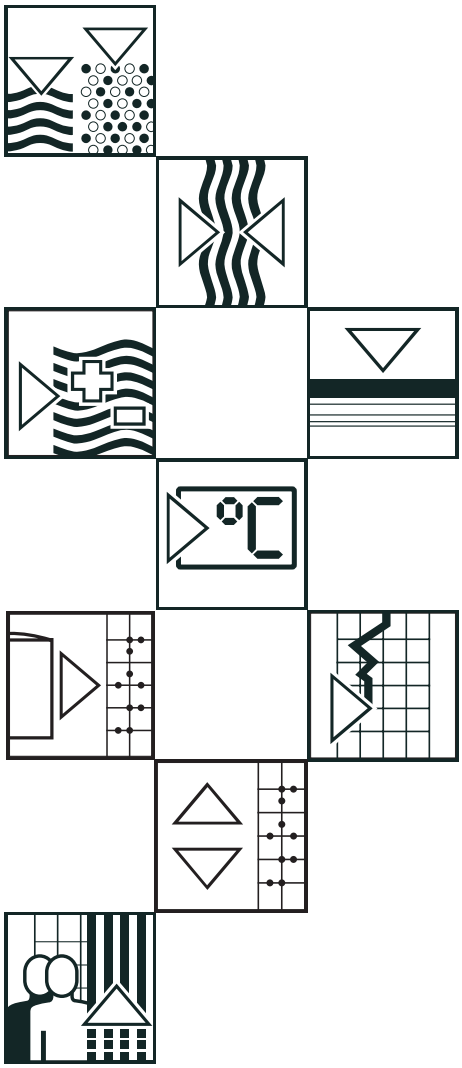
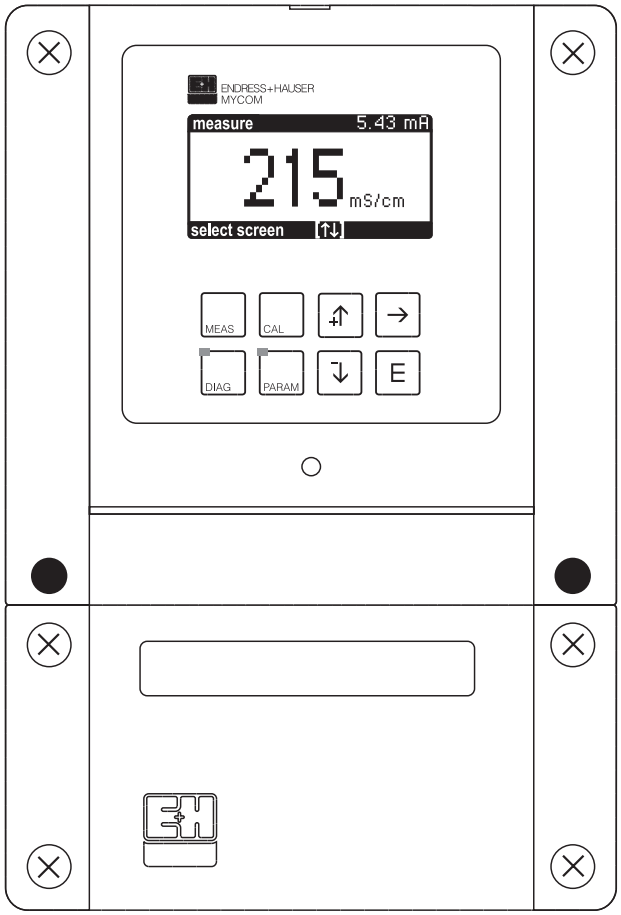
BA 168C/24/ae/03.00
63002112
Software Version 2.00 or later

mycom CLM 152

Conductivity Analyzer

Operating Manual





Quality made by Endress+Hauser
ISO 9001

Endress+Hauser
The Power of Know How

Please familiarize yourself with the instrument before you take any other steps:

General Information

Safety

Description

You want to install and start up the instrument.
All the necessary steps can be found in these chapters:

Installation

First Start-up

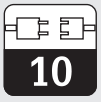
You want to operate or reconfigure the instrument.
The operating concept is explained in these chapters:

Operation

Instrument Configuration

Limit Configuration

Calibration



Profibus Interface

When you encounter problems or when the instrument requires maintenance, please refer to these chapters:

Diagnostics

Appendix

Maintenance and Service

Index

Please refer to the Mycom menu structure overview on the last pages of these operating instructions.

Table of Contents

IMPORTANT NOTICE
RETURN AUTHORIZATION POLICY

Endress+Hauser must pre-approve and assign a Return Authorization number to any instrument you plan to return. Please identify the Return Authorization number clearly on all shipping cartons and paperwork.

Please note that the issuance of a Return Authorization number does not automatically mean that credit will be issued, or that the return is covered by our warranty. An Endress+ Hauser associate will contact you regarding the disposition of your returned equipment.

In order to serve you better, and to protect our employees from any potentially hazardous contaminants, Endress+Hauser must return unopened, at the sender's expense, all items that do not have a Return Authorization number.

To get a Return Authorization number, call

1-800-428-4344
In Canada 1-800-668-3199

Please be sure to include the following information when requesting a Return Authorization number. This information will help us speed up the repair and return process.

Customer name:
Customer address:
Customer phone number:
Customer contact:
Equipment type:
Original sales order or purchase order number:
Reason for return:
Failure description, if applicable:
Process material(s) to which the equipment has been exposed:

OSHA Hazard Communication Standard 29CFR 1910.1200 mandates that we take specific steps to protect our employees from exposure to potentially hazardous materials. Therefore, all equipment so exposed must be accompanied by a letter certifying that the equipment has been decontaminated prior to its acceptance by Endress+Hauser.

The employees of Endress+Hauser sincerely appreciate your cooperation in following this policy.

Address your equipment to:

Endress+Hauser
2350 Endress Place
Greenwood, IN 46143
Return Authorization number:

In Canada:

Endress+Hauser
1440 Graham's Lane, #1, Burlington
Ont. Canada L7S 1W3
Return Authorization number:

Effective November 1987

1 General Information

1.1 Symbols used

In order to highlight safety-relevant or alternative operating procedures in the manual, the following conventions have been used, each indicated by a corresponding icon.

Note!
A note highlights actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned.


Note!

Caution!
Caution highlights actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the instrument.


Caution!

Warning!
A warning highlights actions or procedures which, if not performed correctly, will lead to personal injury, a safety hazard or destruction of the instrument.


Warning!

1.2 Conformity Statement

The conductivity transmitter Mycom CLM 152 has been developed and manufactured in accordance with current European & U.S. standards and directives.

Note!
A conformity statement can be obtained from Endress+Hauser.


Note!

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2 Safety

2.1 Intended Application

The transmitter Mycom CLM 152 is a microprocessor-controlled measuring and control instrument used to determine and evaluate specific conductivity. Since it has been designed to permit extensive programming and the addition of optional plug-in modules, it can be adapted to different process applications. If the version of the Mycom CLM 152 with intrinsically safe design is chosen, it can be operated in explosive atmospheres as well.

2.2 General Safety Instructions

Warning!
Operating this instrument in any way other than described in these instructions may compromise the safety and function of the measuring system.

The Mycom CLM 152 instrument has been designed and manufactured for safe operation according to the state of the art in engineering and conforms to the relevant regulations and US and EC directives (see "Technical Data"). However, if used improperly or other than the intended purpose, it may be hazardous, e.g. due to improper connection.

Installation, electrical connection, start-up, operation and maintenance of the measuring system must therefore be performed exclusively by trained specialist personnel properly authorized by the system operator for such work. The specialist personnel must be familiar with these operating instructions and must adhere to the instructions contained therein.

2.3 Safety Functions

Access Code: Unauthorized access to the calibration and configuration data of the transmitter is effectively prevented by access codes.

Alarm Function: The failure contact is activated in case of system faults, temperature sensor failure and serious defects.

The alarm contact is fail-safe by design, i.e., the alarm is also actuated immediately in case of a power failure.

Data Integrity: The current configuration is maintained even after a power failure.

Electromagnetic compatibility: This instrument is protected against interference, such as pulse-shaped transients, high frequency and electrostatic discharges in accordance with the current European standards.

This is, however, only the case for instruments connected as outlined in these operating instructions.

2.4 Repairs, Hazardous Materials

The following procedures must be carried out before a Mycom CLM 152 is sent to Endress+Hauser for repair:

- In every case, a note must be enclosed with the instrument, containing a description of the fault, the application and the chemical and physical properties of the product being measured.
- Remove all residue which may be present. Pay special attention to the gasket grooves and crevices where fluid may be present. This is especially important if the fluid is dangerous to health, e.g. corrosive, poisonous, carcinogenic, radioactive, etc.
- No instrument should be returned to us without all dangerous material being removed first (e.g. in scratches or diffused through plastic).

Incomplete cleaning of the instrument may result in waste disposal or cause harm to personnel (burns, etc.). Any costs arising from this will be charged to the owner of the instrument.

See Return Authorization Policy on page 4.

2.5 Technical Improvements

The manufacturer reserves the right to modify technical data without prior notice.

3 Description

3.1 Application Areas

The Mycom CLM 152 transmitter is highly suitable for carrying out measuring and control assignments in the following areas:

- Food industry
- Pharmaceutical industry
- Chemical process engineering
- Water treatment
- Drinking water
- Ultrapure water monitoring

3.2 Operating Principle

General Principle

The general principles of the instrument are the measurement of specific conductivity, the measurement of specific resistance, concentration measurement, difference measurement (if the instrument is equipped with two measuring channels). The CLM 152 also provides remote measuring range switching.

Toroidal Conductivity

In toroidal conductivity measurement, an excitation coil generates a continuous magnetic alternating field that induces an electric voltage in a liquid. The ions present in the liquid enable a current flow which increases with increasing ion concentrations. The ion concentration serves as a measure of conductivity. The current in the liquid generates a magnetic alternating field in the receiving coil. The resulting current induced in the receiving coil is processed in the measuring instrument and output as a conductivity value.

The advantages of this measuring principle are accurate measurement in media with a tendency to sediment, no electrically conductive connection between measuring cell and liquid, an no polarization since there are no electrodes.

3.3 Measuring Functions

Concentration Measurement

Data for NaOH, HNO_3, H_2SO_4 and H_3PO_4 are permanently stored in the instrument for this mode of operation. The user can enter the data of four other substances within the permissible value ranges, store them and activate them as concentration measuring ranges whenever required. See chapter 7 “Measurement Type”.

Difference Measurement

Two measuring cells are used at different points of a process, e.g. for heat exchanger monitoring (upstream and downstream from the exchanger) in media separation or mixture control. The difference between the two measured values is used to control the process.

Polarization Compensation (Contacting)

Polarization effects in the boundary layer between the electrode and measuring solution limit the measuring range of contacting measuring cells. The Mycom CLM 152 transmitter can detect and compensate for polarization effects using an innovative, intelligent signal evaluation procedure. This results in a significant expansion of the measuring cell measuring range (overview of conductivity measuring cells).

Measuring Range Switching
The instrument can store the following settings for a total of four measuring ranges:

- Measured value assignment for current output (0/4 and 20 mA)
- Setpoint and hysteresis values for the limit contacts
- Temperature coefficients
- Alarm delay
- Type of temperature compensation

Switching is affected by configuring the internal trigger thresholds accordingly or by controlling the binary inputs (requires expansion module FCXI).

3.4 Measuring System

A typical measuring system consists of:

- a toroidal conductivity measuring cell with an integrated temperature sensor Pt 100
- an appropriate conductivity measuring cable with or without junction box for cable extension
- the Mycom CLM 152 transmitter

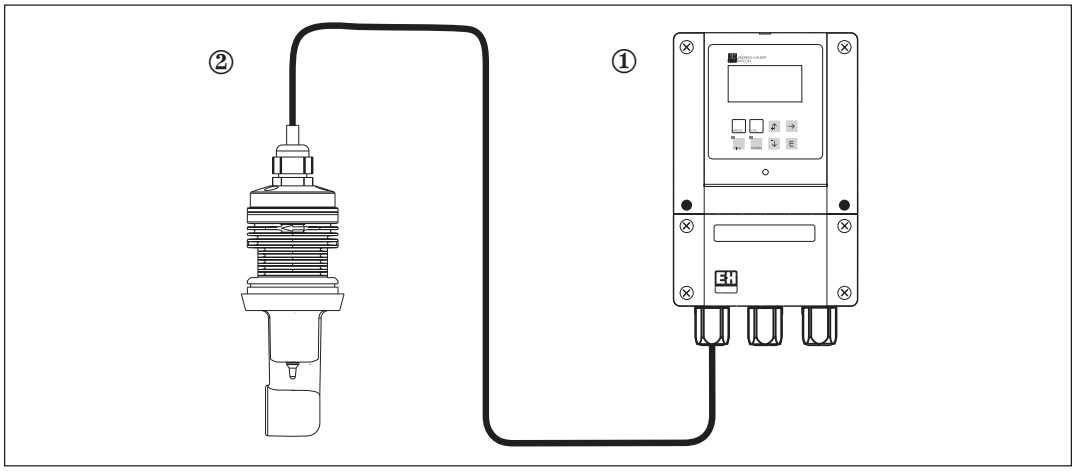


Figure 3.1
Example of a complete measuring system
① Mycom CLM 152 toroidal option
② Conductivity measuring cell (e.g. CLS 52)

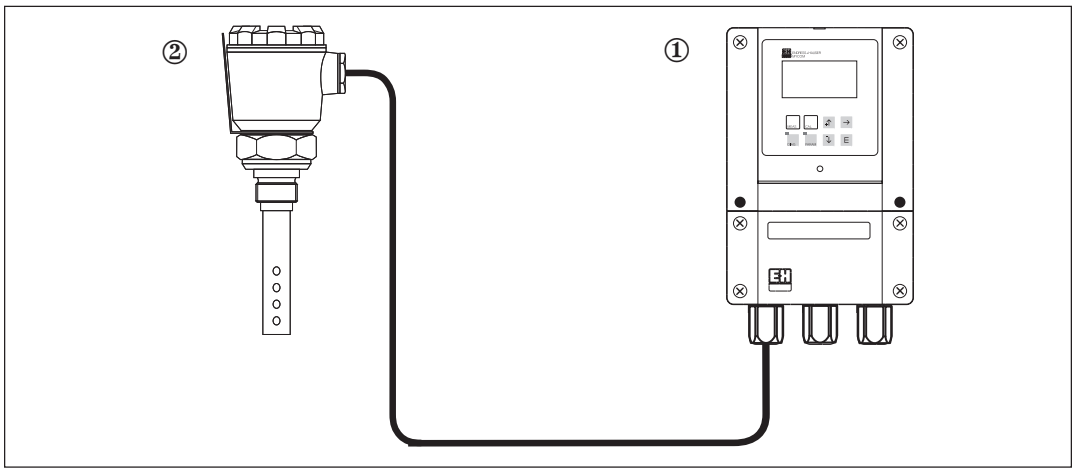


Figure 3.2
Example of a complete measuring system
① Mycom CLM 152 contacting option
② Conductivity measuring cell (e.g. CLS 12)

3.5 Major Features

- Illuminated graphics display, 128 x 64 dots
- Menu-guided plain text operation
- Extensive and clearly structured programming alternatives
- Protection of configuration and calibration by user-defined access codes
- Modular design with plug-in modules, therefore, two measuring inputs, active current input, two current outputs 0/4 to 20 mA and up to five contact outputs are possible.

Note!
Expansion of the instrument by adding new plug-in modules or replacement of individual modules must, however, be carried out exclusively by the manufacturer or the Endress+Hauser service organization (see the back cover of these operating instructions for a list of offices).

3.6 Instrument Versions

You can identify the instrument version by means of the order code on the nameplate and the required power supply.

CLM152- **MYCOM CLM 152**
Conductivity and resistance measurement transmitter

Configuration and certificate

A1A	1-circuit; base version
A1C	1-circuit; feedback/hold contact/remote MR switching
A2A	2-circuit; base version
F1A	1-circuit; FM CL. I, Div 2; CL II/III Div 1; CL. I Zone 2; NI outputs
F1B	1-circuit; 3 optocouplers/Chemoclean, FM CL. I, Div 2; CL II/III Div 1; CL. I Zone 2; NI outputs
F1D	1-circuit; 3 optocouplers/Chemoclean/feedback/hold contact, MR switching FM CL. I, Div 2; CL II/III Div 1; CL. I Zone 2; NI outputs
F1G	1-circuit; feedback/hold contact/remote MR switching, Profibus, FM CL. I, Div 2; CL II/III Div 1; CL. I Zone 2; NI outputs
F2B	2-circuit; 3 optocouplers/Chemoclean FM CL. I, Div 2; CL II/III Div 1; CL. I Zone 2; NI outputs
G1A	1-circuit; FM CL. I, Div 2; CL II/III Div 1; CL. I Zone 1; IS outputs
G1B	1-circuit; 3 optocouplers/Chemoclean, FM CL. I, Div 2; CL II/III Div 1; CL. I Zone 1; IS outputs
G1D	1-circuit; 3 optocouplers/Chemoclean/feedback/hold contact, MR switching FM CL 1, Div 2; CL II/III Div 1; CL. I Zone 1; IS outputs
G1G	1-circuit; feedback/hold contact/remote MR switching, Profibus, FM CL. I, Div 2; CL II/III Div 1; CL. I Zone 1; IS outputs
G2B	2-circuit; 3 optocouplers/Chemoclean, FM CL. I, Div 2; CL II/III Div 1; CL.I Zone 1; IS outputs

Power supply

1	Power supply: 115 V AC
8	Power supply: 24 V DC

Language version

A	Language: D, E, F, I switchable

Measuring process/Feature

31	NPT 1/2” cable entry, contacting and toroidal
41	NPT 1/2” cable entry, contacting and toroidal with moisture protection

Mounting

A	Without additional mounting kit
B	With post mounting kit

3.7 Accessories

3.7.1 Supplied Accessories

- Mounting kit for panel and post mounting (mounting version B only)
- One (1) measuring point label with two (2) nails

Endress+Hauser conductivity measuring cells that can be connected.

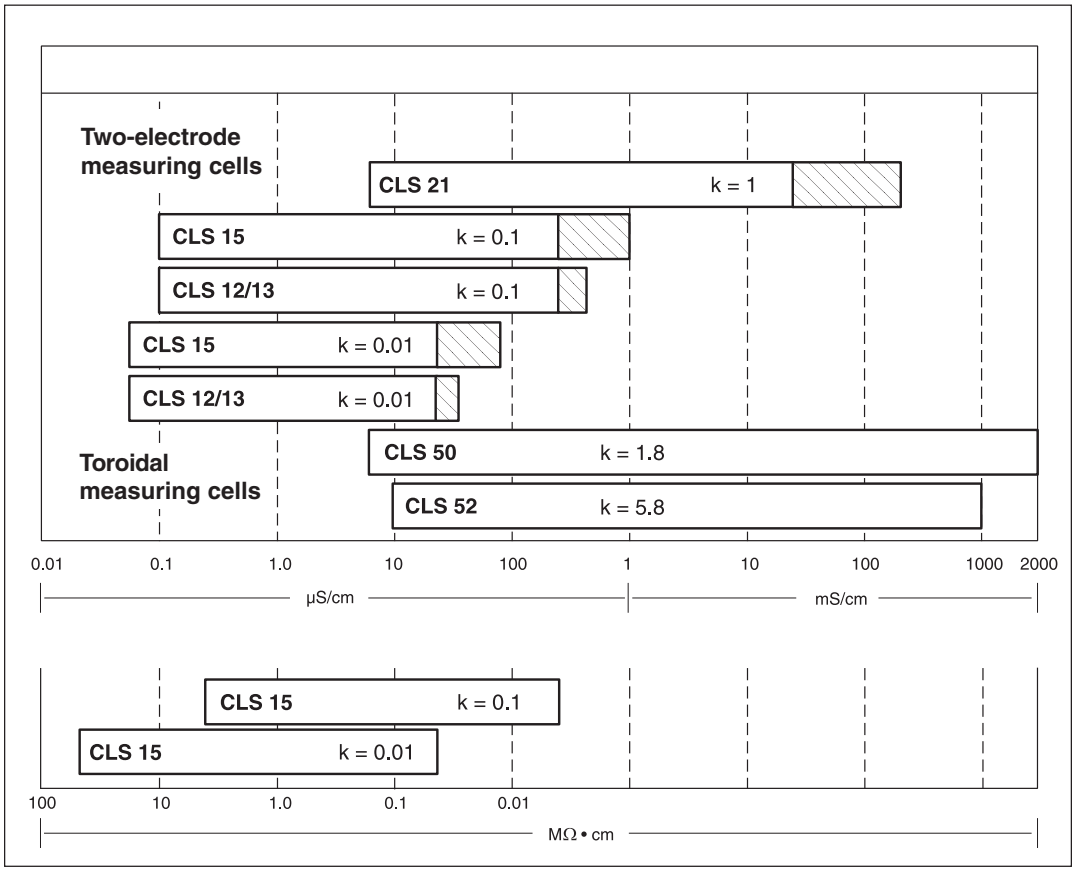


Figure 3.3 Conductivity measuring cells by Endress+Hauser

Specified application range

Extended measuring range due to polarization compensation

3.7.2 Calibration Solutions

Type	Conductivity at 77°F (25°C) [1]	Order Number
CLY 11-A	74.0 µS	50081902
CLY 11-B	149.6 µS	50081903
CLY 11-C	1.406 mS	50081904
CLY 11-D	12.64 mS	50081905
CLY 11-E	107.00 mS	50081906

Precision calibration solutions for conductivity, accuracy ± 0.5% at 77°F (25°C), bottle containing 33 oz. (500 ml).

