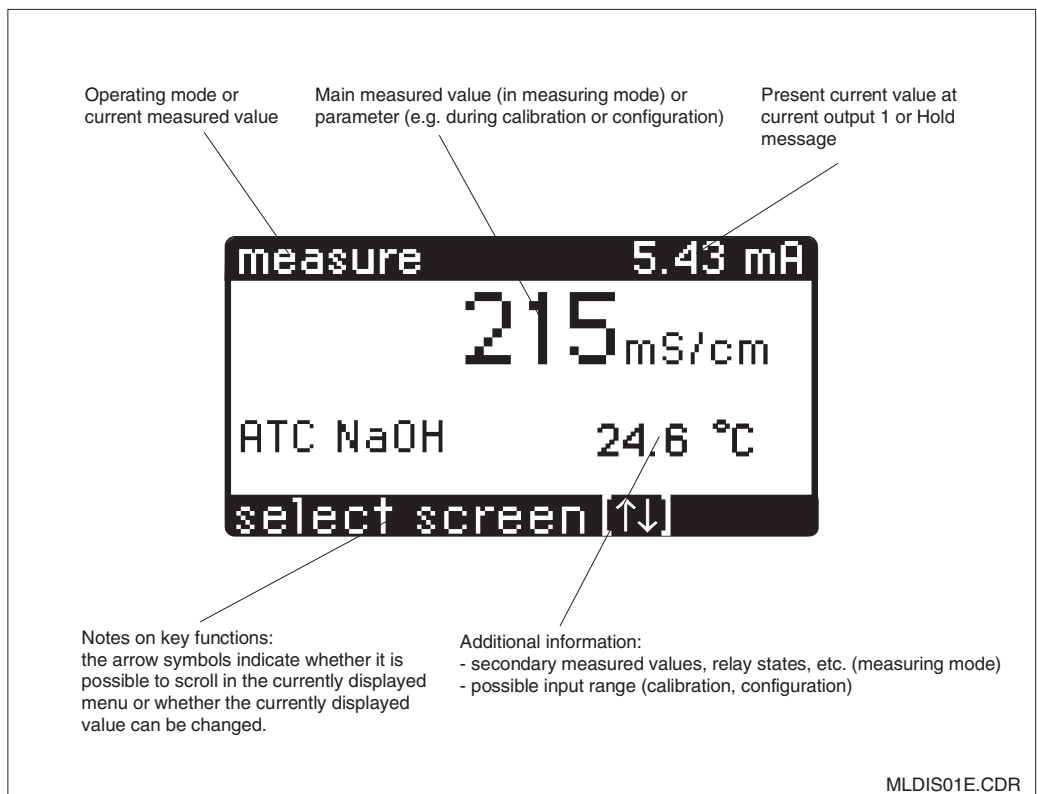


Fig. 5.2 Mycom CLM 152 display

5.3 Keyfunction



Measurement

- Measured value display
- Returns to measuring mode from any position



Calibration

- Activation calibration mode
- Calibration menu display



Diagnosis

- Displays fault and maintenance messages
- Displays information and statistics
- Calls the service routine with simulation, internal data and instrument check



Configuration

- Displays the configuration menu (to set up for other measuring and control tasks)
- Returns to the next higher menu level



- Increments the digit displayed in inverted mode
- Selects a menu line by moving the inverted bar
- Returns to the previous measured value display



- Decrements the digit displayed in inverted mode
- Selects a menu line by moving the inverted bar
- Steps to the next measured value display



- Selects the editing point in numerical values with several digits



Enter

- Accepts a value or a parameters during configuration
- Selects the menu line displayed in inverted mode

5.4 Operating concept

The functions of the measuring transmitter Mycom CLM 152 are divided into four main groups:

- Measurement
- Calibration
- Diagnosis
- Configuration

These groups are called with the corresponding keys. Within each main group, the functions relating to a particular subject are combined into sub-groups, some of which are subdivided further. The sub-groups are displayed in the form of a menu and can be selected with the keys ↑ and ↓ (inverted display). A menu may also contain more lines than can be displayed on one page. This is indicated by small arrows in the left margin of the window. Confirm your selection by pressing the E key.