[1] Values may vary due to manufacturing tolerances. The accuracy is given for the value specified on the bottle

3.7.3 Junction Box VBM

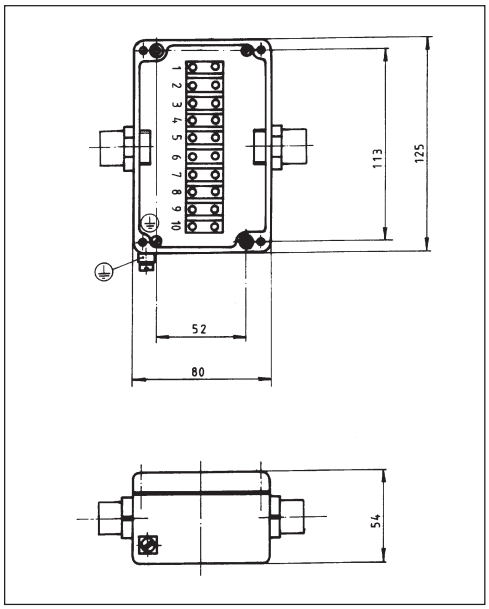


Figure 3.4
Dimensions of junction box VBM

Installation of junction box VBM is required when the connecting cable of the CLS 52/ CLS 50 sensor must be extended beyond the normal length by means of a special extension cable. Junction box VBM is supplied with two (2) NPT ½″ conduit entries and 10 high-resistance isolated screw terminals for connection of individual cores; material: painted aluminum; protection type NEMA 4X (IP 65); order no. 51500177.

3.7.4 Sensor Cable CLK 5

Special cable for extension of sensor cable in conjunction with toroidal measuring cells. Maximum total cable length 197 ft. (60 m); order number 50085473.

3.7.5 Sensor Cable CLK 71

Special cable for extension in conjunction with contacting measuring cells.

4 Installation

4.1 Storage and Transport

The packaging material used to store or transport the instrument must provide shock and moisture protection. Optimal protection is provided by the original packaging materials. The ambient conditions also have to meet the requirements (see “Technical Data”).

4.2 Unpacking

Inspect for any damaged contents. The post office or freight carrier must be informed of any damage and the supplier must be notified.

Check that the delivery is complete and corresponds to your order and the shipping documents:

- Quantity delivered
- Instrument version according to the nameplate
- Accessories (see chapter 3.7)
- Operating instructions

Keep the original packaging materials for future storage or shipment of the instrument.

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

4.3 Mounting

Insert the screws in the mounting holes in the housing and secure the instrument as shown in Figure 4.1.

The holes are covered with plastic caps.

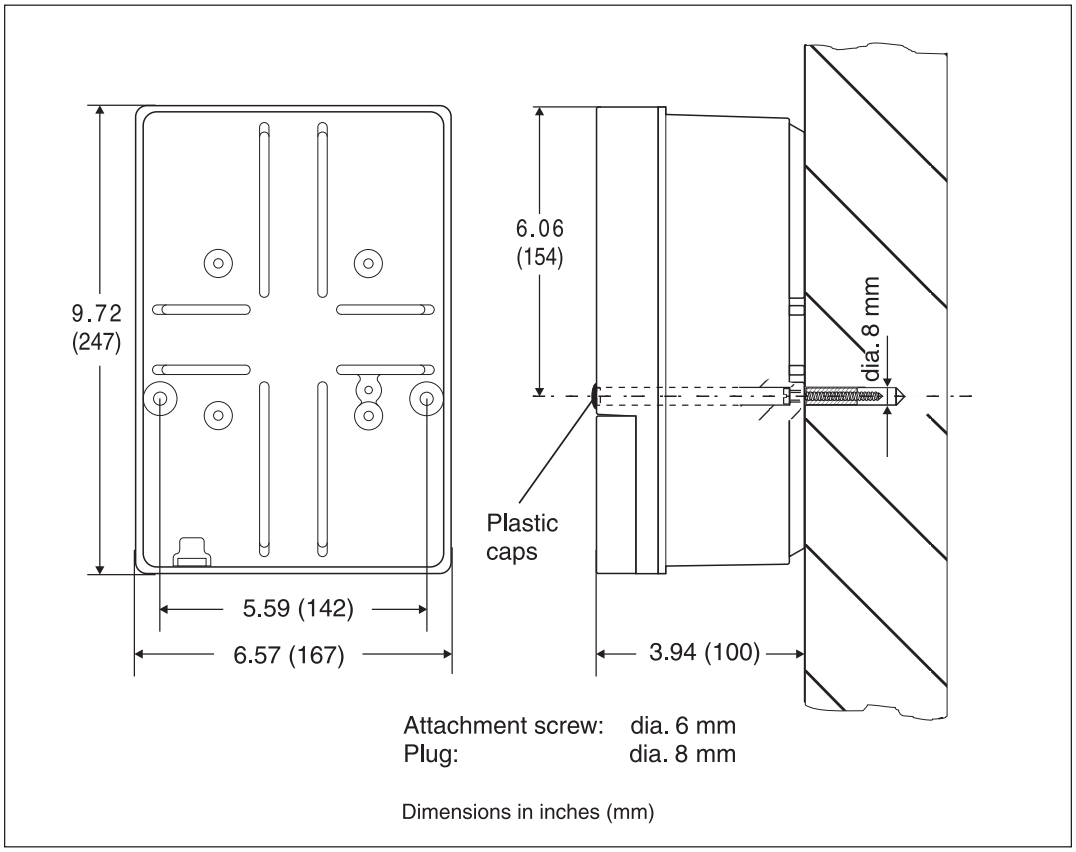


Figure 4.1
Dimensions for wall mounting

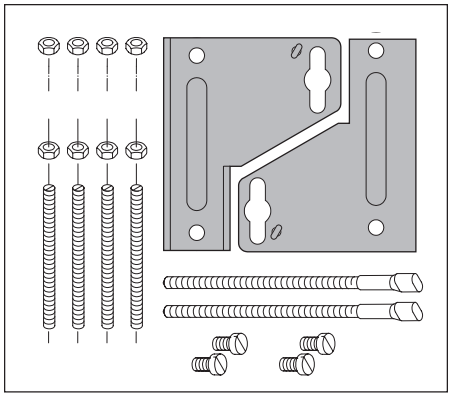
4

Post Mounting and Panel Installation (Mounting Version B)

Attach the parts of the mounting kit supplied with the mounting version B to the back of the housing, as shown in Figure 4.2:

Cut-out required: $6.34^{+.02}$ x $9.49^{+.02}$ ($161^{+0.5}$ x $241^{+0.5}$ mm)
Installation depth: 5.26″ (134 mm)
Pipe diameter: max. 2.76″ (70 mm)

Caution!



Caution!
Weather protection cover CYY 101 has to be used for outdoor installation (see “Mounting accessories” below).

Figure 4.2
Mounting kit for panel installation and post mounting (order no. 50061357)

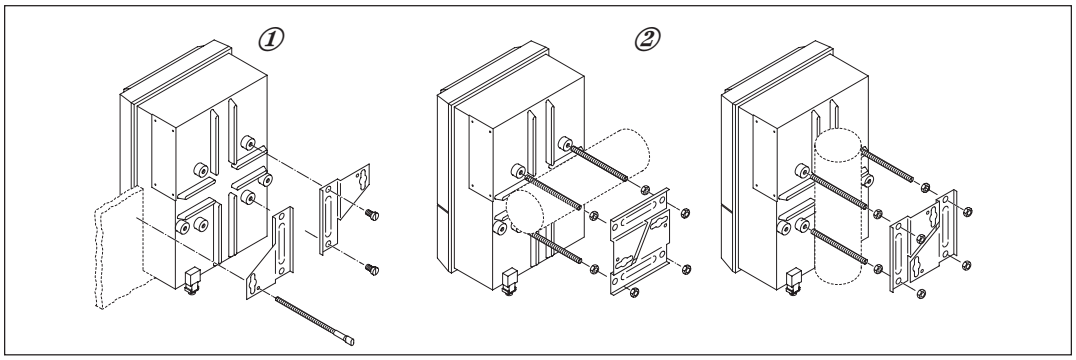


Figure 4.3
① Panel installation
② Post mounting of Mycom CLM 152

Mounting Accessories

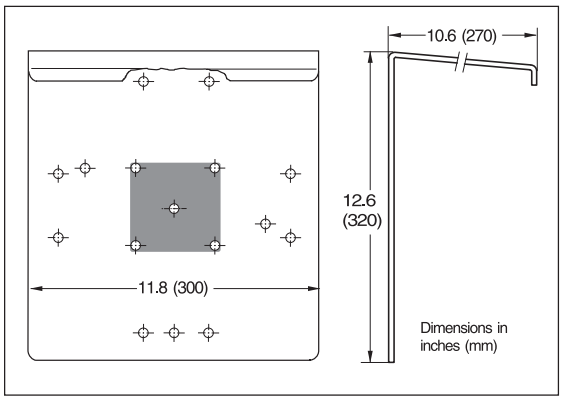


Figure 4.4
Weather protection cover

Weather protection cover CYY 101 for outdoor installation of the Mycom CLM 152.

The weather protection cover post mounting kit (see Fig. 4.5) is also needed for installation on vertical or horizontal pipes.

Material: stainless steel
Order no. CYY101-A

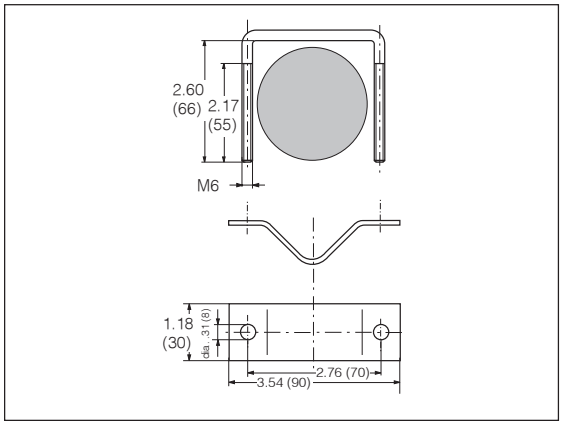


Figure 4.5
Round post mounting kit for weather protection cover CYY 101

Round post mounting kit for weather protection cover CYY 101. For installation on vertical or horizontal pipes with diameters of up to 2.75 in. (70 mm).

Material: stainless steel
Order no. 50062121

4.4 Electrical Connection of Mycom CLM 152

Warning!

- Only appropriately trained personnel are allowed to work on the instrument when the system is live and is connected to the power supply.
- A power disconnect must be installed near the instrument.
- Do not start up the instrument until the PE conductor has been connected!
- Before connecting the instrument to the input power source, make sure the voltage matches the voltage rating on the nameplate!

Caution!
All lines conducting signals are to be shielded and run separately from other control lines.

Note!

- Immunity against interference can only be guaranteed if the shielded ground wire is kept as short as possible. Do not solder an extension onto the shield!
- If the instrument is being installed on a post, grounding the post is recommended.

Instrument Connections

- Undo the four screws in the bottom third of the front of the front panel.
- Remove the connection compartment cover.
- A connection diagram and information about the plug-in modules installed can be found folded up in the cover.
- Replace the plugs in the holes on the bottom of the housing.
- Feed the cable through the conduit entries into the connection compartment.
- Connect the cables in accordance with the connection diagrams on the following pages.

Warning!
In the non-Ex (non-hazardous) area, the output contacts can also be connected to the instrument's auxiliary power supply.

To do this, the thin section provided in the separating wall on the connection compartment lid must be broken out with a pair of pliers.

Now a cable connection between the right and left parts of the connection compartment can be established by attaching the cable carefully and without forming a loop in the cable clip provided.

4.4.1 Connection of Mycom CLM 152 in non-Ex (non-hazardous) Areas

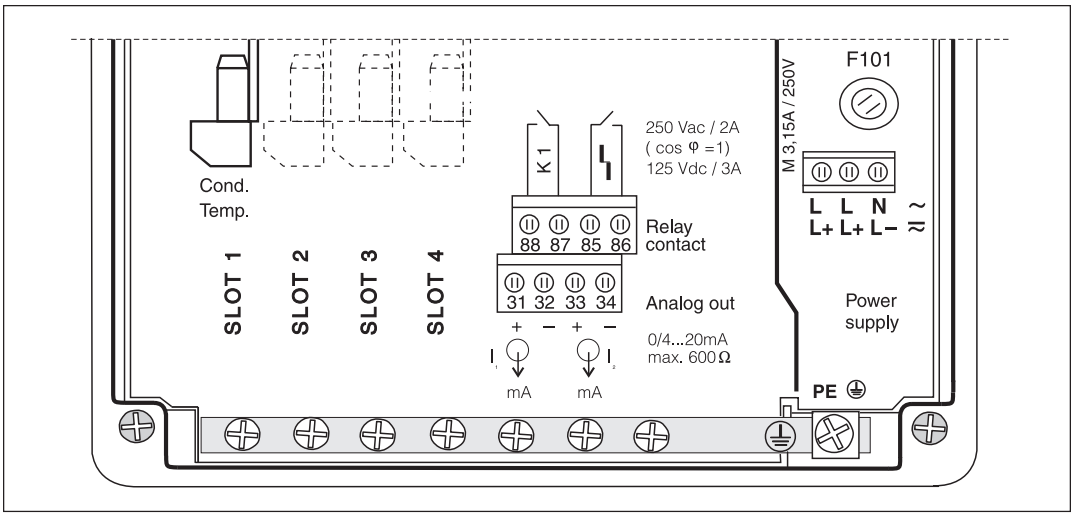


Figure 4.6
Connection compartment of Mycom CLM 152 (basic configuration)

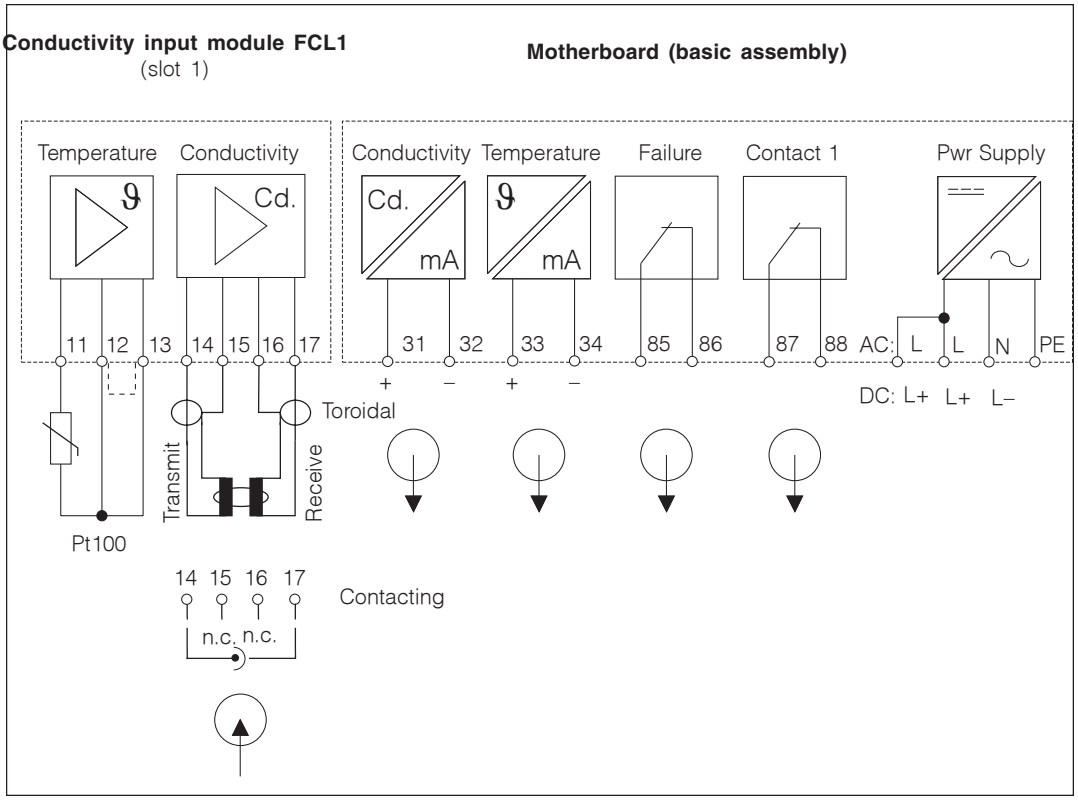


Figure 4.7
Connection diagram for Mycom CLM 152 (basic configuration)

FCL1 module (slot 1, basic configuration):

11	Pt 100 connection, sensor cable
12	Pt 100 connection, sensor cable
13	Cable compensation connection
For toroidal measuring cell	
14	Inner conductor of transm. coil
15	Transmission coil shield
16	Receiving coil shield
17	Inner conductor of receiving coil
For contacting measuring cell	
14	Inner electrode
17	Outer electrode

Terminal blocks (basic configuration):

L/L+	Power supply voltage AC phase or DC +
L/L+	Power supply voltage AC phase or DC +
N/L–	Power supply voltage AC neutral or DC –
PE	Power supply protective ground
31	Current output (cond. signal) plus
32	Current output (cond. signal) minus
33	Current output (temp. signal) plus
34	Current output (temp. signal) minus
85	Failure contact
86	Failure contact
87	Contact 1
88	Contact 1

Note!
- The contact position in case of power failure or fault can be set for “Contact 1” and “Failure contact” via the system configuration.
- All the switching contacts are interference-suppressed with varistors. External loads that are connected may require additional interference-suppression measures.

Expansion Module FCL1

For a second conductivity input.

11 Pt 100 connection, sensor cable (gn)
12 Pt 100 connection, sensor cable (wt)
13 Cable compensation connection (ye)
14 Inner conductor of transm. coil
15 Transmission coil shield
16 Receiving coil shield
17 Inner conductor of receiving coil

Measuring channel assignments:
Cond. 1 / temperature 1 slot 2
Cond. 2 / temperature 2 slot 1

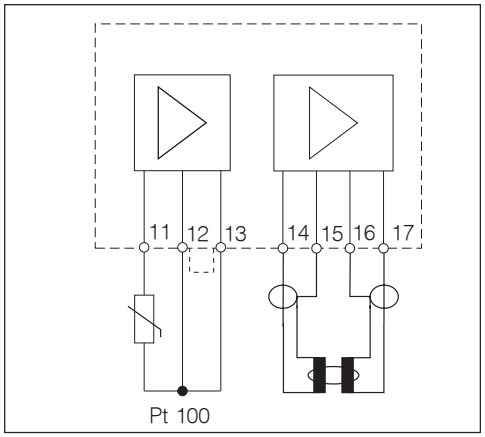


Figure 4.8 Connection of module FCL1 with toroidal sensor

11 Pt 100 connection, sensor cable (gn) [1)]
12 Pt 100 connection, sensor cable (wt) [1)]
13 Cable compensation connection (ye) [1)]

[1)] with CYK 71 cable

For 2-electrode measuring cell:
14 Inner electrode (inner conductor)
17 Outer electrode (outer conductor)

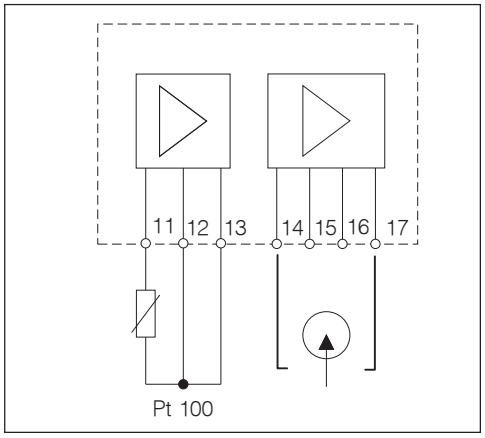


Figure 4.9 Connection of module FCL1 with contacting sensor

Expansion Module FCYK:

With three (3) relays for limit contacter or Chemoclean

89 Contact 2
90 Contact 2
91 Contact 3
92 Contact 3
93 Contact 4
94 Contact 4

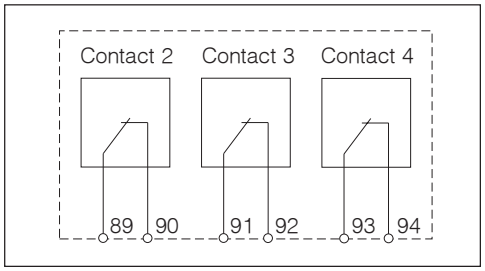


Figure 4.10 Connection of module FCYK, non-Ex

Expansion Module FCXI:

With two (2) binary input contacts for hold and remote measuring range switching and an auxiliary voltage

21 Current input plus
22 Current input minus
81 Binary input 1
82 Binary input 1
83 Binary input 2
84 Binary input 2

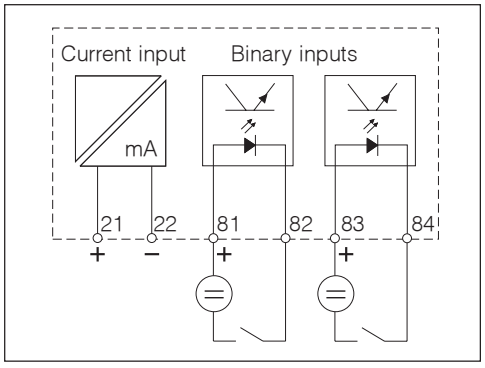


Figure 4.11 Connection of module FCXI

Connection for Use of Internal Auxiliary Voltage

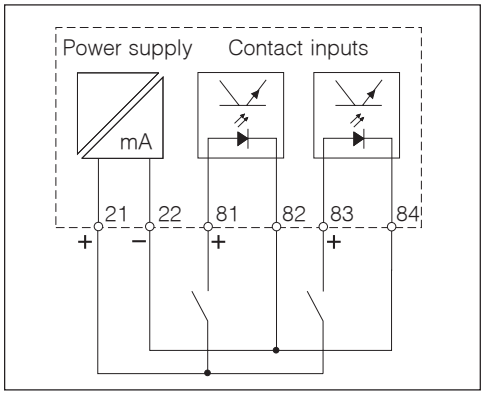


Figure 4.12
Connection of module FCXI as an integral power supply

When the analog input of the FCXI module is not used, the internal transmitter power supply can be used to supply the contact inputs with power.

Technical Data

Use of external power supply:	
Contact inputs (terminals 81-84)	Passive, auxiliary power supply required
Terminal voltage	Max. 30 V, nominal 12 V
Internal power supply (terminals 21/22)	
Current consumption	Nominal ~ 2 mA
Isolation voltage	Max. galvanic separation 276 V_{rms}
Supply voltage	20 V for 30 mA

Expansion Module FCYP

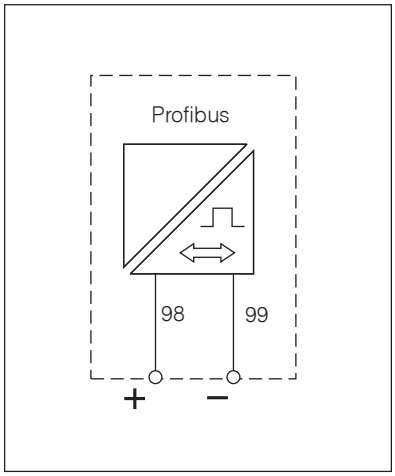
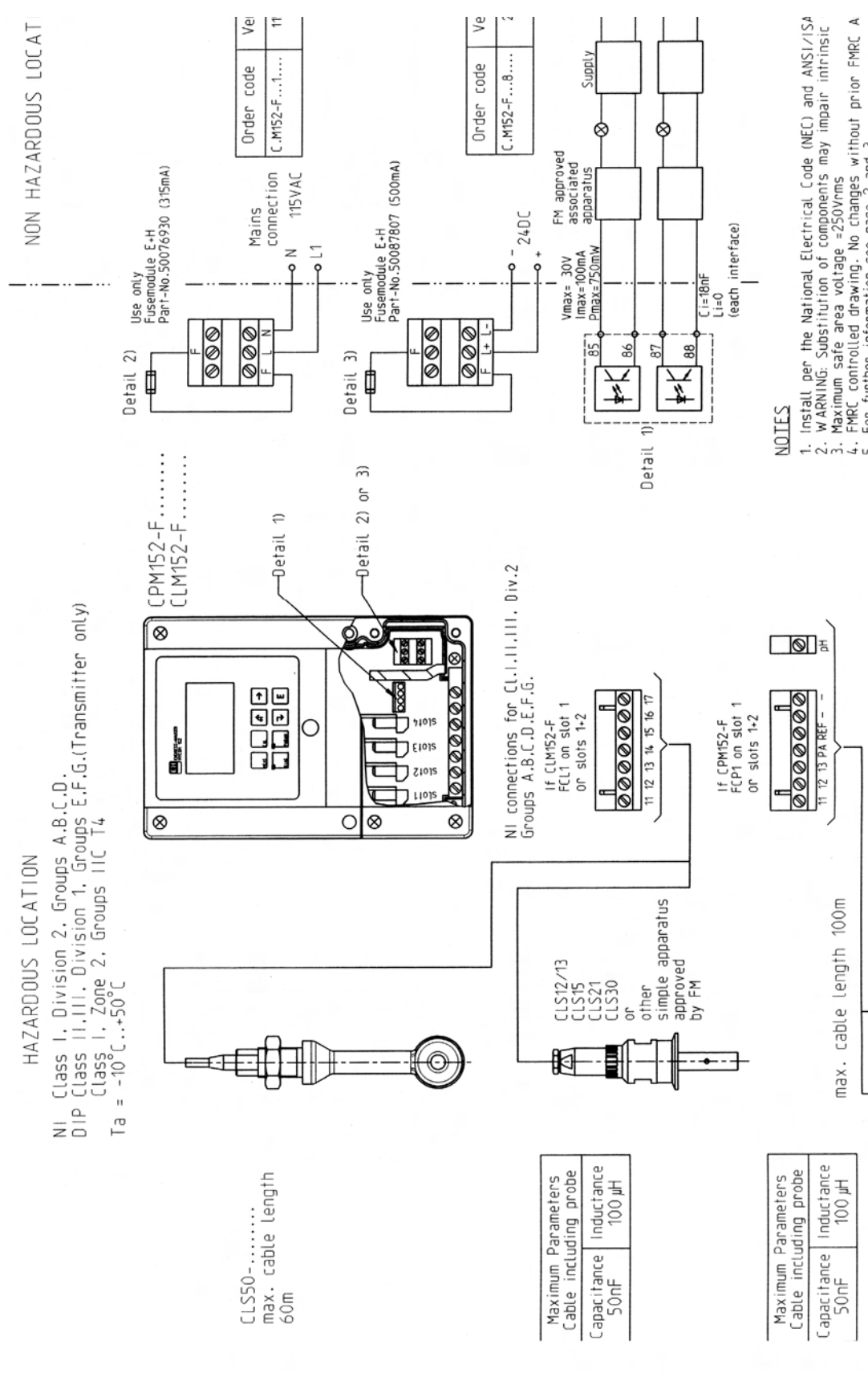


Figure 4.13
Connection of module FCYP

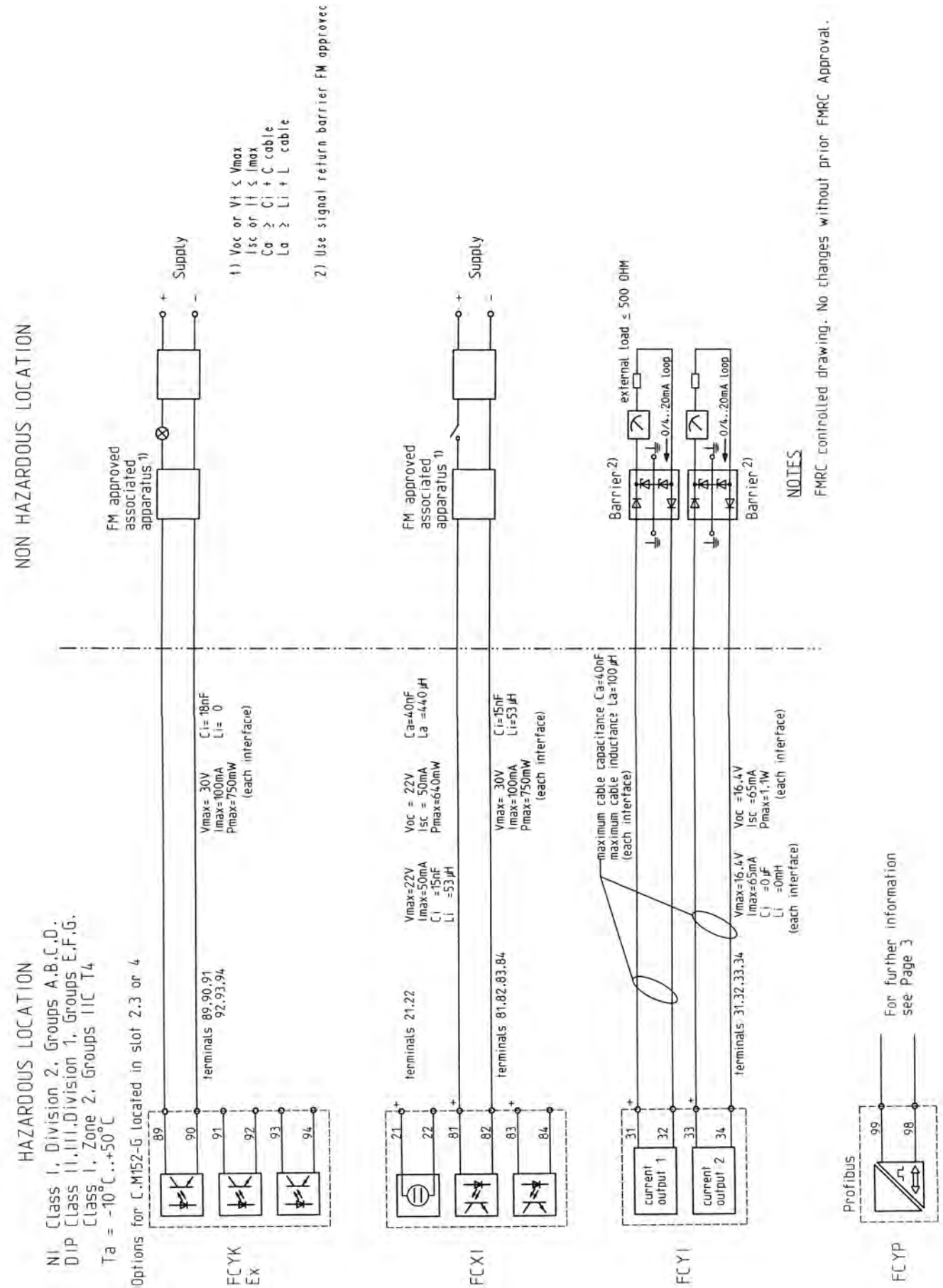
Digital interface Profibus PA:

98	PA–
99	PA+

4.4.2 Connection of Mycom CPM 152-F and CLM 152-F in Ex (Hazardous) Areas with NI Outputs (Page 1 of 3)



Connection of Mycom CPM 152-F and CLM 152-F in Ex (Hazardous) Areas with NI Outputs (Page 2 of 3)



FISCO-Concept

The FISCO Concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination.
The criteria for interconnection is that the voltage (Ui or Vmax), the current (Ii or Imax) and the power (Pi or Pmax) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (Uo or Voc or Vt), the current (Io or Isc or It) and the power (Po or Pmax) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (Ci) and inductance (Li) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 10 µH respectively.

In each segment only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system.
The voltage Uo (or Voc or Vt) of the associated apparatus has to be limited to the range of 14V to 24V DC. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50 µA for each connected device. Separately powered equipment needs a galvanic isolation to assure that the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices needs to have the parameters in the following range:

loop resistance R´:	15 ... 150 Ω /km
inductance per unit length L´:	0.4 ... 1 mH/km
capacitance per unit length C´:	80 ... 200 nF/km

C´ = C´ line/line + 0,5 C´ line/screen, if both lines are floating or
C ´= C´ line/line + C´ line/screen, if the screen is connected to one line

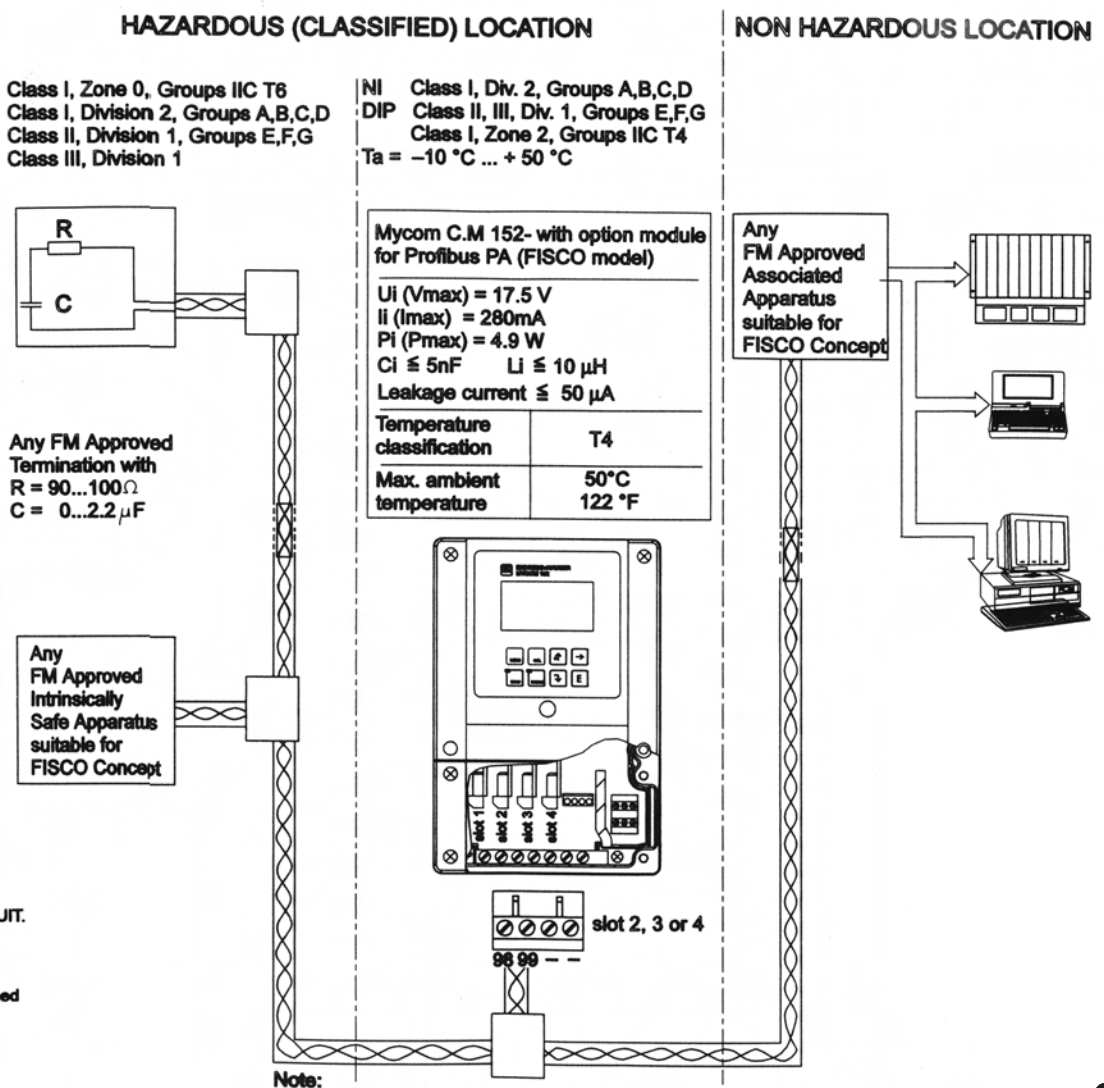
length of spur cable:	≤ 30 m
length of trunk cable:	≤ 1 km.
length of splice:	≤ 1 m

At each end of the trunk cable an approved infallible line termination with the following parameters is suitable:
R = 90 ... 100
C = 0 ... 2.2 µF.
One of the allowed terminations might already be integrated in the associated apparatus.
The number of passive devices connected to the bus segment is not limited due to I.S.reasons. If the above rules are respected, up to a total lenght of 1000 m (sum of the length of trunk cable and all spur cables), the inductance and capacitance of the cable will not impair the intrinsic safety of the installation.

Notes:

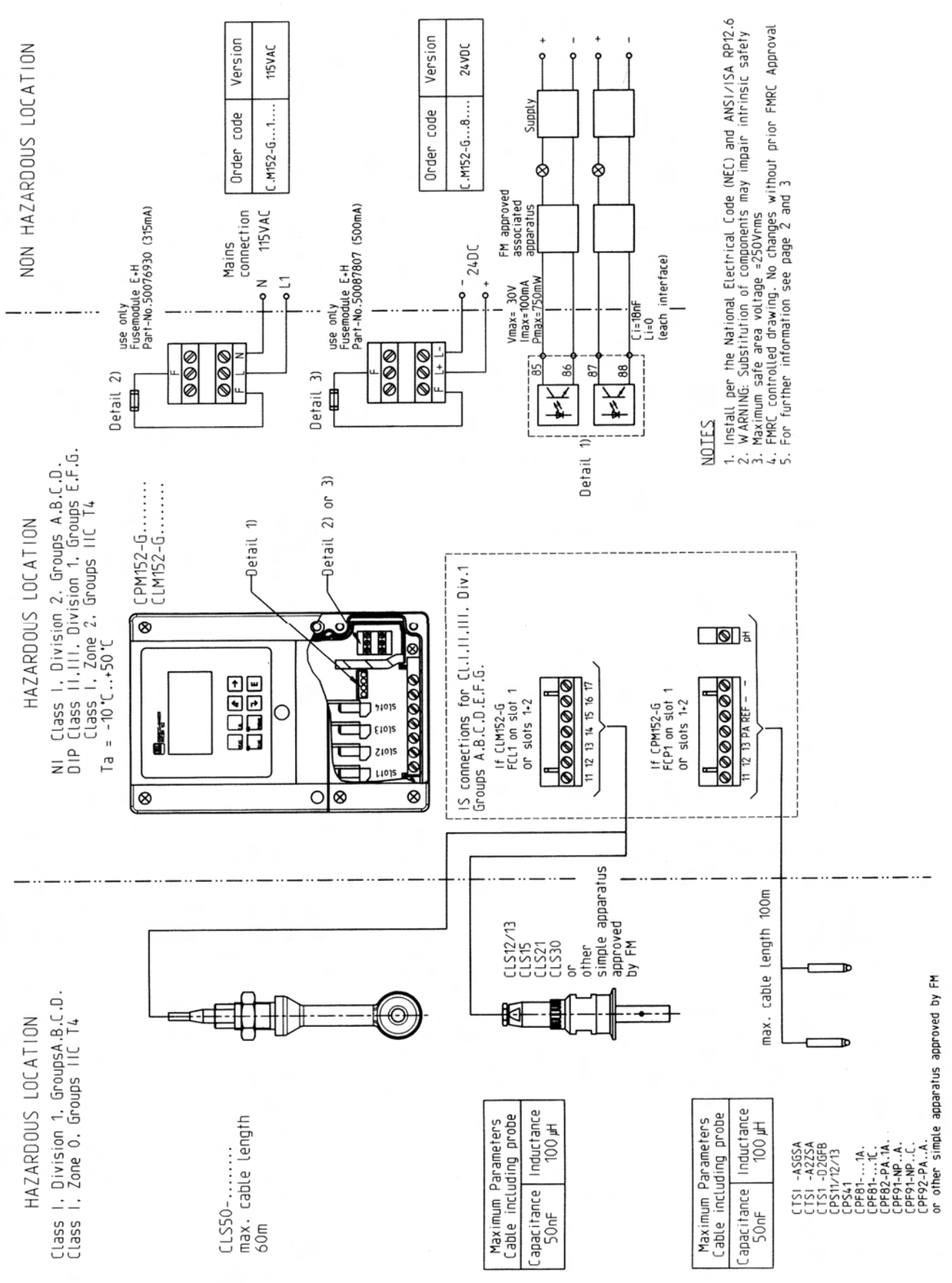
NONINCENDIVE. CLASS 1, DIV.2, GROUP A,B,C,D AND DIP for CLASS II AND III, DIV.1, GROUP E, F, G HAZARDOUS LOCATION INSTALLATION.

1. INSTALL PER NATIONAL ELECTRICAL CODE (NEC) USING THREADED METAL CONDUIT. Intrinsic safety barrier not required. Max. supply voltage 30V. For T-code see table.
2. A Dust tight seal must be used at the conduit entry when the transmitter is used in a CLASS II & III Location.
3. WARNING: Explosion Hazard - do not disconnect equipment unless power has been switched off or the area is known to be Non Hazardous.
   WARNING: Substitution of components may impair suitability for CLASS I, Division 2.

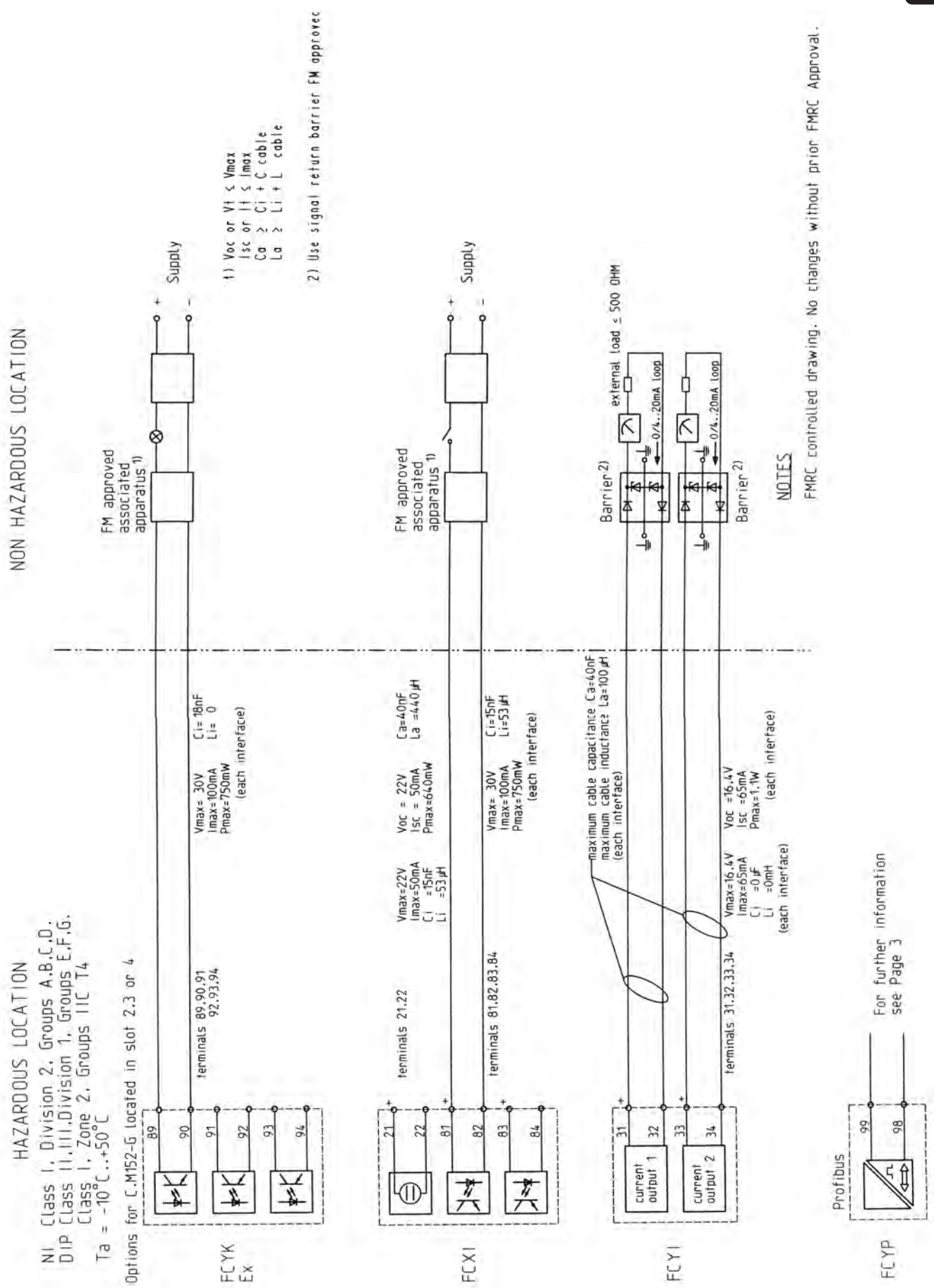


Note:
FMRC controlled drawing. No changes without prior FMRC Approval.