Options are selected and parameters are set within the sub-groups by selection from a menu (see above) or by editing numeric values. To edit a value, select the digit to be edited with the → key and then adjust the value with the ↑ and ↓ keys. repeat this procedure as necessary for all other digits of the value. Then confirm the setting by pressing the E key. The limits within which a numerical value can be adjusted are shown on the penultimate line of the display. It is not possible to set a value outside these limits. After confirmation, you are prompted for the next parameter. When all parameters of a sub-group have been set, the menu of the sub-group is displayed again. You can return to the next-higher group menu by pressing the "Param" key.



Note:

It is also possible to switch to a different main group even when you are in the middle of a sub-group. Any settings which have not been confirmed with the E key before this is done are lost.

If you do not enter anything in a sub-group for 10 minutes, the instrument automatically returns to the measuring mode (except when it is in calibration or simulation mode).

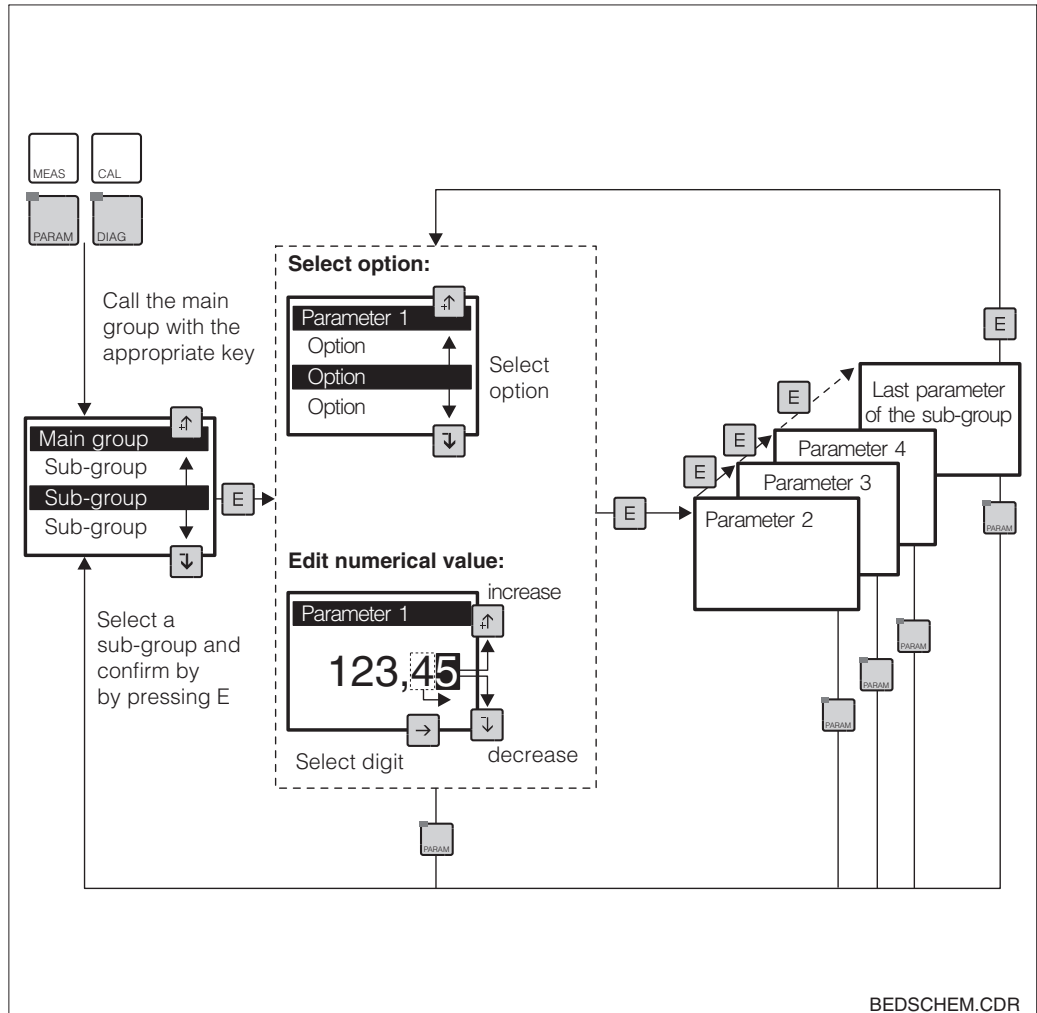


Fig. 5.3 Diagram of the Mycom operating concept

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6 Setting up and Measuring

6.1 Measures before first power-up

Before switching the instrument on for the first time, familiarise yourself with the operation of the measuring transmitter!