4.4.3 Connection of Mycom CPM 152-G and CLM 152-G in Ex (Hazardous) Areas with IS Outputs (Page 1 of 3)



4.4.3 Connection of Mycom CPM 152-G and CLM 152-G in Ex (Hazardous) Areas with IS Outputs (Page 2 of 3)



4.4.3 Connection of Mycom CPM 152-G and CLM 152-G in Ex (Hazardous) Areas with IS Outputs (Page 3 of 3)

<u>FISCO-Concept</u>

The FISCO Concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination.
The criteria for interconnection is that the voltage (Ui or Vmax), the current (Ii or Imax) and the power (Pi or Pmax) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (Uo or Voc or Vt), the current (Io or Isc or It) and the power (Po or Pmax) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (Ci) and inductance (Li) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 10 µH respectively.

In each segment only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system.
The voltage Uo (or Voc or Vt) of the associated apparatus has to be limited to the range of 14V to 24V DC. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50 µA for each connected device. Separately powered equipment needs a galvanic isolation to assure that the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices needs to have the parameters in the following range:

- loop resistance R´: 15 ... 150 Ω /km
- inductance per unit length L´: 0.4 ... 1 mH/km
- capacitance per unit length C´: 80 ... 200 nF/km
- C´ = C´ line/line + 0,5 C´ line/screen, if both lines are floating or
- C´ = C´ line/line + C´ line/screen, if the screen is connected to one line
- length of spur cable: ≤ 30 m
- length of trunk cable: ≤ 1 km.
- length of splice: ≤ 1 m

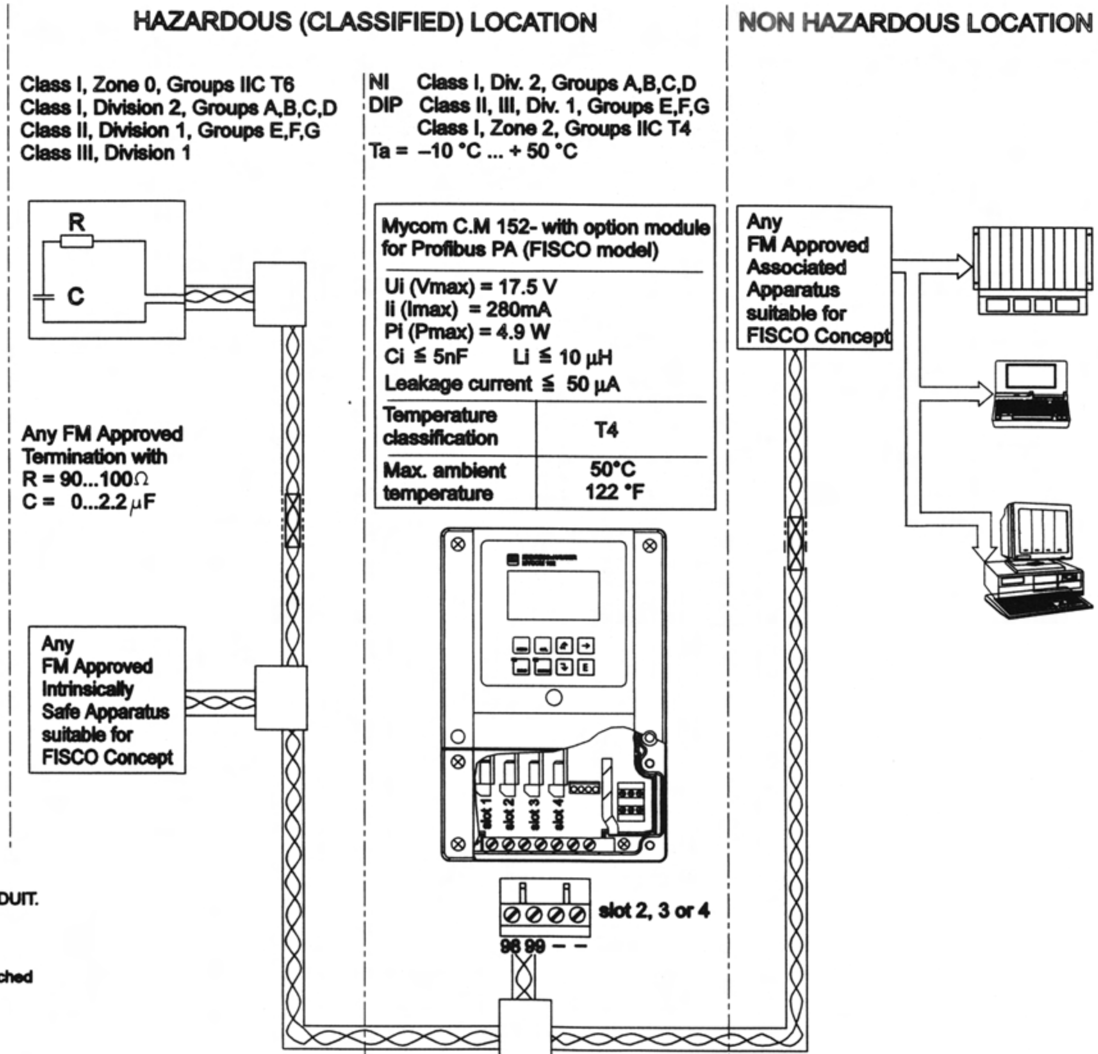
At each end of the trunk cable an approved infallible line termination with the following parameters is suitable:
R = 90 ... 100
C = 0 ... 2.2 µF.

One of the allowed terminations might already be integrated in the associated apparatus.
The number of passive devices connected to the bus segment is not limited due to I.S.reasons. If the above rules are respected, up to a total lenght of 1000 m (sum of the length of trunk cable and all spur cables), the inductance and capacitance of the cable will not impair the intrinsic safety of the installation.

<u>Notes:</u>

<u>NONINCENDIVE, CLASS 1, DIV.2, GROUP A,B,C,D AND DIP for CLASS II AND III, DIV.1, GROUP E, F, G HAZARDOUS LOCATION INSTALLATION.</u>

1. INSTALL PER NATIONAL ELECTRICAL CODE (NEC) USING THREADED METAL CONDUIT. Intrinsic safety barrier not required. Max. supply voltage 30V. For T-code see table.
2. A Dust tight seal must be used at the conduit entry when the transmitter is used in a CLASS II & III Location.
3. WARNING: Explosion Hazard - do not disconnect equipment unless power has been switched off or the area is known to be Non Hazardous.
   WARNING: Substitution of components may impair suitability for CLASS I, Division 2.



Note:
FMRC controlled drawing. No changes without prior FMRC Approval.

Connection Compartment and Connection Diagram

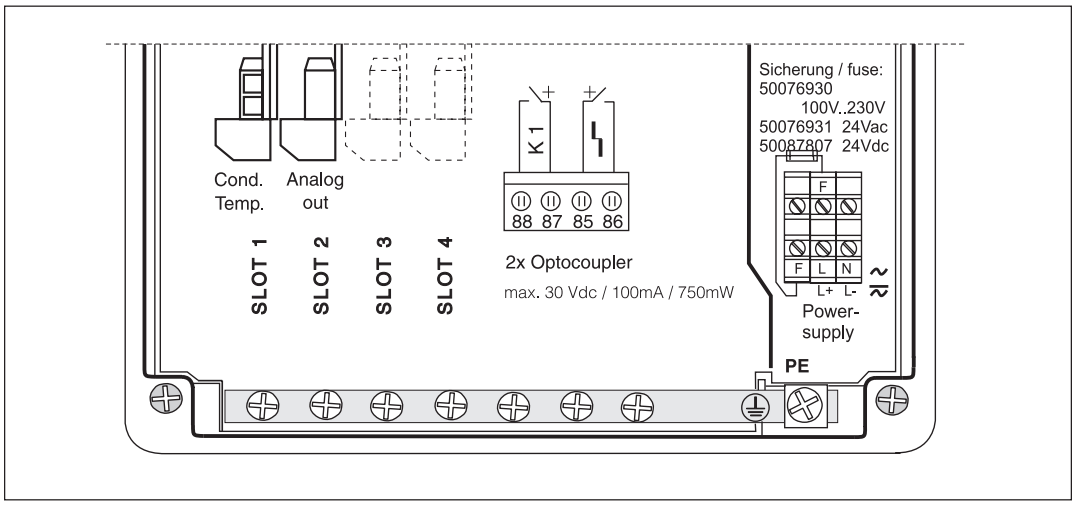


Figure 4.14 Connection compartment of Mycom CLM 152 (Ex)

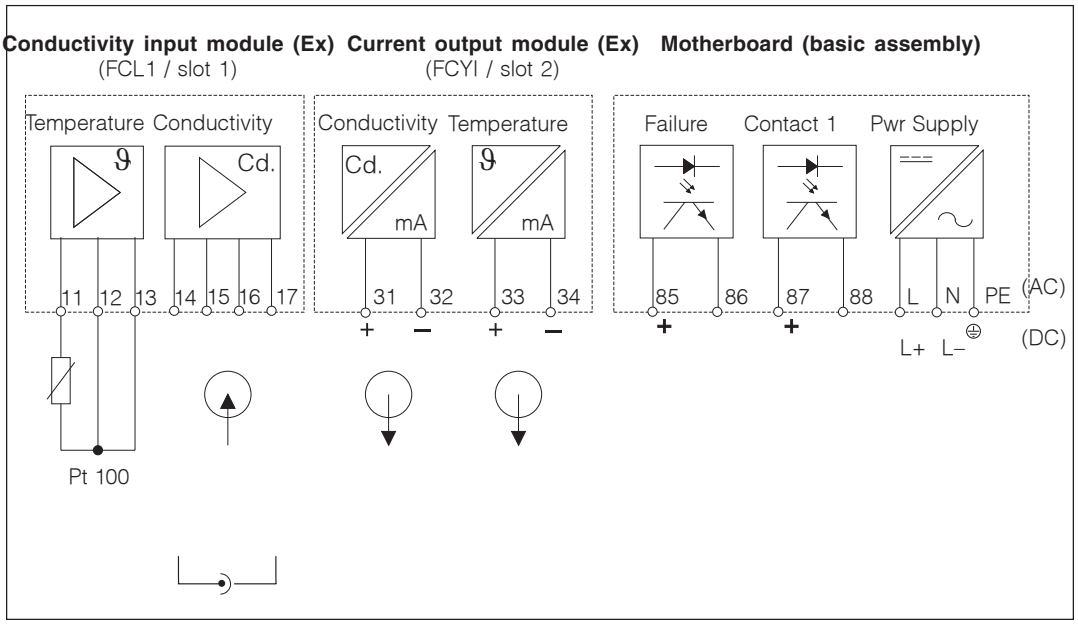


Figure 4.15 Connection diagram for CLM 152 (basic equipment)

FCL1 module (slot 1, basic configuration):

11 Pt 100 connection, sensor cable (gn) [1)]
12 Pt 100 connection, sensor cable (wt) [1)]
13 Cable compensation connection (ye) [1)]

[1)] with CYK 71 cable

For toroidal measuring cell:
14 Inner conductor of transm. coil
15 Transmission coil shield
16 Receiving coil shield
17 Inner conductor of receiving coil

For contacting measuring cell:
14 Inner electrode
17 Outer electrode (shield)

Circuit power requirements, term. 11 to 17:
$C_{a,max}$ = 50 nF $L_{a,max}$ = 100 µH

FCYI module (slot 2, basic configuration):

31 Current output (cond. signal) plus
32 Current output (cond. signal) minus
33 Current output (temp. signal) plus
34 Current output (temp. signal) minus

Circuit power requirements, term. 31 to 34:
U_{max} = 16.4 V I_{max} = 65 mA
P_{max} = 1.1 W
$C_{a,max}$ = 40 nF $L_{a,max}$ = 100 µH

Terminal blocks (basic configuration):

Power Supply
L/L+ Power supply voltage AC phase or DC +
L/L+ Power supply voltage AC phase or DC +
N/L– Power supply voltage AC neutral or DC –
PE Power supply protective ground

85 Failure contact
86 Failure contact
87 Contact 1
88 Contact 1

Note!

Note!
The optocoupler outputs are high-impedance in case of power failure.

Expansion Module FCL1 (toroidal):

For a second conductivity input.

11 Pt 100 connection, sensor cable
12 Pt 100 connection, sensor cable
13 Cable compensation connection
14 Inner conductor of transm. coil
15 Transmission coil shield
16 Receiving coil shield
17 Inner conductor of receiving coil

Measuring channel assignments:
Cond. 1 / temperature 1 slot 2
Cond. 2 / temperature 2 slot 1

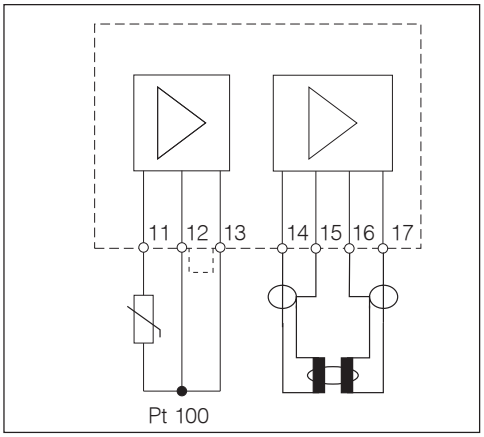


Figure 4.16
Connection of module FCL1

Expansion Module FCYK-Ex:

With three (3) optocouplers as switched outputs for limit contacters or Chemoclean

89 Contact 2
90 Contact 2

91 Contact 3
92 Contact 3

93 Contact 4
94 Contact 4

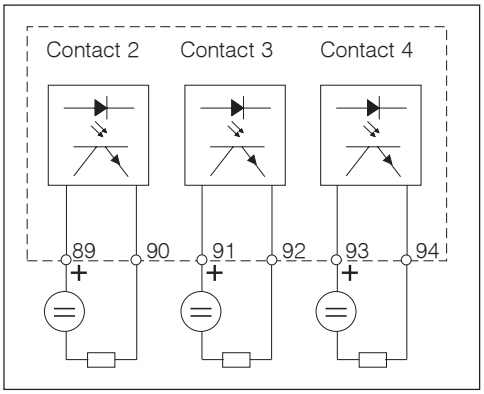


Figure 4.17
Connection of module FCYK, Ex

Outputs with npn transistors. The emitter connections (E) must have negative potential in relation to the collectors (C).

Expansion Module FCXI:

With two (2) contact outputs for hold and remote measuring range switching and an analog input with transmitter power supply.

21 Current input plus
22 Current input minus

81 Contact output 1
82 Contact output 1

83 Contact output 2
84 Contact output 2

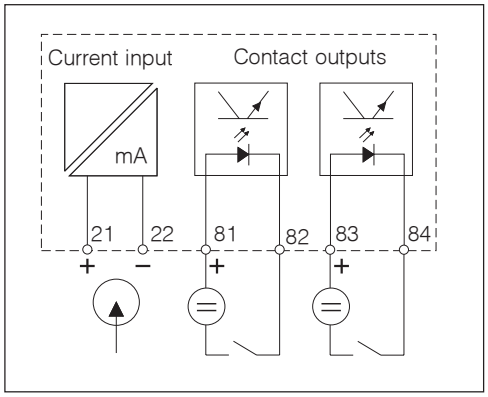


Figure 4.18
Connection of module FCXI

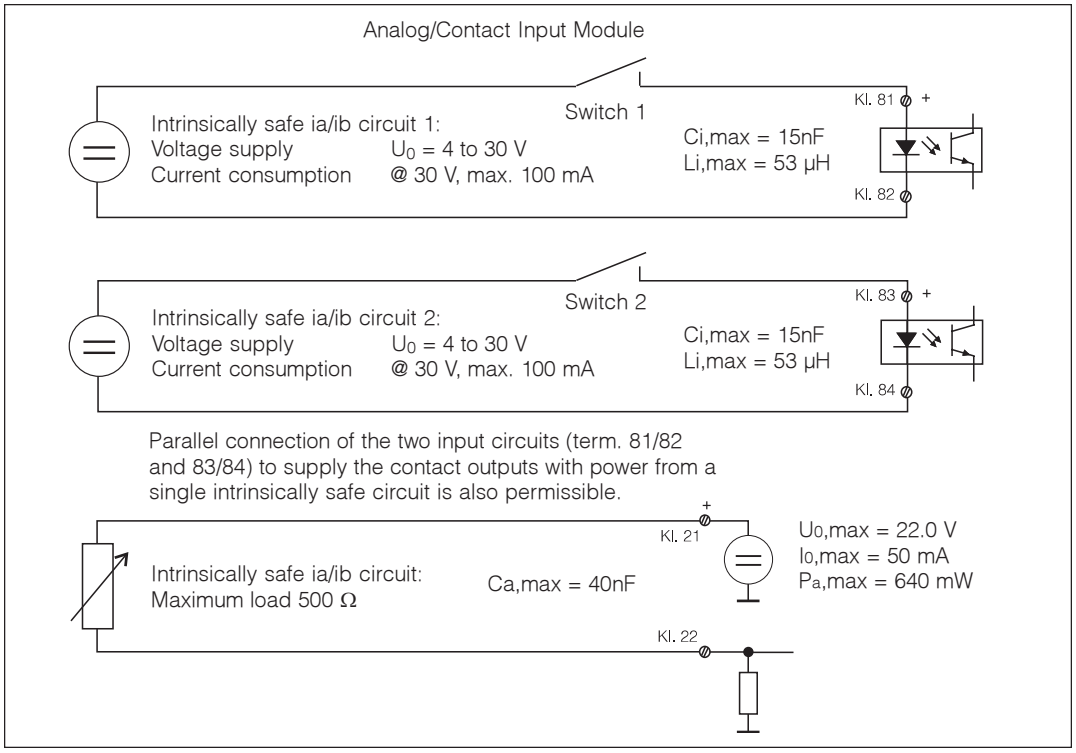
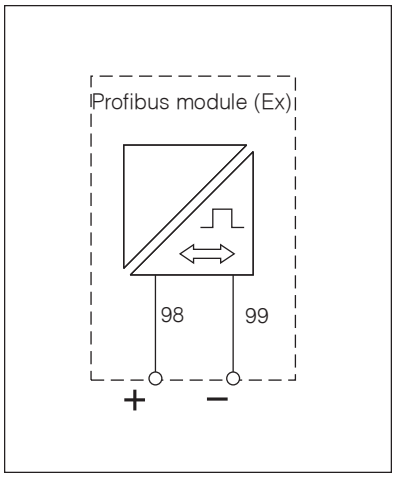


Figure 4.19
External wiring of input circuits on FCXI module

Expansion Module FCYP



Digital interface Profibus PA:

98	PA–
99	PA+

Figure 4.20
Connection of module FCYP

4.5 Connection of Conductivity Measuring Cells

Caution!

Caution!
It is vital to protect connectors and terminals against moisture to prevent inaccurate measuring results!

Note!

Note!
- The instrument has a function to offset cable length and capacitance in order to compensate for cable resistance.
- Due to thermal adaptation and depending on the measuring cell used and medium temperature, it may take some time before the measuring cell supplies correct values. This waiting time may be between 30 s and 30 min.