Caution:

Make sure all connections have been established correctly before power-up

Ensure that the measuring cell is immersed in the medium to be measured or in a calibration solution, since the displayed values will otherwise be implausible.

6.2 First start-up

When the instrument is switched on for the first time, it is automatically in measuring mode. Since all default settings (measurement type, measuring cell with cell constant and language) have already been made in the factory, the instrument can be used without making any further settings.

In order to change the basic settings of the instrument, a start-up menu can be called,

permitting the following settings, which are not decisive for the measurement, to be changed:

- Menu language
- Contrast
- Date
- Time
- Unit for temperature measurement

Key sequence for changing the basic settings:

Select:

	Specialist		Start-up		Basic setting menu selected
--	------------	--	----------	--	-----------------------------

Once this menu has been called, the desired settings can be selected and confirmed with the selection keys (see chapter 5.3). The possible settings are shown in the following list.



Note:

If the user has entered an authorisation code, the "Param" level can be accessed only with the aid of this code.

Start-up / Check list for changing the basic settings				
Prompt	Possible selections	Factory settings	Adjustment or setting required after instrument reset	Setting irrelevant for measurements
language (Language)	Deutsch, English, Français, Italiano	Deutsch		X
LCD contrast	For best viewing	"medium"		X
Date	Input of the current date	Current date		X
Time	Input of the current time	CET (not summer time)		X
Measuring mode	Conductivity, concentration, resistance (MΩ)	Resistance		
Measuring cell	2-electrode measuring cell, cell constant 4-electrode measuring cell, cell constant	2-electrode measuring cell, k = 0.01	yes	
Unit for temperature measurement	Celsius [°C], Fahrenheit [°F], Kelvin [K]	Celsius [°C]		X
Temperature compensation	manual (MTC) automatic (ATC)	ATC		
Compensation temperature (for MTC only)	-35.0 ... 250.0 °C	25 °C		
Measuring principle	Single-circuit measurement	Single-circuit measurement		X
Input contact	Hold, remote switching (only if card FCXI is fitted)	Hold		X
Relay function	Maintenance, limit value (in basic configuration)	Maintenance		X
	NAMUR ¹⁾ / GW 1 x GW / Chemoclean, 2 x GW / Chemoclean (if equipped with expansion module FCYK)	NAMUR ¹⁾ / GW		X
NAMUR contacts ¹⁾	Normally closed, normally open	Normally open		X
Failure relay	Wiper contact, continuous contact	Continuous contact		X
Fault contact assignment	to maintenance contact, not assigned	Maintenance contact		X