Toroidal Measuring Cell

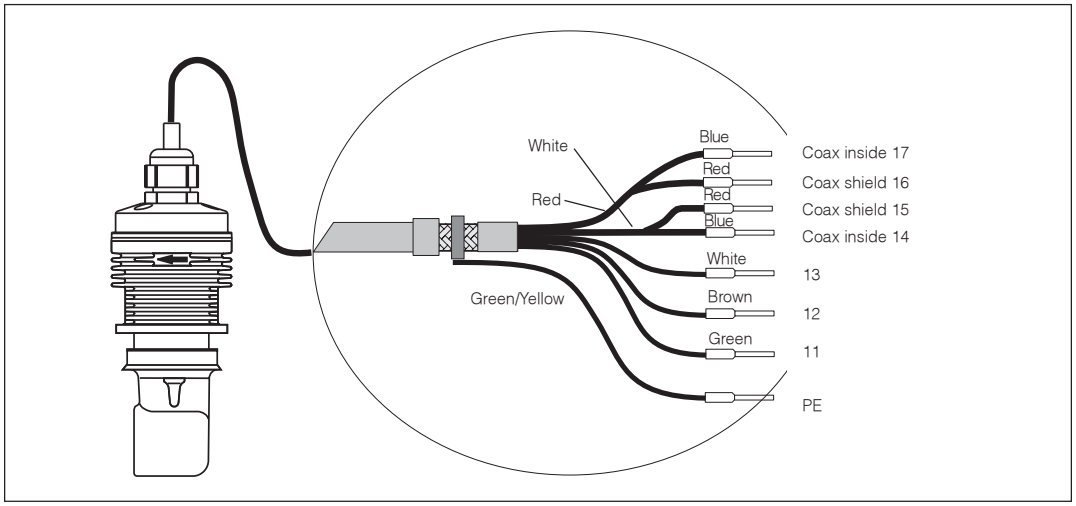


Figure 4.21
Sensor CLS 52 with connecting cable

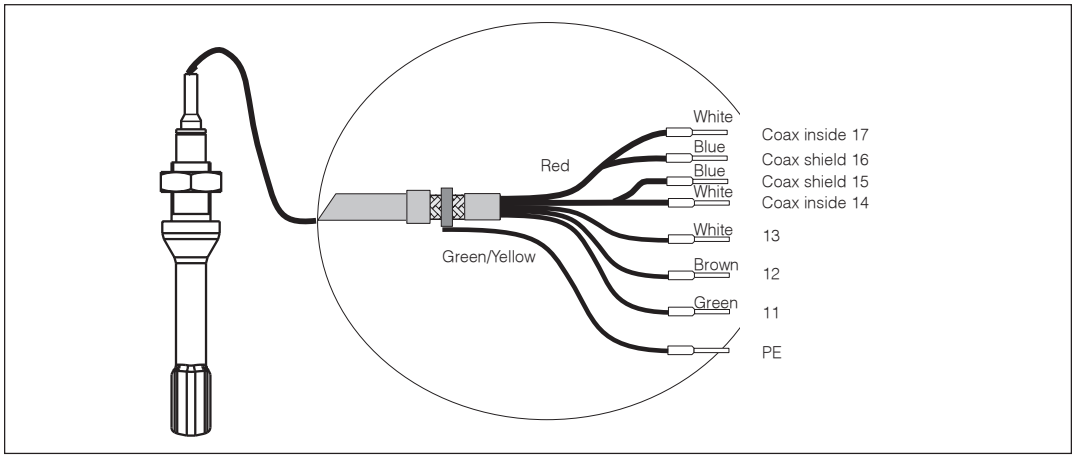


Figure 4.22
Sensor CLS 50 with connection cable

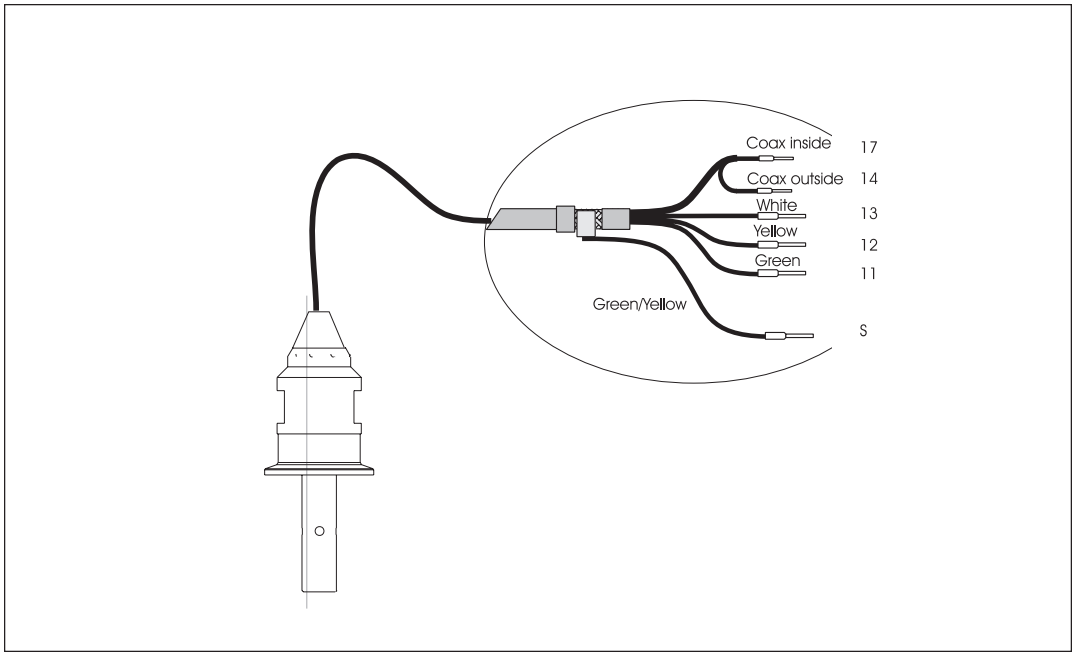
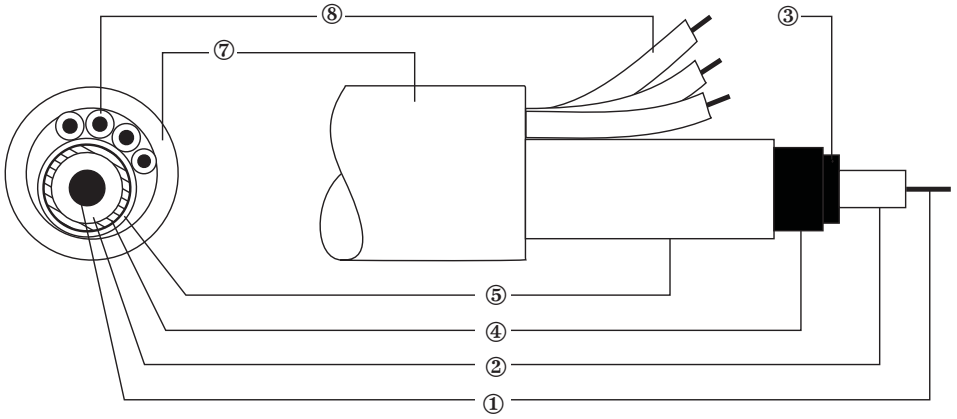


Figure 4.23
Sensor CLS 15/CLS 21 with connection cable

Construction and Preparation of Cable CYK71 and CYK5



① Inner conductor (measuring signal)
② Internal insulation
③ Black semiconductor layer

Caution!

Caution!
Strip semiconductor layer to inner screen for connection!

④ Inner shield (alternating measuring voltage)
⑤ Second insulation
⑥ Outer shield (PE)
⑦ Outer insulation
⑧ Auxiliary cores for Pt 100

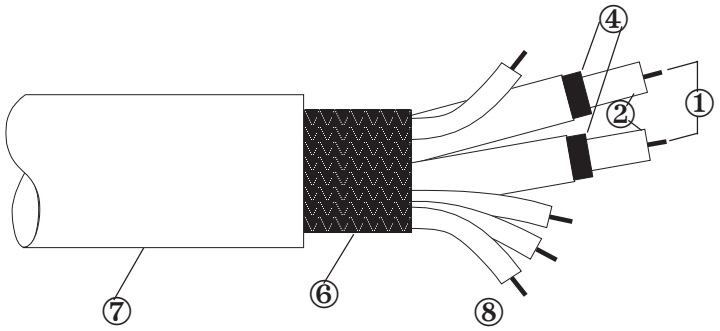


Figure 4.24
Construction / preparation of special measuring cable CYK5

4.6 Packaging and Disposal

Packaging

The packaging material used to store or transport the instrument must provide shock and moisture protection. Optimal protection is provided by the original packaging materials.

Disposal

Note!

Note!
Electronic components to be disposed of are to be considered special waste.
Observe local regulations for disposal.

5 First Start-up

5.1 Measures Before the First Power-up

Familiarize yourself with the operation of the transmitter before switching it on for the first time!

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

Make sure the measuring cell is located in the medium or in a calibration solution. If it is not, implausible readings are to be expected.

Warning!
Before power-up, make sure that there is no risk of damage to the system that the instrument is part of; for example, due to valves, pumps etc. that might operate in an uncontrolled manner.

5.2 The “Set-up Guide” Menu

When it is powered up for the first time, the instrument is in the Set-up guide menu. All the setting data needed for operation is checked here. This automatically guarantees that all the selections required for operation are made.

First, the instrument prompts for the language to be used for text displays. The selections available are shown. Select the “English” line – it appears in reverse video – and confirm your choice by pressing the “E” (“Enter”) key. Your selection is stored, and the next prompt is displayed.

Proceed in the same manner for all other prompts.

- You can abort the set-up guide procedure by pressing the CAL, DIAG, MEAS or PARAM key.
- The set-up guide menu will come up every time the instrument is powered up until the procedure is completed all the way, acknowledging the last field with “end”.
- Thereafter, the start-up routine can be accessed via the menu structure following entry of the advanced (specialist) code.

Set-up Guide / Checklist

Prompt	Possible Choices	Factory Settings	User Settings
Language	Deutsch, English, Francais, Italian	English	
Contrast of the LCD display	Set as desired	“Medium”	
Date	Entry of current date	Current date	
Time of day	Entry of current time of day	CET, (no daylight savings time)	
Measurement type	Conductivity, Resistance (M Ohm) Concentration	Conductivity	
Measuring cell	CLS 50, CLS 52 2-electrode K = 0, 01 K = 0, 1 K = 1 K = 10	CLS 52	
Measuring principle (difference only)	Difference measurement (one-circuit of difference)	Difference measurement	
Unit	Selection of available units: µS/cm, mS/cm or mS/m, S/m	µS/cm, mS/cm	
Temperature sensor 1	Type of temperature sensor Pt 100 / Pt 1000 / NTC 30K	Pt 100	
Temperature sensor 2	Type of temperature sensor Pt 100 / Pt 1000 / NTC 30K (only 2-circuit)	Pt 100	
Temperature unit	Celsius (°C), Fahrenheit (°F), Kelvin (K)	Celsius (°C)	
Temperature compensation	Manual (MTC) Automatic (ATC)	ATC	
Compensation temperature (MTC 1 only; MTC 2 for difference only)	-31.0 to +482.0°F (-35.0 to +250.0°C)	77°F (25°C)	
Air set select	Skip Air Set Activate Air Set Input Air Set	Air set escape	
Input contact (with FCXI card only)	2 x hold; 1 x hold + 1 x remote switching; 2 x remote switching	2 x hold	
Relay function	Fault & Maint. Fault & Contact		
NAMUR contacts[1)]	N.C. contact, N.O. contact	N.O. contact	
Failure relay	Fleeting contact, Steady contact	Steady contact	
Fault contact assignment	Pulsed, continuous No contact		
Proc. Warnings	Assign to maintenance contact Assign to no contact		
Set-up guide	End, Resume	End	

1) According to recommendation by NAMUR (Normen-Ausschuß Meß - und Regeltechnik, i.e., Measuring and Control Engineering Standards Committee)

6 Operation

6.1 Operating Elements

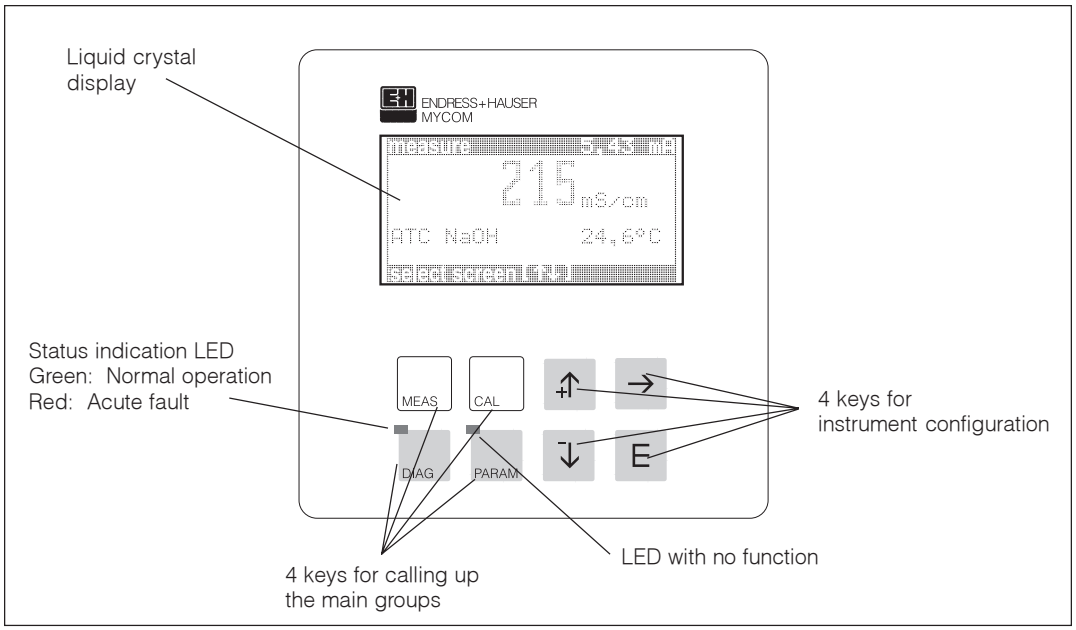


Figure 6.1
Operating elements
Mycom CLM 152 Toroidal

6.2 Display

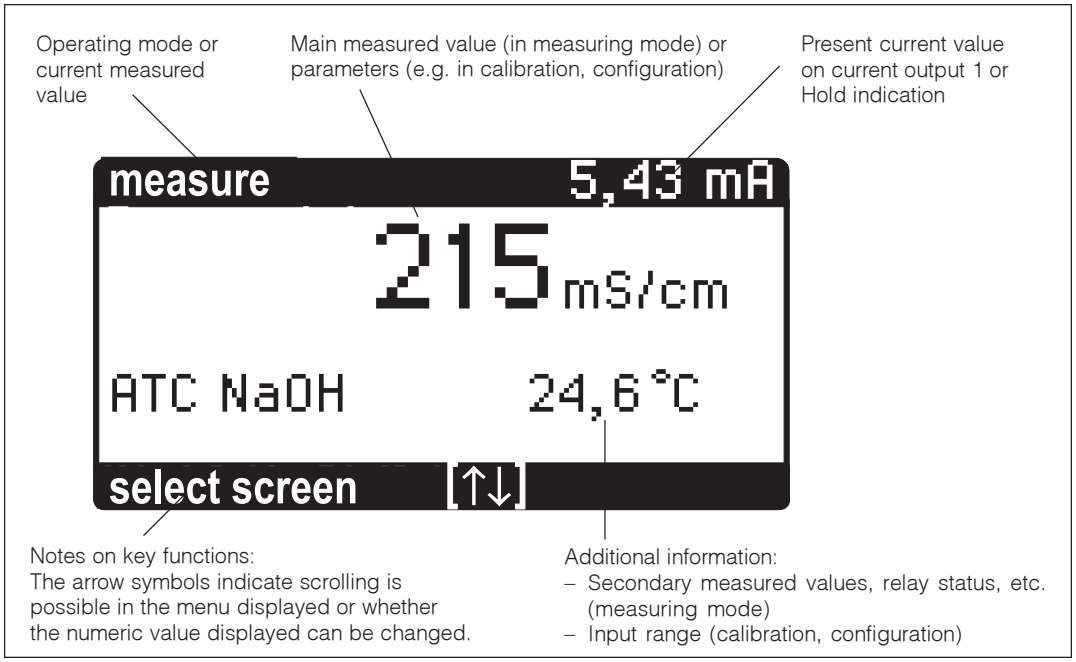


Figure 6.2
Display
Mycom CLM 152 Toroidal

6.3 Key Functions

MEAS

Measurement

- Measured value display
- Return to measurement from any position

CAL

Calibration

- Activation of calibration mode
- Calibration menu display

DIAG

Diagnostics

- Display of error and maintenance messages
- Display of information and statistics
- Access to service routine with simulation, internal data and instrument check

PARAM

Parameter Configuration

- Display of configuration menu (adaptation of instrument to other measurement and control tasks)
- Return to higher menu level

↑

- Increase value shown in reverse video
- Moves inverted bar for menu line selection
- Returns to previous measured value display

↓

- Decreases value shown in reverse video
- Moves inverted bar for menu line selection
- Advances to next measured value display

→

- Selection of digit to be edited (multi-digit numbers)

E

Enter

- Accepts a value or parameter setting during configuration
- Selects menu line shown in reverse video

6.4 Operating Concept

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

• Measurement • Calibration • Diagnostics • Parameter Configuration

These main groups are accessed by pressing the corresponding keys (see chapter 6.3). Related functions within the main groups are combined into sub-groups, some of which are divided up into further groups.

The sub-groups are displayed as menus and are selected with the ↑ and ↓ keys (inverted line). Menus may contain more items 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.

Note!

Note!
Refer to the last pages of this manual for an overview of the menu structure.

Options are selected and parameters are set in the sub-menus by choosing a menu item (see above) or by editing a numeric value.

To do this, select the digit of the value to be edited with the → key and change the value with the ↑ and ↓ keys to obtain the desired value. Repeat this procedure for all other digits of a value. Confirm the new setting by pressing the E key. The limits of a parameter are shown on the next to the last line of the display. Values outside these limits are not accepted.

When a setting has been confirmed, the prompt for the next parameter is displayed. When all parameters of a sub-group have been set or acknowledged, the sub-menu reappears.

Press the “PARAM” key to go up a level in the menu structure.

Note!
It is possible to change to a different main group even when you are in the middle of a sub-group. Any setting not confirmed with the E key reverts to the previous setting.

If there is no input in a sub-group for more than 10 minutes, the instrument automatically returns to the measuring mode (exceptions: calibration, simulation and set-up guide).

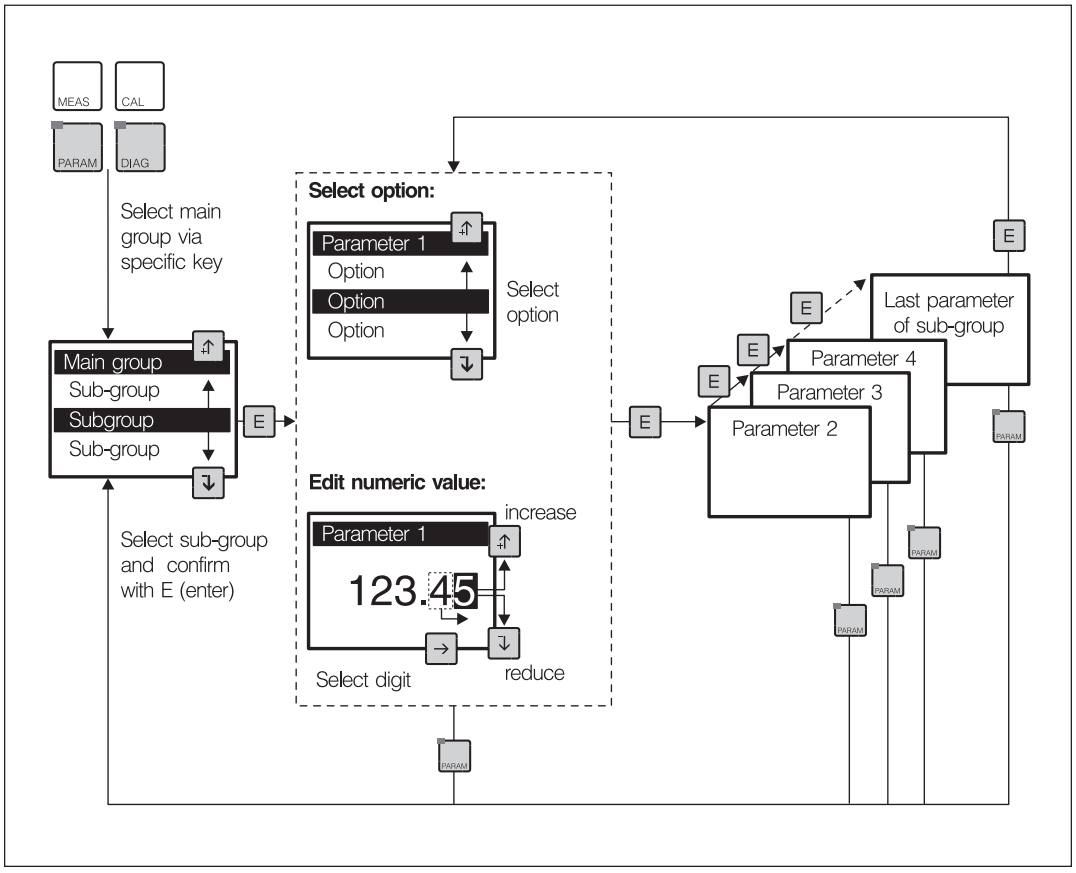


Figure 6.3
Diagram of the Mycom operating concept

Hold Function

In order to avoid unintentional changes to the current outputs during configuration or calibration, the present current value at the current output can be "frozen" with the "hold" function or a fixed current value can be specified.

The limit relays are switched to the passive state while "hold" is in effect (NO contacts are open, NC contacts are closed).

"Hold" appears on the right-hand side of the top display line instead of the current output value; the current value of the main parameter continues to be displayed on the left.

Also see:

- Chapter 6.7, Short-cut menu: Hold on / off
- Chapter 7.2, Current output menu, hold type: fixed current value / last measurement
- Chapter 7.4, Preset calibration data, hold during cal.: yes / no

6.5 Measured Value Displays

The ↑ and ↓ keys can be used to select different measured value display formats. These formats differ in the size of the display characters and the amount of supplementary information displayed.

Note!
Contact status is only displayed if one or two contacts are configured as limit contacts.

Conductivity Measurement			
One-circuit	1st meas. value display	Main display: Suppl. info:	Conductivity value measured in mS/cm or µS/cm (large characters for reading from a distance) Measuring range (measuring range switching only)
	2nd meas. value display	Main display: Suppl. info:	Conductivity value measured in mS/cm or µS/cm Measuring range (remote meas. range switching only) Type of temperature compensation Substance measured Current compensation temperature
	3rd meas. value display	Main display: Suppl. info:	Conductivity value measured in mS/cm or µS/cm Same as 2nd measured value display plus contact states (limit contacter only)
Difference	1st meas. value display	Main display: Suppl. info:	Difference in conductivity measured (ΔCD) in mS/cm or µS/cm Measuring range (measuring range switching only)
	2nd meas. value display	Main display: Suppl. info:	Difference in conductivity measured (ΔCD) in mS/cm or µS/cm Measuring range (measuring range switching only) Type of temperature compensation Substance measured Current compensation temperature
	3rd meas. value display	Main display: Suppl info:	Difference in conductivity measured (ΔCD) in mS/cm or µS/cm Same as 2nd measured value display plus contact states (limit contacter only)
	4th meas. value display	Main display: Suppl. info:	Conductivity value measured, channel 1 (CD1) in mS/cm or µS/cm Same as third measured value display
	5th meas. value display	Main display: Suppl. info:	Conductivity value measured, channel 2 (CD2) in mS/cm or µS/cm Same as third measured value display
Concentration Measurement			
One-circuit	1st meas. value display	Main display: Suppl. info:	Concentration value measured in % (large characters) Measuring range (measuring range switching only) Substance name
	2nd meas. value display	Main display: Suppl. info:	Concentration value measured in % Same as first measured value display plus type of temperature compensation, current compensation temperature
	3rd meas. value display	Main display: Suppl. info:	Concentration value measured in % Same as 2nd measured value display plus contact states (limit contacter only)
	4th meas. value display	Main display: Suppl. info:	Concentration value measured in % Same as first measured value display plus conductivity value measured
	5th meas. value display	Main display: Suppl. info:	Concentration value measured in % Same as third measured value display plus conductivity value measured

Resistance Measurement			
One-circuit	1st meas. value display	Main display: Suppl. info:	Resistance value measured in MΩcm or kΩcm (large characters for reading from a distance) Measuring range (remote meas. range switching only)
	2nd meas. value display	Main display: Suppl. info:	Resistance value measured in MΩcm or kΩcm Measuring range (remote meas. range switching only) Type of temperature compensation Substance measured Current compensation temperature
	3rd meas. value display	Main display: Suppl. info:	Resistance value measured in MΩcm or kΩcm Same as 2nd measured value display plus contact states (limit contacter only)
	4th meas. value display	Main display: Suppl. info:	Resistance value measured in MΩcm or kΩcm Measuring range (remote meas. range switching only) Conductivity value measured
	5th meas. value display	Main display:	Resistance value measured in MΩcm or kΩcm Same as third measured value display plus conductivity value measured
Difference	1st meas. value display	Main display: Suppl info:	Difference in resistance measured in MΩcm or kΩcm (large characters for reading from a distance) Measuring range (remote meas. range switching only)
	2nd meas. value display	Main display: Suppl. info:	Difference in resistance measured in MΩcm or kΩcm Measuring range (remote meas. range switching only) Type of temperature compensation Substance measured Current compensation temperature
	3rd meas. value display	Main display: Suppl. info:	Difference in resistance measured in MΩcm or kΩcm Same as 2nd measured value display plus contact states (limit contacter only)
	4th meas. value display	Main display: Suppl. info:	Resistance value measured, channel 1 in MΩcm or kΩcm Same as third measured value display
	5th meas. value display	Main display: Suppl. info:	Resistance value measured, channel 2 in MΩcm or kΩcm Same as third measured value display

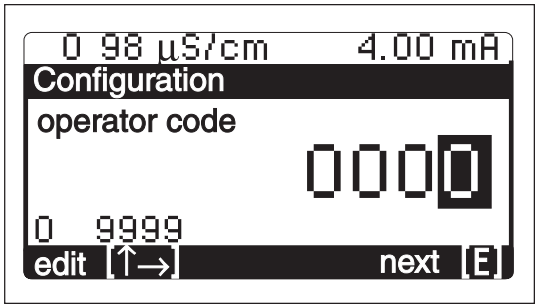
6.6 Locking of Functions

The Mycom CLM 152 transmitter has two operating levels that are accessed by entering four-digit numeric access codes:

- Operator (maintenance)
- Advanced (specialist)

Menu items that are not available at the current operating level are not displayed. If there is no input in response to the code prompt or if the input is incorrect, the field can only be exited with the MEAS key. The access codes are set in the System set-up menu group (see chapter 7.1.3).

Note!
The instrument is supplied unlocked.



Note!

Figure 6.4
Code prompt

Accessible Without Code Entry:

- Measured value displays
- Error list
- Info list
- Logbook
- Calibration data history
- Air Set Info (toroidal)

Accessible With Operator Code:

- Short-cut to relays
- Calibration parameters
- Temperature measurement type (ATC, MTC)
- Internal data (instrument number, SW no., module info.)
- Language, date, time, tag no., contrast, operator code

Accessible With Advanced Code:

- All menus and functions

Caution!
If the codes are lost, unlocking is possible with the default code "**7156**". A new code can then be set in the Commissioning / System set-up menu.

All calibration functions are accessible at the operator (maintenance) and advanced (specialist) levels.

6.7 The "Short-Cut to Relays" Menu

→ Short-cut to relays

This menu gives you direct access to the main functions without having to go through the entire configuration menu. The short-cut menu includes the following functions:

- Hold On / Off
- Manual/Automatic contact operation
- Limit settings

Short-Cut to Relays Menu		
Function	Selection	Factory setting
Hold	Hold on / hold off	Hold off
Clean function	Automatic on Automatic off Start cleaning (if Chemoclean on)	Last setting
Limit contacter operating mode	Automatic / manual operation	Manual operation
	When "manual operation" is selected: Contact 1 off / on Contact 2 off / on [1)] Current state is indicated	 Contact 1 off Contact 2 off
Limit contacter setpoints	Entry of limit 1 Entry of limit 2 [1)]	5% full scale 95% full scale

[1)] If the second contact is configured as a limit contacter.

7 Instrument Configuration

Note!
Refer to the last pages of these operating instructions for an overview of the Mycom menu structure.

→ **Set-up guide**	• Guided run through the major menus	☞ Chapter 5.2
→ **Short-cut to relays**	• Hold on/off • Manual relay operation, • Limit parameters • Start Chemoclean	☞ Chapter 6.7
→ **Commissioning (Start-up)**		
→ System set-up	• Operating mode, cell type, 2nd current • Locking codes • Output relays • General	☞ Chapter 7.1
→ Current outputs	• Current output parameters • Hold with last value/fixed value	☞ Chapter 7.2
→ Temperature	• Temperature compensation • Temperature compensation automatic/manual	☞ Chapter 7.3
→ Calibration	• Parameters for calibration	☞ Chapter 7.4
→ Cleaning function	• Parameters for cleaning function	☞ Chapter 7.5
→ Relay contacts	• All sub-groups for limit configuration	☞ Chapter 8

7.1 System Configuration

→ Commissioning (Start-up)

→ System set-up

→ Parameter	☞ Chapter 7.1.1
→ Code	☞ Chapter 7.1.3
→ Output relays	☞ Chapter 7.1.4
→ General settings	☞ Chapter 7.1.5

7.1.1 Measurement Type

Function	Selection	Default
Selection of measurement type	Conductivity, concentration, resistance	Conductivity
Setting cell connected	CLS 50, CLS 52 2-electrode K = 0.01 K = 0.1 K = 1 K = 10	CLS 52 K = 0.01
Difference or one-circuit measurement (instruments with two measuring channels only)	Difference measurement, One-circuit measurement	Difference measurement
Selection of unit	(µS/cm), (mS/cm) (mS/m), (S/m)	(µS/cm), (KΩ cm); (mS/cm), (MΩ cm)
Selection of temperature sensor Selection of temperature sensor (only 2-circuit)	Pt 100, Pt 1000, NTC 30K	Pt 100 Pt 100
Configuration of input contacts (only with expansion module FCXI, see below for remote measuring range switching)	2 x hold, 1 x hold / 1 x remote switching, 2 x remote switching, External cleaning control	2 x hold
Definition of measurement type for 2nd current output (instrument with 2nd CD input only)	CD1, CD2, Temperature 1, Temperature 2	Temperature 2
Two-circuit measurement		
Selection of measurement type	Conductivity concentration	Conductivity
Setting according to toroidal measuring cell connected	CLS 50, CLS 52 (measuring cell selection determines cell constant)	CLS 52
Setting cell connected	CLS 50, CLS 52 2-electrode K = 0.01 K = 0.1 K = 1 K = 10	CLS 52 K = 0.01

Caution!
Changing the operating mode resets all data to the factory settings (defaults).

Note!
2-circuit instruments are permanently configured as difference measuring instruments:
1st current output: difference in conductivity
2nd current output: CD 1, CD 2, T 1 or T 2

7.1.2 Measuring Range Switching

The Mycom CLM 152 offers two alternatives for measuring range switching: Either external measuring range switching or automatic internal measuring range switching with conductivity mode.

Measuring range switching affects:

- Current output
- Limit settings
- Temperature compensation type
- Substance selection (with concentration measurement)

Remote Measuring Range Switching

Measuring range switching is affected by means of external contacts, e.g. of a PLC. Expansion module FCXI is required. Up to four measuring ranges can be selected.

Measuring Range		MR 1	MR 2	MR 3	MR 4
Contact state (1 x remote switching)	83/84	open	closed	–	–
Contact state (2 x remote switching)	81/82	open	closed	open	closed
	83/84	open	open	closed	closed

Automatic Measuring Range Switching with Conductivity-Mode

The Mycom automatically switches to the next measuring range. The current measuring range is signalled to the downstream evaluation unit via contacts 3 and 4. This function is automatically activated during programming of contacts 3 and 4 as the “MR switching” function (see chapter 7.1.2). This operating menu is also used to set the switching points and their individual switching hystereses (LOW and HIGH values).

Example for automatic measuring range switching with four measuring ranges:

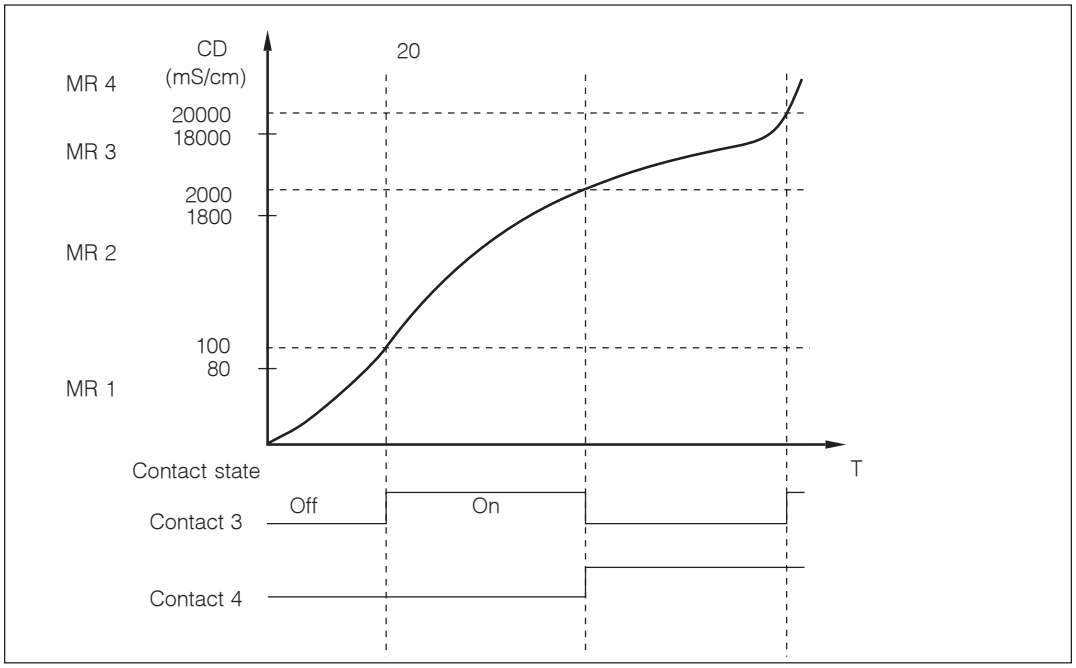


Figure 7.1
Example for measuring range switching

Settings for above example:

	Trigger thresh. 1	Trigger thresh. 2	Trigger thresh. 3	Trigger thresh. 4
LOW value	—	80 µS/cm	1800 µS/cm	18 µS/cm
HIGH value	100 µS/cm	2000 µS/cm	20 µS/cm	—

7.1.3 Code

Function	Selection	Factory setting
Entry of desired operator code (maintenance) code (0000 = no locking)	0000 - 9999	0000
Entry of desired advanced (specialist) code (0000 = no locking)	0000 - 9999	0000

7.1.4 Output Relays

Caution!
- Before starting up, check whether the wiring corresponds to the contact configuration selected.
- The contacts of the non-Ex version respond differently to a power failure (see table of contact assignments on next page).

Function	Selection	Factory setting
Base version (2 output relays)		
Function for contact 1 [1]	Maintenance	Maintenance
If equipped with expansion module FCYK (5 output relays)		
Function for contacts 1 - 7 [1]	**Toroidal** NAMUR [2] / limit NAMUR [2] / MR switching (only conductivity) Maintenance / limit / MRS 1 x limit / Chemoclean 2 x limit / Chemoclean **Contacting** NAMUR / limit / USP	NAMUR / limit
NAMUR [2] contact type	N.C. contact, N.O. contact	N.O. contact
Failure contact type	Pulsed contact (closed for 1 second) Continuous contact	Pulsed contact
Assignment of process warnings (E055-E078)	To maintenance contact To no contact	To maintenance contact

Contact assignments for base version			
Selection	"Maintenance"	"Limit"	"USP"
Failure contact Ter. 85/86	"Failure [1]	Failure [1]	Failure [1]
Contact 1 Ter. 87/88	Maintenance required [2]	Limit contact [2]	USP [2]

Relay contact for non-Ex version in case of power failure:
[1] Active (N.O. contact is closed, N.C. contact is open).
[2] Passive (N.O. contact is open, N.C. contact is closed)

Contact Assignments with Expansion Module FCYK						
Selection	"NAMUR", limit	"NAMUR" / MR switching	Maintenance / limit / MRS	1 x Limit Chemoclean	2 x Limit Chemoclean	NAMUR / GW / USP
Failure contact term. 85/86	Failure [1]	Failure [1]	Failure [1]	Failure [1]	Failure [1]	Failure [1]
Contact 1 term. 87/88	Maintenance required [2]	Maintenance required [2]	Maintenance required [2]	Maintenance required [2]	Limit contact [2]	Maintenance required [2]
Contact 2 term. 89/90	Function check [2]	Function check [2]	Limit contact 1 [2]	Limit contact 1 [2]	Limit contact 2	Function check [2]
Contact 3 term. 91/92	Limit contact 1 [2]	MRS 1 [2]	MRS 1 [2]	Water [3]	Water [3]	Limit contact 1 [2]
Contact 4 term. 93/94	Limit contact 2 [2]	MRS 2 [2]	MRS 2 [2]	Cleaner [3]	Cleaner [3]	USP [2]

Relay contact of non-Ex version in case of power failure:
1) Active (N.O. contact is closed, N.C. contact is open)
2) Passive (N.O. contact is open, N.C. contact is closed)
3) Open.

Note!
The **"failure contact"** is activated by system errors and defects (error codes 1 - 23) which would cause instrument failure.

Current outputs 1 and 2 output the defined error current (see chapter 7.2.1).

The failure contact is an obligatory part of all instrument configurations.

If configured, the **"maintenance required"** contact signals the instrument or process faults which permit operation to continue but make it necessary to check the measuring system.

Error codes 30 to 52 or 30 to 78 will cause maintenance required to be signalled according to the configuration described in 7.1.4.

The **"function check"** contact is activated in the "hold" state and when the instrument configuration is changed (e.g. during calibration).

7.1.5 General

Function	Selection	Default
Selection of Language	Deutsch, English, Francais, Italiano	English
Input damping[1)] Size of the time window, over which the measurement is averaged.	Filter length, 0 (= off) to 30	0
Temperature unit	Celsius (°C) Fahrenheit (°F) Kelvin (K)	Celsius (°C)
Date setting	Day of week, month, year	
Time setting	Hour, minute	
Tag number (up to 32 characters) (measuring point designation)	0 - 9; A - Z	
Display contrast (E+H logo)	Setting for optimal viewing	

1) Input damping
A continuous input damping function in the form of an input filter (average formation) can be switched on to increase the resistance of the measurement to interference. The length of the filter must be adapted to the process on an empirical basis in such a way that short-term interference pulses are suppressed, but that any actual changes in the measured value are recorded.

7.2 Current Output

→ Commissioning (Start-up)
→ Current Output
→ General settings
→ Current output 1 ☞ Chapter 7.2.1
→ Current output 2 ☞ Chapter 7.2.1

7.2.1 Current Output

Current output signal: characteristics and assignment

Function	Selection	Default
Current monitoring (Broken line activates failure contact, error message 15/16)	Active, Inactive	Inactive
Error current (output in case of "failure" to current outputs 1 and 2)	Off (no error current) Min. current [1)] Max. current [2)]	Off
Type of hold	Fixed current-output Last value	Fixed current-output
Current output during hold	0.00 to 20.00 mA	20.00 mA
Current output 1		
Measuring current range	0 to 20 mA or 4 to 20 mA	4 to 20 mA
Output damping	1.0 to 20.0 mA/s	20.0 mA/s
Selection of output signal characteristic	Linear, bilinear, logarithmic, table	Linear
Selection of remote switching measuring range (remote switching activated, see Measurement type menu, chapter 7-7.1.1)	Measuring range 1 to measuring range 4	Measuring range 1
Entry of measuring range limits depending on characteristic selected	Refer to A) to D) for possible settings and factory settings (next page)	

Continued on the next page...

Current output 2		
Measuring current range	0 to 20 mA or 4 to 20 mA	4 to 20 mA
Output damping	1.0 to 20.0 mA/s	20.0 mA/s
Lower measuring range limit	Temperature: -31.0 to +482.0°F (-35.0 to +250.0°C)	32.0°F (0.0°C)
Upper measuring range limit	Temperature: -31.0 to +482.0°F (-35.0 to +250.0°C)	392.0°F (200.0°C)

1) 0.00 mA for measuring current range 0 to 20 mA;
2.40 mA for measuring current range 4 to 20 mA

2) 22.00 mA

The current output signal characteristic can be individually adapted to the requirements of the downstream signal processing, display or registration equipment.

The assignment of the measured value to the current output signal depends on the internal measuring ranges of the instrument and the characteristic type chosen.

The following characteristics can be selected:

A) Linear
B) Bilinear
C) Logarithmic
D) Table (free programmable current output characteristics)

A) Linear Current Output Signal Characteristic

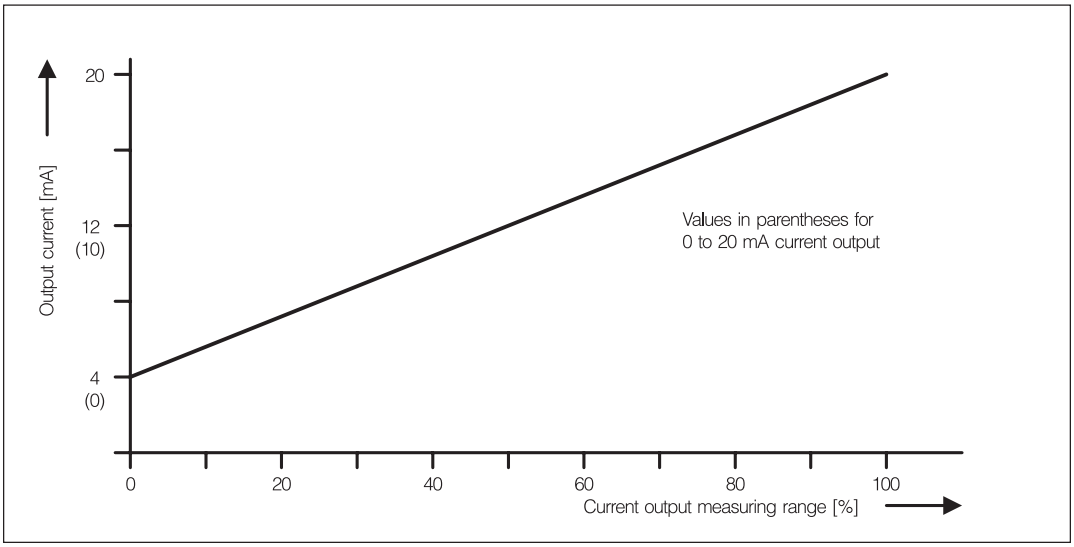


Figure 7.2
Current output signal with linear characteristic

The measuring range is automatically adapted to achieve maximum accuracy and resolution via the internal switching steps. The current-output can be spread up to 10 times in comparison to the internal measuring range.

Example: Measuring Range Assignment of a Measuring Cell with CLS 52, Rising Characteristic

- The measuring range is determined by the conductivity values defined for 0 or 4 mA and 20 mA.
- The difference between the 20 mA value and the 0/4 mA value must be greater than the current output spread TD of the switching step in which the 20 mA value is located.
- If a value of 300 µS/cm is assigned to 20 mA, then the 0/4 mA value must be at least 200 µS/cm lower (TD for switching step 1).
- Possibilities 100 µS/cm to 300 µS/cm
  or 0.0 µS/cm to 300 µ/cm
  but not 150 µS/cm to 300 µS/cm!