6.3 Measuring

6.3.1 Overview of the measuring setup and the type of temperature compensation

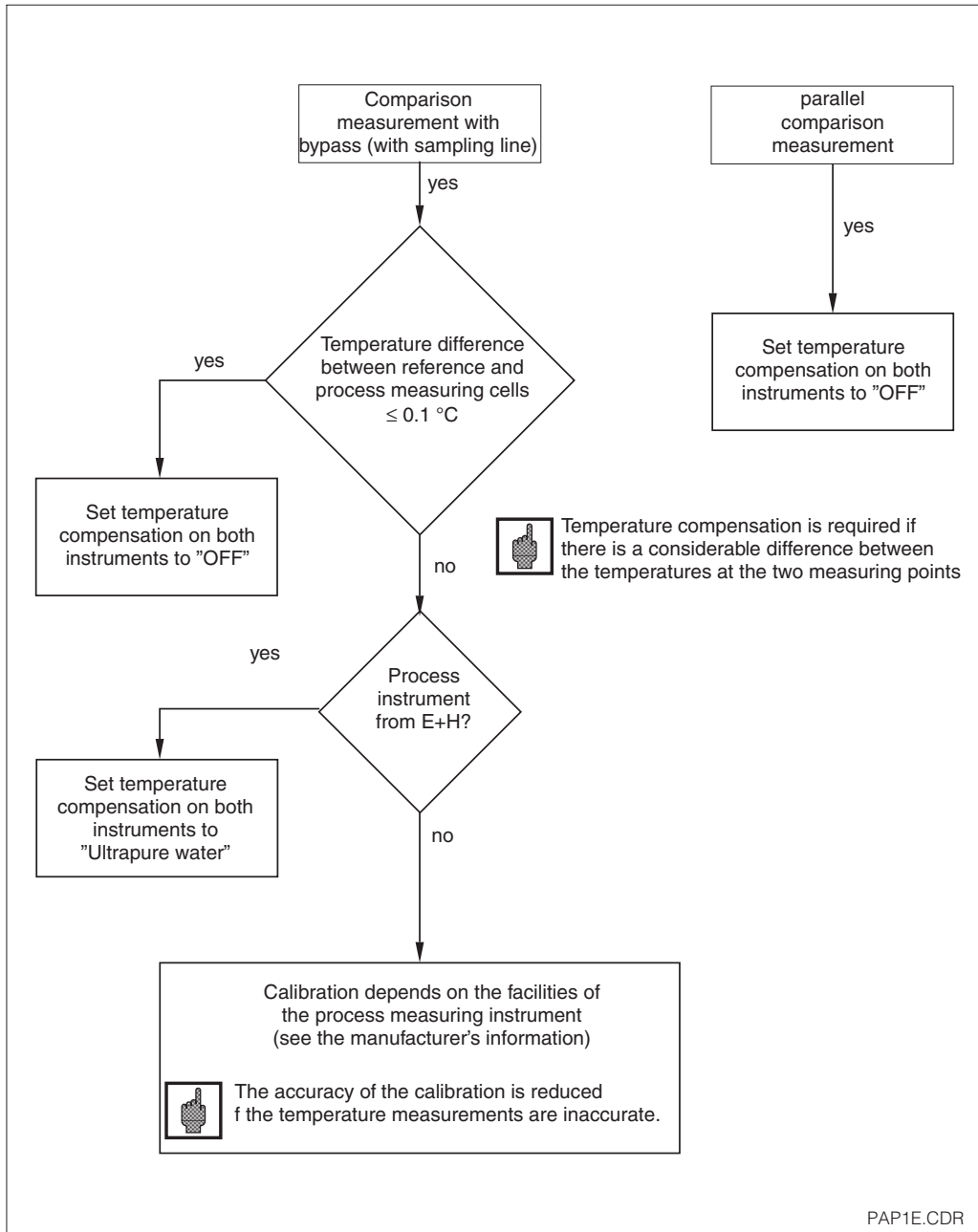


Fig. 6.1 Comparison of bypass and parallel comparison measurements

6.3.2 Parallel comparison measurement

Since the reference measuring cell and the processing measuring cell are at the same temperature, no temperature compensation is necessary.

After correct connection of the flow assembly and of the Mycom CLM 152, measurements can be made immediately (use inlet "IN 2" and screw a plug into "IN 1").

6.3.3 Comparison measurement with bypass

For a comparison measurement with bypass (with a separate sampling line), ensure that both cells are at the same temperature. This can be achieved at moderate fluid temperatures by using a short hose (temperature difference $\leq 0,1$ °C). Then measure the temperature with the ConCal and calibrate the temperature sensor of the process measuring cell. After this, the conductivity measurement can be calibrated.

If the temperatures are not identical during a comparison measurement, the compensated conductivity must be calibrated. For E+H instruments, use the compensation type "ultrapure water". Process measuring instruments made by other companies must be calibrated as specified in the manufacturer's instructions.

6.4 Resetting the instruments

If you want to reset the measuring transmitter to the data originally set in the factory, or if this becomes necessary due to incorrect

adjustment, the settings for measuring mode (measurement type, measuring cell, measuring principle) must be entered again.

Key sequence for “reset”:

Select:

	Service		Specialist		Factory settings	
--	---------	--	------------	--	------------------	--

Select:

All data		return to measuring mode
----------	--	--------------------------

Key sequence for "factory settings":

Select:

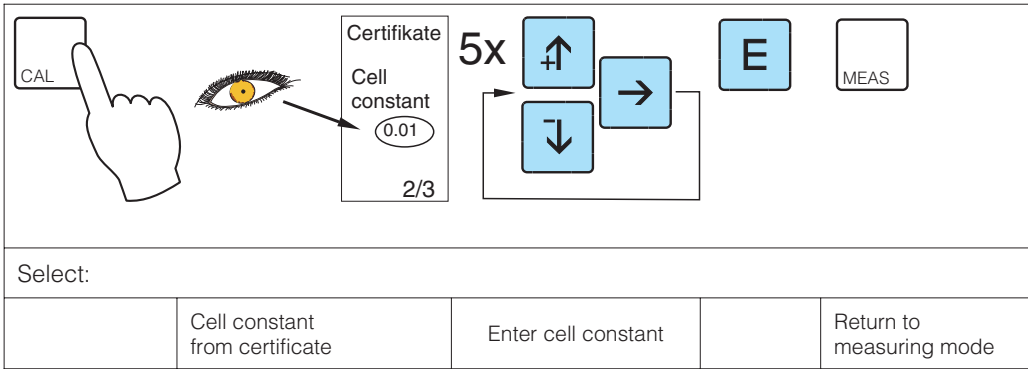
	Specialist		Unit data	System config.	Variable	Resistance		2EI. 0.01
--	------------	--	-----------	----------------	----------	------------	--	-----------