B) Bilinear Current Output Signal Characteristic

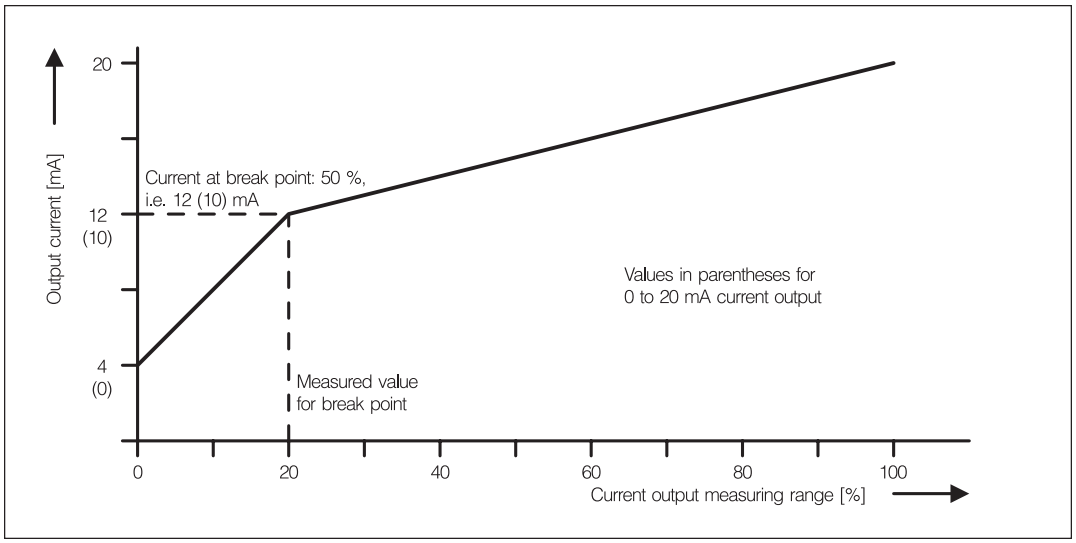


Figure 7.3
Current output signal with bilinear characteristic

The measured value for the break point must be less than (20 mA value - TD). The 0/4 mA value is 0 S/cm in all cases.

C) Logarithmic Current Output Signal Characteristic

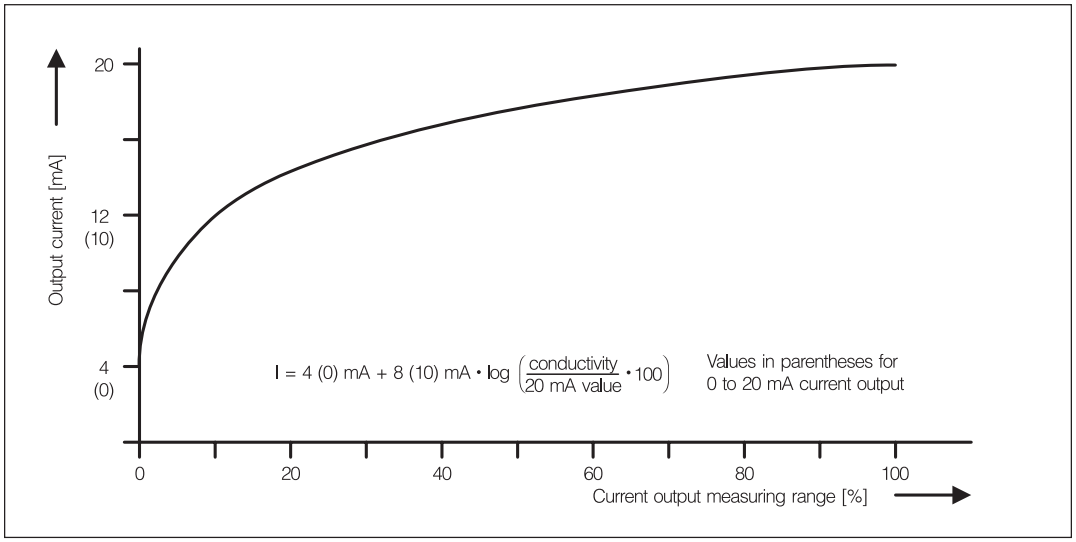


Figure 7.4
Current output signal with logarithmic characteristic

Conductivity	CLS 50	200.0 µS/cm - 1000 mS/cm
	CLS 52	2000 µS/cm - 1000 mS/cm
	K = 0.01	200.0 mS/cm - 200.0 µS/cm
	K = 0.1	2.000 µS/cm - 2000 µS/cm
	K = 1	20.00 µS/cm - 20.00 mS/cm
	K = 10	200.0 µS - 200.0 mS/cm
MOhm	K = 0.01	200.0 KΩcm - 20.00 MΩcm
	K = 0.1	20.00 KΩcm - 2000KΩcm
	K = 1	2.000 KΩcm - 200.0 KΩcm

The 0/4 mA value is automatically set to 1% of the 20 mA value.

D) User-Selectable Current Output Characteristic

Any output characteristic can be defined by means of a current output table which may contain up to 21 elements:

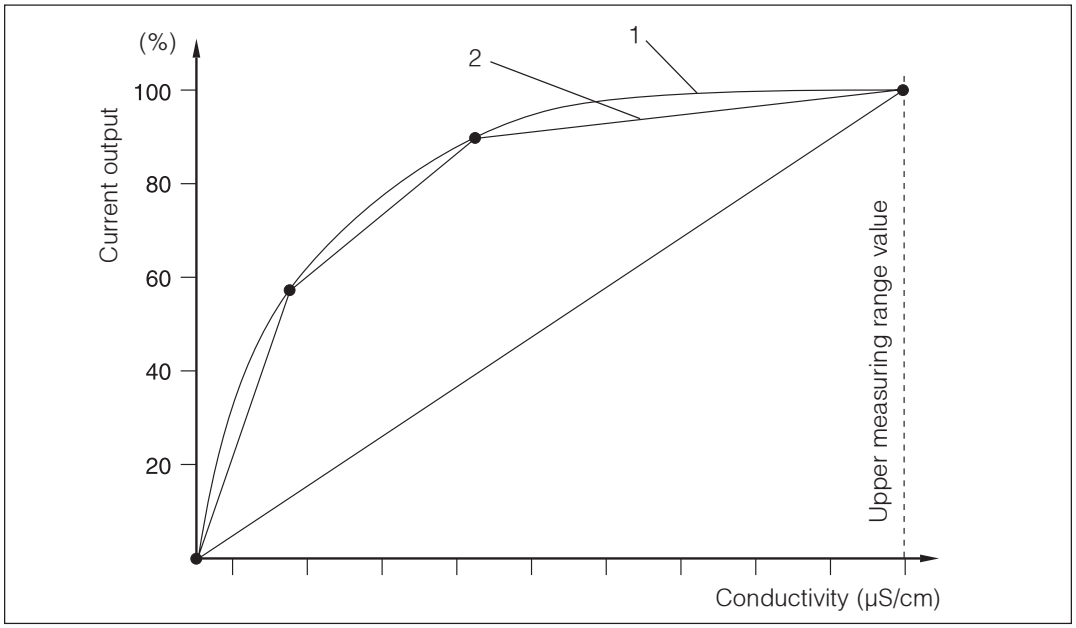


Figure 7.5
Example of a characteristic with 2 and 4 value pairs

1: Actual curve
2: Interpolated curve

Example of a current output table for log 3

Current output (%)	Conductivity (µS/cm)	Current output (%)	Conductivity (µS/cm)
0	0.1	55	4.47
5	0.14	60	6.31
10	0.2	65	8.91
15	0.28	70	12.6
20	0.4	75	17.8
25	0.56	80	25.1
30	0.79	85	35.5
35	1.12	90	50.1
40	1.58	95	70.8
45	2.24	100	100
50	3.16		

Programming

To select the output table, proceed as described in 7.2.1. Select “table” in the characteristic selection menu.

Function	Selection	Factory setting
See Current Output table		
Selection of characteristic for the output signal	Linear, bilinear, logarithmic, table	Linear
Table element selection	Entry of number of value pairs (elements): 2 to 21	2
Entry of values for current output (%) and conductivity (µS/cm)	0 to 100% 0 to upper measuring range value (depends on meas. cell connected)	
Press the “E” key when finished entering numeric values.		

When programming is complete, the table values are checked. The current output and conductivity values must increase from one table element to the next; if this is not the case, this is indicated by an appropriate message:

- “Percent values not monotonously increasing”
- or “Cd values not monotonously increasing”.

7.2.2 Hold Type (Current Output During Hold)

Function	Selection	Factory setting
Selection of hold function type	Fixed current value Last measured value	Fixed current value
Entry of fixed current value (if fixed current value has been selected)	Current value during hold: 0 to 22 mA	20.00 mA

Note!
When set to “last measured value”, the corresponding value is stored in EEPROM. When the instrument is restarted with the hold condition active, this stored value is output.

7.3 Temperature Compensation

→ Commissioning (Start-up)
→ Temperature
→ Temperature compensation ☞ Chapter 7.3.1
→ Temperature measurement ☞ Chapter 7.3.2

The temperature coefficient indicates the change in conductivity per degree of temperature change. It depends on the chemical composition of the solution and on its temperature.

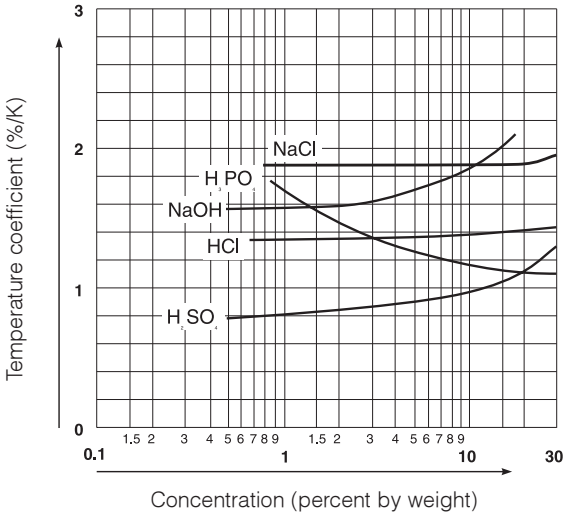


Figure 7.6 Concentration dependence of temperature coefficient for various electrolyte solutions (reference temperature T_{ref} = 77°F/ 25°C)

For example, salt solutions (NaCl) have a non-linear temperature coefficient. The NaCl characteristic (acc. to DIN IEC 746 for low concentrations) is stored in the instrument.

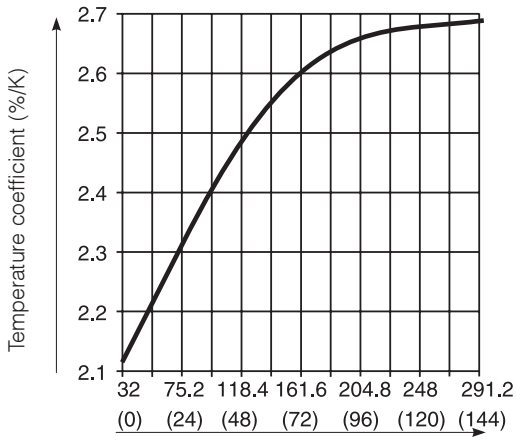


Figure 7.7 Dependence of temperature coefficient on temperature for NaCl solutions.

There are also several other compounds selectable as well as up to four free programmable tables.

7.3.1 Temperature Compensation

Function	Selection	Factory setting
Measuring range selection when switching is activated	Measuring range 1 - 4	Measuring range 1
Type of temperature compensation (for resistance)	No comp., linear, ultrapure water	Linear
Type of temperature compensation (for conductivity)	No comp., linear, NaCl acc. to DIN 746, Tc curve, high pure water NaCl, high pure water USER	
Type of temperature compensation (for concentration measurement) conductive	No comp. [2)] substance table (see chapter 7.4)	Substance table
For "linear selection		
Entry of reference temperature	-31.0 to 482.0°F (-35.0 to +250.0°C)	77°F (25°C)
Entry of temperature coefficient	0.00 to 10.0% / K	2.1% / K
If "NaCl according to DIN 746" is chosen, or "High Purity Water NaCL		
No further settings necessary		
If "High purity water user" is chosen		
Selection of the type of ultrapure water compensation	NaCl User 2 - User 4	NaCL
If "Tc curve" is chosen		
Selection of the substance for compensation with Tc curve (*The first four* substances are already programmed, i.e. no further settings are required. Tc curves can be chosen as required for four additional substances.) (USER 1 - USER 4)	NaOH, HNO_3, H_3PO_4, H_2SO_4, USER 1 - USER 4	NaOH
Entry of the name of the substance that has been chosen as required (User 1 - USER 4)	Name of the substance, max. 5 characters 0 - 9, a - Z	USER 1
Entry of the number of support points for the Tc curve	Support points, 2 - 10	2
The temperature coefficient for a specific temperature is allocated to each of the support points in table form	000.0 °C 00.0 %/K (temp. and Tc for support point)	
If an error is made in entering the figures, a corresponding error message is displayed. The support points are then redefined.	Error message	

1) Select value with "↑↓" keys.
Press "→" key to access edit mode.
Select digit with "→" key and edit with "↑↓" keys.
Acknowledge edited value with "E" key.
Use "↑↓" keys to select another value or press "E" key to acknowledge all adjustments made.

2) Required for measurement according to USP

7.3.2 Temperature Measurement

Temperature measurement requires either manual or automatic temperature compensation.

Manual Temperature Compensation (MTC):

Without temperature sensor.
The process temperature in the range of –31 to +482°F (–35 to +250°C) is entered directly.

Procedure:

- Select “MTC” in the temperature measurement menu.
- Enter the known value of the process temperature in the “MTC temp” field.
- Two-circuit measurement: Repeat procedure for second measuring point.

Automatic Temperature Compensation (ATC):

In order to measure the temperature precisely, the temperature sensor of the measuring cell must be calibrated independent of the conductivity measurement. Calibration requires a precision temperature sensor for comparison measurement. The temperature of the measuring solution must be within the specified temperature measuring range from –31 to +482°F (–35 to +250°C). This calibration consists of a shift of the Pt 100 characteristic to the temperature value measured.

Procedure:

- Immerse the measuring cell and the precision temperature sensor (comparison measurement) in the measuring solution.
- Select “ATC” in the temperature measurement menu.
- Enter the temperature value of the comparison measurement in the “Offset temp.” field.
- Two-circuit measurement: Repeat procedure for second measuring point.

Function	Selection	Factory setting
Type of temperature compensation	Manual (MTC) Automatic (ATC)	Automatic (ATC)
For “Automatic (ATC)” selection		
Enter actual temperature value for channel 1	–31 to +482°F (–35 to +250°C)	
Display of temperature 1, offset 1	No selection	
Enter actual temperature value for channel 2 (difference only)	–31 to +482°F (–35 to +250°C)	
Display of temperature 2, offset 2 (difference only)	No selection	
For “Manual (MTC)” selection		
Enter MTC temperature	–31 to +482°F (–35 to +250°C)	77°F (25°C)
Enter MTC temp. channel 2	–31 to +482°F (–35 to +250°C)	77°F (25°C)

7.4 Calibration Settings

→ Commissioning (Start-up)

→ Calibration

Function	Selection	Factory setting
Hold during calibration	Yes, No	Yes
Entry of temperature coefficient Tc of calibration solution	0.0 to 10.0 %/K	2.1 %/K
Entry of temperature of calibration solution (MTC only)	–31 to +482°F (–35 to +250°C)	77°F (25°C)

7.5 Cleaning Function

→ Commissioning (Start-up)

→ Chemoclean

An instrument with a total of five output contacts is needed for the Chemoclean function with a contacting measuring cell.

The holder CLA 611 and spray head CLR 30 are required to automate the cleaning function.

The “Chemoclean” cleaning function is to be adjusted in the “System set-up / Output relays” (see chapter 7.1.4).

“Chemoclean” is started from the “Short-cut to relays” menu (see chapter 6.7).

Note!
The options “Chemoclean off” and “Setting” cannot be accessed during an ongoing cleaning cycle.

The cleaning cycle starts again from the beginning when changes have been made in the “Settings” menu.

7.6 Substance Selection / Concentration Measurement

→ Commissioning (Start-up)

→ Substance selection

Note!
This menu only appears when concentration measurement has been selected as the measurement type (see Measurement type in chapter 7.1.1).

Note!

Function	Selection	Factory setting
Measuring range selection with remote switching activated	Measuring range 1 - 4	Measuring range 1
Substance selection	NaOH HNO_3 (fixed, other settings H_3PO_4 not required) H_2SO_4 USER 1 - USER 4 (user-selectable)	NaOH
For USER 1 - USER 4		
Entry of a substance name	Substance designation, max. 5 characters: 0 to 9, a to Z	USER 1
Entry of a number of elements (value pairs) for the substance concentration curve	Substance curve elements, 2 - 10	2
Each element consists of a conductivity value and associated concentration value	Concentration 000.0 % Conductivity 0.000 mS/cm	
Entry of number of elements (value pairs) for the Tc curve	Elements of Tc curve, 2 - 10	2
Each element consists of a temperature value and associated temperature coefficient		
If an error is made entering the numbers, this is indicated by an appropriate error message. The elements will then need to be redefined.		

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8 Limit Configuration

Limit Monitor

The contact in question is either continuously open or closed.

The nature and scope of the possible settings are determined by the equipment available in your instrument as well as by the settings made in the System set-up / Output relays menu. (See chapter 7.1.4, Output relays, relay assignments.)

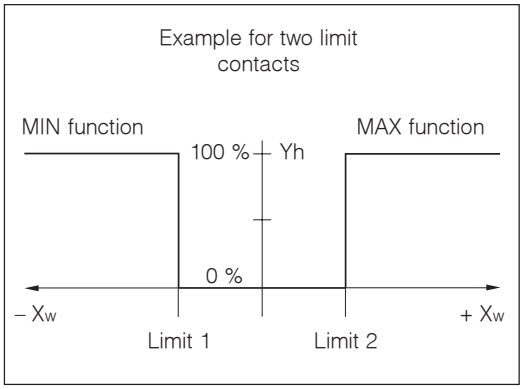

Figure 8.1
Control characteristic of a limit contacter
X_W = system deviation
Y_h = manipulated variable output

8.1 Instruments with Two Contacts

→ Commissioning (Start-up)
→ Relay contacts

Function	Selection	Factory setting
Group selection	Limit configuration Alarm configuration Operating mode	Limit configuration
For “Limit configuration” selection		
Switching output on/off	On, Off	Off
Limit	0 µS/cm to 1000 mS/cm	Depends on selected cell
Hysteresis	0.001 µS/cm to 200.0 mS/cm	Depends on selected cell
Contact function	Min. function, Max. function	Min. function
Pickup delay	0 to 7200 s	0 s
Dropout delay	0 to 7200 s	0 s
Contact type	N.C. contact, N.O. contact	N.O.
For “Alarm configuration” selection		
Alarm threshold	0.001 µS/cm to 1000 mS/cm	Depends on selected cell
Alarm delay	0 to 6000 s	0 s
For “Operating mode” selection		
Switching operating mode	Automatic limit contacter 1, Manual limit contacter 1	Manual limit contacter 1

8.2 Instruments with Five Contacts

→ Commissioning (Start-up)
→ Relay contacts

Function	Selection	Factory setting
Group selection	Limit configuration Alarm configuration Operation mode	Limit configuration
For “Limit configuration” selection		
Limit contacter selection	Limit contacter 1 Limit contacter 2	Limit contacter 1
Switch output on/off	Off, On	1: On 2: Off
Limit	0 µS/cm to 1000 mS/cm	Depends on selected cell
Hysteresis	0.001 µS/cm to 100.0 mS/cm	Depends on selected cell
Contact function	Min function Max function	1: Min function 2: Max function
Pickup delay	0 to 7200 s	0 s
Dropout delay	0 to 7200 s	0 s
Contact type	N.C. contact, N.O. contact	N.O. contact
For “Alarm configuration” selection		
Selection of alarm contact	Alarm 1 Alarm 2	Alarm 1
Alarm threshold	0.001 µS/cm to 1000 mS/cm	Depends on selected cell
Alarm delay	0 to 6000 s	0 s
For “Operating mode” selection		
Limit contacter selection	Limit contacter 1 Limit contact 2	Limit contacter 1

Note!
In the case of two-circuit instruments (= difference measurement), all contact settings (limits, alarm, etc.) refer to the difference value, not the absolute conductivity value.

8.3 USP Function (Contacting mode)

The Mycom CLM 152 is able to measure and monitor uncompensated conductivity according to the USP ("United States Pharmacopeia") guidelines.

When equipped with the USP option, the instrument fulfills the USP requirement of measuring conductivity and monitoring for deviation at the same time.

The monitoring function is automatic and can be enabled via the Commissioning menu.

USP Requirements on Measurement

The following measurement procedure is employed:

The measurement is performed uncompensated, and the current measured value is compared to a reference value for pure water (see table below).

If the values measured exceed the reference values, an alarm condition is signalled via the USP contact.

The transmitter must fulfill the following USP requirements for a quasi-compensation:

- Temperature measurement at the place of the conductivity measurement
- Temperature is to be rounded down to the next 5°C step.
- The valid monitoring value is to be determined via a table (see table below)
- Alarm signalling when the limit is exceeded

Temperature (°C)	Conductivity (µS/cm)	Temperature (°C)	Conductivity (µS/cm)
0	0.6	55	2.1
5	0.8	60	2.2
10	0.9	65	2.4
15	1.0	70	2.5
20	1.1	75	2.7
25	1.3	80	2.7
30	1.4	85	2.7
35	1.5	90	2.7
40	1.7	95	2.9
45	1.8	100	3.1

The USP function can be activated in the Commissioning / System set-up / Output relays menu.