Select:

	Temperature	Temp. comp.		No comp.	Temperature	Temperature measurement	
--	-------------	-------------	--	----------	-------------	-------------------------	--

Select:

automatic	Calculate value: actual value + offset = new actual value (offset from certificate)	Enter new actual value	Compare set value with certificate
-----------	--	------------------------	------------------------------------



Caution:

It must be emphasised that these settings must be made each time the instrument is reset or the measurement type is changed. If this is not done, the displayed results will be incorrect.

7 Maintenance and Service

7.1 Cleaning

For cleaning the keys and the case of the Mycom CLM 152 and the case, we recommend the use of non-abrasive neutral detergents containing tensides.

No special cleaning is necessary for the flow assembly and the reference measuring cell, since these cannot become contaminated if used correctly in the pure and ultrapure water sector (see chapter 3.1). If cleaning should nevertheless become necessary, they can be rinsed with hot pure water.



Note:

If concentrated acids or alkalis, benzyl alcohol, methylene chloride or high-pressure steam are used for cleaning, we can accept no responsibility for any resulting damage.

7.2 Changing the fuse on the Mycom CLM 152

ConCal version:

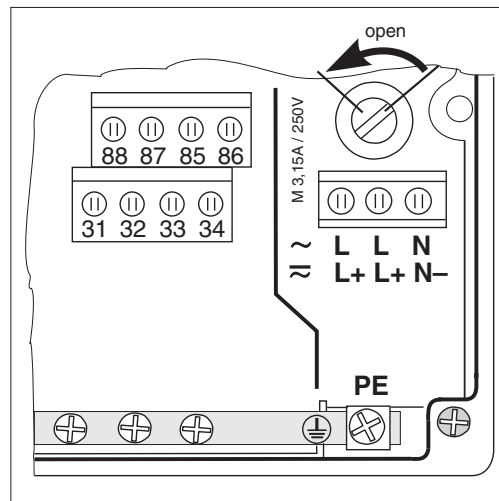


Fig. 7.1 Fuse holder on the ConCal version

Open the fuse holder by turning with a screwdriver in the indicated direction (see fig. 7.1), remove the defective fuse and insert a new fuse with the rating M 3.15 A / 250 V.

7.3 Repair

Repairs may be carried out only in the factory or by the Endress+Hauser service organisation. A list of Endress+Hauser

service locations can be found on the rear cover of these operating instructions.

7.4 Recalibration

We recommend that you have the ConCal calibration set recalibrated annually by E+H. You will then receive an updated factory calibration certificate.

8 Appendix

8.1 Technical data of ConCal

External dimensions of case (LxWxH)	520 x 340 x 165 mm
Weight	10 kg
Measuring instrument	Mycom CLM 152
Measuring range	$\mu\text{S}/\text{cm}$ or $\text{M}\Omega\cdot\text{cm}$; switchable
Cable length	5 m
Measuring cell	CLS 15
Supply voltage	230V 50Hz / 115V 50Hz
Temperature range of fluid	0 ... 100 °C
Flow assembly	
Installation positions	1 to 2 for 1/2" NPT thread
Temperature range	0 ... 100°C
Pressure	max. 6 bar
Minimum flow rate	30 l/h
Material	PVDF
Connections	
Inlet	G 1/2"
Outlet	G 1/2"
Vent	1/2" NPT
Error limits	
Calibration of factory reference system ($k = 1 \text{ cm}^{-1}$) at 149 $\mu\text{S}/\text{cm}$	
Error limit of calibration solution	0.5%
Max. indication error of factory conductivity meter at 149 $\mu\text{S}/\text{cm}$	0.2%
Calibration of ConCal at approx. 5 $\mu\text{S}/\text{cm}$ (or 200 $\text{k}\Omega \cdot \text{cm}$)	
Max. indication error of factory conductivity meter at 200 $\text{k}\Omega\cdot\text{cm}$	0.6%
Max. indication error of conductivity meter ConCal at 200 $\text{k}\Omega\cdot\text{cm}$	0.6%
Total error	$\Sigma = 1.9\%$
This ignores the change of the cell constant of the reference measuring cell in the conductivity range between 149 $\mu\text{S}/\text{cm}$ and 5 $\mu\text{S}/\text{cm}$	

8.2 Technical data of Mycom CLM 152

Resistance measurement

Measuring and display ranges for specific resistance

Cell constant k	Measuring range (MR) ¹⁾	Display range (DR)
0.01 cm ⁻¹	20.0 kΩcm ... 100.0 MΩcm	20.0 kΩcm ... 37.99 MΩcm

Deviation of measured value ²⁾display ±0.5% ±2 digits of measured value
 Reproducibility ²⁾ ±0.1% ±2 digits of measured value
 Reference temperature adjustable -35 ... +250 °C, typ. +25 °C
 Measuring frequency 128 ... 1024 Hz
 Measuring voltage ≤ 150 mV
 Conductivity signal output
 Current range 0 / 4 ... 20 mA
 Measurement deviation ²⁾ max. 0.5% of full-scale value
 Load max. 600 Ω
 Signal characteristic linear, bilinear, logarithmic, hyperbolic, inverse hyperbolic

Temperature measurement

Temperature sensor Pt 100 (3-wire connection)
 Measuring range (MR, can also be displayed in °F and K) -35 ... +250 °C
 Resolution 0.1 °C
 Deviation of measured value ²⁾ display max. 0.5 % of MR
 Reproducibility max. 0.1 % of MR
 Temperature signal output
 Current range 0 / 4 ... 20 mA
 Measurement deviation ²⁾ max. 0.5% of full-scale value
 Load max. 600 Ω
 Temperature signal output range adjustable Δ 28.5 ... Δ 285 °C

1) In each measuring range, the instrument has four internal switching stages.

Maximum accuracy and resolution are achieved automatically as a result.

2) In accordance with DIN IEC 746 Part 1, under rated operating conditions

Technical data of limit value and alarm functions

Function	limit switch
Function type	MIN or MAX
Setpoint settings (in absolute values)	0 ... 100% of DR
Switch-contact hysteresis (an absolute values)	1 ... 10% of DR
Pick / drop delay	0 ... 7200 s
Alarm threshold	0.5 ... 100 % of DR
Alarm delay	0 ... 6000 s

Electrical connection data and connections

AC supply voltage	115 / 230 V +10 / -15 %
Frequency	47 ... 64 Hz
Power consumption	max. 10 VA
Output contacts (optional)	potential-free changeover contacts (Ex version: optocouplers) can be used as normally open or normally closed contacts
Switched current	max. 3 A
Switched voltage	max. 250 VAC / 125 VDC
Switched power	max. 750 VA
Signal outputs	2 x 0 / 4 ... 20 mA, isolated from the other circuits but not from each other
Isolation voltage	270 V _{rms}
Terminals, maximum wire cross-section	2.5 mm ²

General technical data

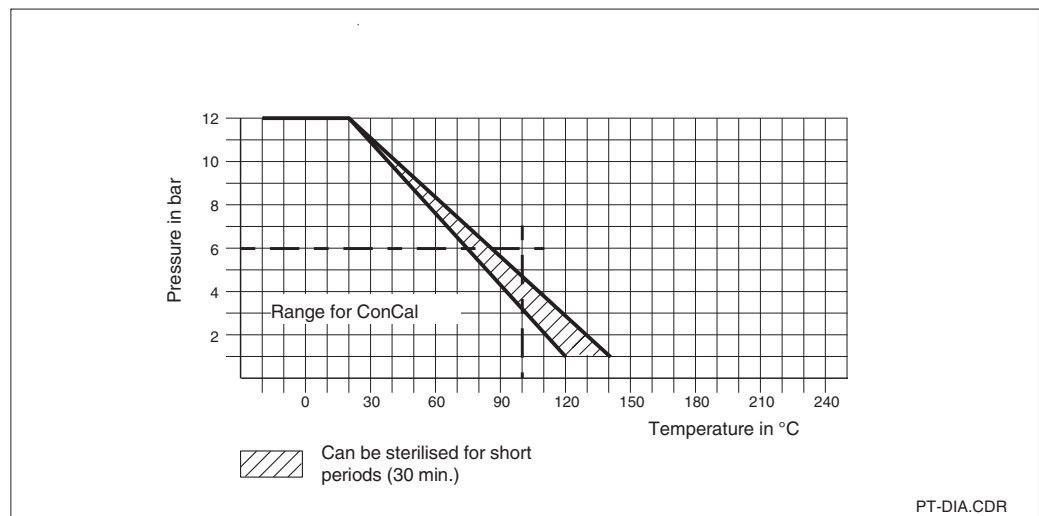
Measured value display	illuminated LC display with 128 x 64 dot matrix
Electromagnetic compatibility (EMC)	
Interference emission	acc. to EN 50081-1, 01.92
Interference resistance	acc. to EN 50082-2, 03.93
Rated operating conditions	
Ambient temperature	-10 ... +55 °C
Relative humidity	10 ... 95% non-condensing
AC supply voltage	115 / 230 V +10 / -15 %
Frequency	47 ... 64 Hz
DC supply voltage	24 V, +20 / -15 %
Limit operating conditions	
Ambient temperature	-20 ... +60 °C
Storage and transport temperature	-25 ... +85 °C

Mechanical data

Dimensions (HxWxD)	247 x 167 x 111 mm
Weight	max. 6 kg
Degree of protection	IP 65
Materials	
Case	GD-AISI 12 (Mg content < 0.05 %), plastic-coated
Front panel	Polyester, UV-resistant

8.3 Technical data of CLS 15

Cell shaft	PES (polyethersulfone)
Electrodes	stainless steel (1.4435), polished
Surface roughness	Rz 2 µm
Cell constant k	0.01/cm or 0.1/cm
Quality certificate	with details of materials and the individual cell constant
Measuring range for k = 0.01/cm	0.02 µS/cm to 20 µS/cm
Temperaturesensor	Pt 100
Connection	plug with Pg 11-union for measuring cable
Ingress protection	IP 67
Max. temperature	120°C
Max. pressure	12 bar (20°C)
Screw-in thread	1/2" NPT
Clamp connection	1 1/2"



8.4 Calibration certificate

Factory Calibration Certificate



Endress+Hauser Conducta
 Gesellschaft für Meß- und Regeltechnik mbH+Co.
 Dieselstraße 24, D-70839 Gerlingen

declares sole responsibility that the product

Calibration set ConCal
Serial No. 10004
 with
Mycom CLM 152
 and
Conductivity Measuring Cell CLS 15 ($k=0.01 \text{ cm}^{-1}$)

to which this declaration refers, corresponds to the following standards or standard documents:

Calibration with reference to
 ASTM Standard D 5391-93 and
 ASTM Standard D 1125 with
 NIST Standard Reference Material
 according to enclosures 1 to 3

Quality made by
 Endress+Hauser



ISO 9001

Endress + Hauser

Nothing beats know-how



Factory Calibration Certificate Werks-Kalibrierzertifikat

Endress+Hauser



Enclosure / Anlage 1/3

Calibration set / Kalibrierset ConCal
Serial no. / Serien-Nr.: **10004**

Measuring Instrument / Meßgerät Mycom CLM 152
Order Code / Bestell-Code CLM152-A1A0A10A
Serial No./ Serien-Nr.: **402559**

Date Calibrated / Kalibrierdatum: **24.09.97**

Recommended Recalibration /
Empfohlene Nachkalibrierintervalle: 1 Year / Jahr

Test Method / Kalibrierverfahren ASTM Standard D 5391-93

Meas. resistance Meßwiderstand	Cal. value Kalibrierwert	Meas. value Meßwert	Difference Abweichung
Conductivity measurement / Leitfähigkeitsmessung			
1,800 k Ω	180,0 k Ω cm	180,326	-0,326
18,00 k Ω	1800 k Ω cm	1806,763	-6,763
180,0 k Ω	18,00 M Ω cm	18,025	-0,025

Temperature measurement / Temperaturmessung			
109,90 Ω	25,4 $^{\circ}$ C	25	0,4
119,56 Ω	50,4 $^{\circ}$ C	50,14	0,26
138,66 Ω	100,5 $^{\circ}$ C	100,32	0,18

Factory setting see operating instructions ConCal BA 163C/07/en
Geräte-Werkseinstellung siehe Betriebsanleitung ConCal BA 163C/07/de

Calibration Standard for Measuring resistors / Kalibrierstandard für Meßwiderstände

Manufacturer / Hersteller: **Hewlett-Packard**
Type / Typ: **3458**
Serial No./ Serien-Nr.: **A 96123**
DKD-Zertifikat-Nr.: **DKD-K-02201**

Company stamp/ Firmenstempel, Date/Datum:
Workinspector/Werkssachverständiger

SD 030C/07/A3/05.97

Endress + Hauser
CONFORME A LA CERTIFICATION
ISO 9001:2000
Date: 25.03.97
Signature: [Handwritten Signature]

**Factory Calibration
Certificate
Werks-Kalibrierzertifikat**

Endress + Hauser



Enclosure / Anlage 2/3

Calibration set / Kalibrierset **ConCal**
Serial no. / Serien-Nr.: **10004**

Conductivity Measuring Cell / Meßzelle **CLS 15**
Order Code / Bestell-Code **CLS15-A1A1A**
Serial no./ Serien-Nr.: **50978**

Date Calibrated / Kalibrierdatum: **24.09.97**
Recommended Recalibration /
Empfohlene Nachkalibrierintervalle: **1 Year / Jahr**

Test Method / Kalibrierverfahren **ASTM Standard D 5391-93**

Conductivity / Leitfähigkeit	k= 0,01 cm ⁻¹ :		
Cal. value	Meas. value	Cell constant	
Kalibrierwert	Meßwert	Zellkonstante	
Ref. in µS/cm	CLS 15 in µS/cm	CLS 15 in cm⁻¹	
5,727	5,646	0,0101	
Cal. temperature	Meas. value	Temp. offset	
Kalibriertemp. in °C	Meßwert in °C	CLS 15 in °C	
32,73	32,8	-0,1	

Calibration Standards / Kalibrierstandards

Reference cell / Vergleichsmeßzelle
Manufacturer / Hersteller: **Endress+Hauser Conducta**
Type / Typ: **CLS-TSP3567**
No. / Nr.: **L 12750**
Cell constant / Zellkonstante: **1.000 / cm**
Cal. Standard Ref. Cell: **0.949 / cm**

Thermometer

Manufacturer / Hersteller: **Testo**
Type / Typ: **Einbaufühler 06121 1714/608**
DKD-Zertifikat-Nr.: **DKD 09635**

Company stamp/ Firmenstempel, Date/Datum:
Workinspector/Werkssachverständiger

SD 030C/07/A3/05.97

Endress + Hauser
CONDUCTA Gesellschaft für
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Dieselstr. 24, 70839 Gerlingen

Factory Calibration Certificate Werks-Kalibrierzertifikat

Endress + Hauser



Enclosure / Anlage 3/3

Calibration bag / Kalibrierkoffer **ConCal**
Serial no. / Serien-Nr.: **10004**

Conductivity Measuring Cell / Meßzelle **CLS 15**
Order Code / Bestell-Code **CLS15-A1A1A**
Serial no./ Serien-Nr.: **50978**

Date Calibrated / Kalibrierdatum: **24.09.97**

Recommended Recalibration /
Empfohlene Nachkalibrierintervalle: **1 Year / Jahr**

Test Method / Kalibrierverfahren: **ASTM Standard D 5391-93**

Pt 100 calibration / Kalibrierung

Cal. temperature Kalibriertemp. in °C	Meas. value Meßwert in °C
5,080	4,8
50,420	49,7
80,440	79,6

Isolation resistance / Isolationswiderstand

Measured value

Meßwert

Inner electrode / Innenelektrode - Pt 100

> 10 MΩ

Outer electrode / Außenelektrode - Pt 100

> 10 MΩ

Calibration Standards / Kalibrierstandards**Reference resistor / Meßwiderstand**

Manufacturer / Hersteller: **Hewlett-Packard**
Type / Typ: **3458**
Serial No. / Serien-Nr.: **A 9666**
DKD-Zertifikat-Nr.: **DKD-K-02201**

Thermometer

Manufacturer / Hersteller: **Testo**
Type / Typ: **Einbaufühler 06000 9999/703**
DKD-Zertifikat-Nr.: **DKD 11280**

Company stamp/ Firmenstempel, Date/Datum:
Workinspector/Werkssachverständiger

SD 030C/07/A3/05.97

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