The following settings can be adjusted following activation:

→ Commissioning (Start-up)
→ USP contact

Function	Selection	Factory setting
Hysteresis	Entire measuring range	0 µS/cm
Pickup delay	0 to 60 s	0 s

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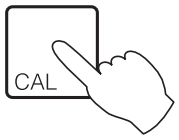
9 Calibration

9.1 Toroidal Calibration



→ Entry of cell constant	☞ Chapter 9.1.2
→ Determination of cell constant	☞ Chapter 9.1.3
→ Entry of adaptation factor	☞ Chapter 9.1.4
→ Determination of adapt. factor	☞ Chapter 9.1.4

9.1.1 Entry of Code

Enter the required code to access the lower menu levels and confirm with the E key. The menu levels can then be accessed. All calibration functions can be selected with the operator or the advanced code.

9.1.2 Input of Cell Constant

Function	Selection	Default
Measuring cell selection (not for one-circuit)	Measuring cell 1 Measuring cell 2	Measuring cell 1
Fine adjustment of cell constant CLS 50	1.000 1/cm to 3.000 1/cm	2.000 1/cm
Fine adjustment of cell constant CLS 52	5.000 1/cm to 7.000 1/cm	5.9 1/cm

Selecting a measuring cell (CLS 50 or CLS 52) in the System set-up menu (see chapter 5.2) automatically results in the assignment of the corresponding cell constant value. However, this value can be edited by the user for fine adjustment.

9.1.3 Evaluation of Cell Constant

The conductivity of a calibration solution (with a known conductivity) is measured (see chapter 3.7.2). Then the display is adjusted to the conductivity of the calibration solution, and the instrument computes the cell constant. Procedure:

- Select the measuring cell to be calibrated (two-circuit measurement only).
- Clean the measuring cell.
- Place the measuring cell and temperature sensor in the calibration solution.
- Start calibration with the “E” key.
  ⇒ The display shows the measured value of the calibration solution.
- Wait for the measured value to stabilize.
- Accept measured value with “E” key ⇒ setpoint adjustment.
- Adjust to the value of the calibration solution with the arrow keys.
  Entry range:
  Cd.: 0 to 2000 mS/cm
- Confirm your entry with the “E” key.
  ⇒ The computed cell constant is displayed.
- Terminate or repeat calibration.

When “End cal” is chosen, the newly determined cell constant is stored, and the instrument switches to the measuring mode.

Note!

Note!
To carry out a highly accurate calibration, it is necessary to eliminate the temperature influence which is due to the temperature difference from the reference temperature, i.e. the calibration should be performed at the reference temperature. If this is not possible, the calibration temperature or Tc value of the calibration solution can be entered in the “Commissioning / Calibration” menu.

Note!

Note!
to assure accurate temperature registration, the temperature sensor should be checked and calibrated before each calibration of the conductivity measurement with the air of the “Commissioning / Temperature” menu.

Function	Selection	Default
Measuring cell selection (not for one-circuit)	Measuring cell 1 Measuring cell 2	Measuring cell 1
	No selection	Clean meas. cell and place in calibration solution
Display of calibration solution, Tc, temperature		
Entry of calibration solution setpoint	0 µS/cm to 1000 mS/cm	Current meas. value
Display of cell constant		x.xxx 1/cm
Calibration	End cal. Repeat cal. Cal. channel 2 (difference only)	End cal.
For “End cal.” selection		
Return to measuring mode		
For “Repeat cal.” selection		
Calibration of measuring cell 1 Return to measuring cell selection (see above)		Measuring cell 1
For “Cal. channel 2” selection		
Calibration of measuring cell 2 Return to measuring cell selection (see above)		Measuring cell 2

9.1.4 Installation Factor (with Toroidal Sensors)

When installed in narrow pipes, the sensor may be influenced by the pipe wall, resulting in inaccurate measurement. This effect may occur when the distance from the wall is less than 0.6 in. (15 mm). It can be compensated for by entering an adaptation factor (installation factor).

Input of Installation Factor

Function	Selection	Default
Measuring cell selection (not for one-circuit)	Measuring cell 1 Measuring cell 2	Measuring cell 1
Entry of adaptation factor	0.001 to 50.000	1.000

Note: The adaptation factor for the CLS 52 cell is 1 for pipes ≥ DN 65 (all measuring cell versions).
For pipe diameter 1½ in. (DN 40), an adaptation factor of 0.990 is to be entered.

Note!
Measuring cell versions equipped with dairy pipe, clamp and internal thread fittings can only be installed in pipes with a diameter of at least DN 65.

Note!

Evaluation of Installation Factor

Function	Selection	Default
Measuring cell selection (not for one-circuit)	Measuring cell 1 Measuring cell 2	Measuring cell 1
Note		Leave meas. cell in process
Display of calibration solution, Tc, temperature		
Entry of calibration solution setpoint	0 µS to 1000 mS/cm	Current meas. value
Display of adaptation factor		x.xxx
Calibration	End cal. Repeat cal. Cal. channel 2 (two-circuit only)	End cal.
For “End cal.” selection		
Return to measuring mode		
For “Repeat cal.” selection		
Calibration of measuring cell 1 Return to Measuring cell selection (see above)		Measuring cell 1
For “Cal. channel 2” selection (two-circuit only)		
Calibration of measuring cell 2 Return to measuring cell selection (see above)		Measuring cell 2

9.2 Contacting Calibration

→ Input of cell constant ☞ Chapter 9.2.1
→ Evaluation of cell constant ☞ Chapter 9.2.2

9.2.1 Numerical Calibration / Input of Cell Constant

The cell constant is measured exactly at the factory, where it is entered directly in cm^{-1}. The entry is made separately for each measuring cell in the case of two-circuit measurement.

Cell Constant	Entry range
0.01 cm^{-1}	0.0005 to 0.0500 cm^{-1}
0.1 cm^{-1}	0.050 to 0.500 cm^{-1}
1 cm^{-1}	0.500 to 5.000 cm^{-1}
10 cm^{-1}	5.00 to 99.99 cm^{-1}

9.2.2 Wet Calibration / Determination of Cell Constant

The conductivity of a calibration solution (of a conductivity that is known exactly) is measured (see chapter 3.6.2 for calibration solutions). The display is adjusted to the conductivity of the calibration solution, and the instrument computes the cell constant.

Procedure:

- Two-circuit measurement:
  Choose the measuring cell to be calibrated.
- Clean the measuring cell.
- Immerse the measuring cell and – if applicable – the temperature sensor, in the calibration solution.
- Start the calibration with the **"E"** key.
- **Display: measured value of calibration solution, ATC/MTC, temperature, Tc of calibration solution.**
- Wait for the measured value to stabilize.
- Accept measured value with **"E"** key.
- **Enter the setpoint.**
- Enter the exact value of the calibration solution with the arrow keys.
- Confirm your entry by pressing the "E" key.
- **The computed cell constant is displayed.**
- Terminate or repeat calibration.

When "End cal." is chosen, the newly determined cell constant is stored, and the instrument switches to the measuring mode.


Note!

Note!
To carry out a highly accurate calibration, it is necessary to eliminate the temperature influence which is due to the temperature difference from the reference temperature, i.e. the calibration should be performed at the reference temperature. If this is not possible, the calibration temperature or Tc value of the calibration solution can be entered in the "Commissioning / Calibration" menu.

To assure accurate temperature registration, the temperature sensor should be checked and calibrated before each calibration of the conductivity measurement with the aid of the "Commissioning / Temperature" menu.


Warning!

Warning!
The hold function does not stop ongoing Chemoclean cleaning cycles. Disable the Chemoclean function in the "Commissioning / Chemoclean" menu (see chapter 7.5) prior to calibration.

10 Profibus Interface

10.1 FCYP Module

In the simplest case, a complete measuring point consists of the Mycom CLM 152 with the FCYP module (see chapter 4, figure 4.13), a bus coupler, a PLC or a PC with the operating program Commuwin II and a PROFIBUS PA terminating resistor.

The maximum number of transmitters in one bus segment is determined by their current consumption, the power of the bus coupler and the required bus length (refer to TI 260F/00/en for details).

Normally, up to 32 Mycom CLM 152 units can be operated in one bus segment in the case of non-Ex applications.

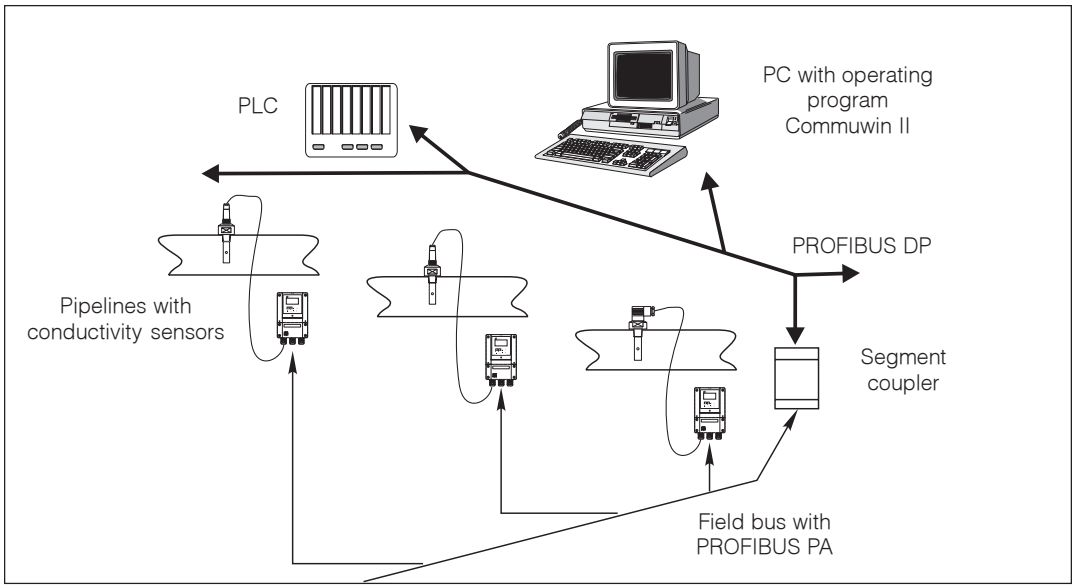


Figure 10.1 Measuring system based on Mycom CLM 152 with PROFIBUS PA protocol

10.2 Bus Cable

Shielded, twisted-pair cable should preferably be used for new installations (e.g. Belden 3097A, Siemens 6xV 1830-5AH10). The FISCO model (explosion protection) prescribes the following specifications:

Loop impedance (DC)	14 to 150 Ω/km
Inductance per unit length	0.4 to 1 mH/km
Capacitance per unit length	80 to 200 nF/km

Please refer to TI 260F/00/en Project planning notes for Profibus PA and the PROFIBUS PA specification for information on set-up and grounding of the network.

Caution!
Multiple grounding of the protective shield in explosion protection applications is only permissible in special cases.

Caution!

10.3 Bus Address

Each device is assigned a unique bus address:

➜ Set address (1 - 126) with switches 1-7
➜ Switch 8 set to OFF:
Address set with DIL switches 1-7 is valid.
➜ Switch 8 set to ON:
The address set in the field or via the interface is valid.

Setting of Profibus address (menu selection):

- Param
- Advanced
- Commissioning
- System set-up

General ➜ Profibus address (default: 126)

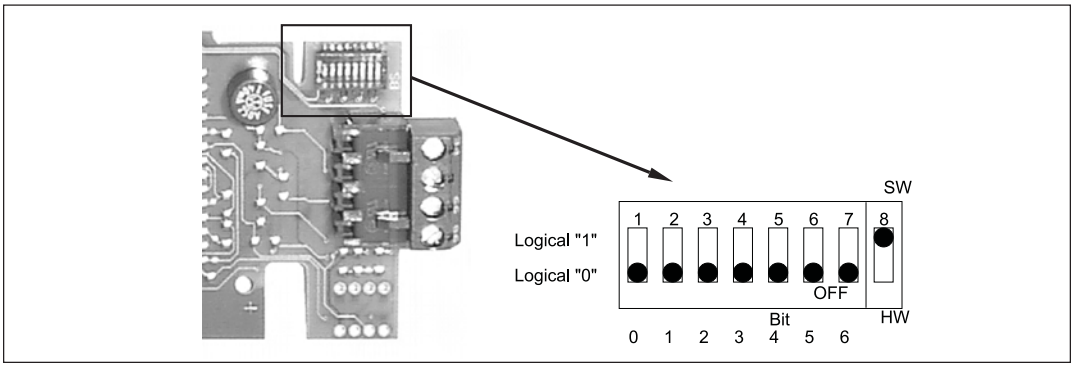
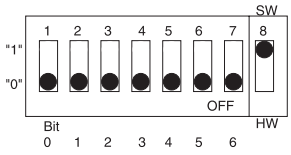


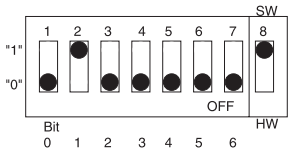
Figure 10.2
Section of Profibus card in Mycom showing address setting 126 (factory setting for software addressing)

Addressing Examples

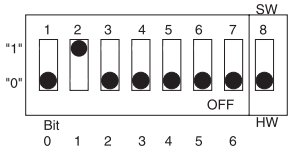
Factory setting:
Software addressing (SW)
(default: 126_d)
(Hardware setting will be ignored)



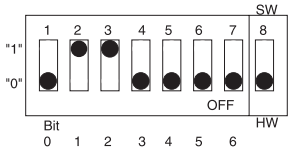
Software addressing
(default: 126_d)
(Hardware setting will be ignored)



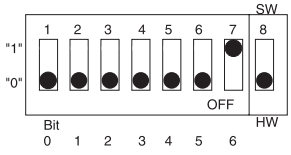
Hardware addressing (HW)
address: 2_d



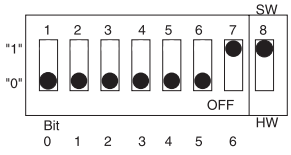
Hardware addressing
address: 6_d



Hardware addressing
address: 64_d



Software addressing
address: 126_d
(default after switching from HW to SW)



10.4 Device Master File / Type File

The device master data is required to use the Profibus. This data must be provided in the Siemens TYP file format. The data must be loaded into the communication partner (Siemens operating system COMET 200 or COM PROFIBUS) before the bus system is started up. The data is stored in the following locations:

- All *.200 files are stored in the type file directory, e.g. ***/TYPDAT5X
- All *.GSD files are stored in the device master file directory, e.g. ***/GSD
- All *.BMP files are stored in the bitmap directory, e.g. ***/BITMAPS

The meaning of the individual device parameters is described in the PROFIBUS-PA specification.

The device master files are provided on a diskette:

- Diskette with Profibus PA device files (order no. 943157-0000)

10.5 Remote-Controlled Operation with Commuwin II

PROFIBUS-PA devices can be operated via the Commuwin II operating program (starting with software version 1.5). Operation with Commuwin II is described in the BA 124F operating instructions. Settings are made via the operating matrix (see Fig. 10.3) or graphical user interface (see Fig. 10.4).

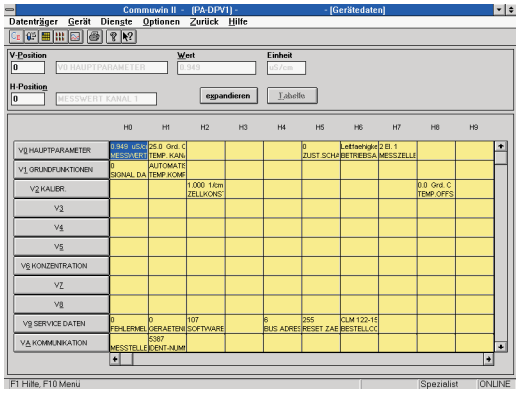


Figure 10.3
Instrument data (commissioning) menu displayed in Commuwin II (contacting)

Establishing the Connection

Remote control requires installation of the PROFIBUS-PA server, and the PC must be equipped with a PROFIBUS-PA card:

- The connection to Commuwin II is established via the PROFIBUS-PA server.
- The device list contains all devices connected to the segments selected.
- The appropriate settings are made in the Commissioning menu.
- PROFIBUS-PA profile parameters can also be displayed and set via the graphical user interface.

Figure 10.4
Operation via graphical user interface of Commuwin II

10.6 System Integration via PLC

The Mycom CLM 152 transmitter makes the measured values (OUT) available cyclically using the PROFIBUS-PA protocol. Other PROFIBUS-PA parameters are made available using the acyclical service.

	Command	Type	Function
Module 1	OUT	Read	Current measured value of process variable in mS/cm, kΩ•cm or % and the corresponding status. – Status = 80 $_{Hex}$, devices OK – Status = 0C $_{Hex}$, warning or alarm active. The information is transferred byte-by-byte in 5 bytes, with the last byte containing the status information.
Module 2	OUT	Read	Current measured value of process variable in °C and the corresponding status. – Status = 80 $_{Hex}$, devices OK – Status = 0C $_{Hex}$, warning or alarm active. The information is transferred byte-by-byte in 5 bytes, with the last byte containing the status information.

Two so-called modules are available for the data exchange with the PLC and are transferred together:

- Module 1: main measured value
- Module 2: temperature value measured

Data Format for Module 1 and Module 2

Byte	Data	Data Format
1	Measured value	IEEE 754-floating point number (mS/cm; kΩ•cm or %)
2	Measured value	
3	Measured value	
4	Measured value	
5	Device status	80_{Hex} = device OK $0C_{Hex}$ = error (alarm active)
6	Measured value	IEEE 754-floating point number (°C)
7	Measured value	
8	Measured value	
9	Measured value	
10	Device status	80_{Hex} = device OK $0C_{Hex}$ = error (alarm active)

IEEE 754 Floating Point Number

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
VZ	Exponent (E)								Fraction (F)						
	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}	2^{-6}	2^{-7}
Fraction (F)															
2^{-8}	2^{-9}	2^{-10}	2^{-11}	2^{-12}	2^{-13}	2^{-14}	2^{-15}	2^{-16}	2^{-17}	2^{-18}	2^{-19}	2^{-20}	2^{-21}	2^{-22}	2^{-23}

10.7 Profibus PA Parameters

10.7.1 Profibus PA Parameters for Toroidal Measurement

Parameter	Matrix VH	Index (Slot = 1)	Data Type	Read	Write	Data
Composite List Directory	–	1	Octet String	yes		24
DEVICE_ID	V99H0	25	Octet String	yes		16
Actual Error	90	42	Unsigned 16	yes		2
Device Bus Address	94	44	Integer 8	yes		1
Device and Software Number	93	48	Unsigned 16	yes		2
Main measured value	00	108	Float	yes		4
Temp. value	01	109	Float	yes		4
Ext. binary input	05	110	Unsigned 8	yes		1
Operating mode	06	111	Unsigned 8	yes		1
Measuring cell	07	112	Unsigned 8	yes		1
Input damping	10	113	Unsigned 8	yes	yes	1
ATC/MTC settings	11	114	Unsigned 8	yes	yes	1
MTC temperature	13	115	Float	yes	yes	4
Cell constant	22	116	Float	yes		4
Adaptation factor	24	117	Float	yes	yes	4
Temp. offset	28	118	Float	yes		4
Subst. selection MR 1	60	119	Unsigned 8	yes	yes	1
Subst. selection MR 2	61	120	Unsigned 8	yes	yes	1
Subst. selection MR 3	62	121	Unsigned 8	yes	yes	1
Subst. selection MR 4	63	122	Unsigned 8	yes	yes	1
Device number	91	123	Unsigned 32	yes		4
Software version	92	124	Unsigned 16	yes		2
Reset counter	95	125	Unsigned 8	yes		1
SAP code	96	126	Octet String	yes		18
Meas. point description	AO	127	Octet String	yes	yes	32
PNO-ID-number	A1	128	Unsigned 16	yes		2

10.7.2 Profibus PA Parameters for Contacting Measurement

Parameter	Matrix VH	Index (Slot = 1)	Data Type	Read	Write	Data
Composite List Directory	–	1	Octet String	yes		24
DEVICE_ID	V99H0	25	Octet String	yes		16
Actual Error	90	42	Unsigned 16	yes		2
Device Bus Address	94	44	Integer 8	yes		1
Device and Software Number	93	48	Unsigned 16	yes		2
Main measured value	00	108	Float	yes		4
Temp. value	01	109	Float	yes		4
Ext. binary input	05	110	Unsigned 8	yes		1
Operating mode	06	111	Unsigned 8	yes		1
Measuring cell	07	112	Unsigned 8	yes		1
Input damping	10	113	Unsigned 8	yes	yes	1
ATC/MTC settings	11	114	Unsigned 8	yes	yes	1
MTC temperature	13	115	Float	yes	yes	4
Cell constant	22	116	Float	yes		4
Temp. offset	28	117	Float	yes		4
Subst. selection MR 1	60	118	Unsigned 8	yes	yes	1
Subst. selection MR 2	61	119	Unsigned 8	yes	yes	1
Subst. selection MR 3	62	120	Unsigned 8	yes	yes	1
Subst. selection MR 4	63	121	Unsigned 8	yes	yes	1
Device number	91	122	Unsigned 32	yes		4
Software version	92	123	Unsigned 16	yes		2
Reset counter	95	124	Unsigned 8	yes		1
SAP code	96	125	Octet String	yes		18
Meas. point description	AO	126	Octet String	yes	yes	32
PNO-ID-number	A1	127	Unsigned 16	yes		2

11 Diagnostics

11.1 Error Messages

11.1.1 Error Classification

A distinction is made between two different error statuses:

- active – cause of error is acute
- inactive – cause of error no longer exists

When there is an active error, the LED in the DIAG key lights up red; if there is no active error, the LED is green.

Errors are divided up into four error categories on a priority basis:

Category	Error Number	Effect
Failure	E001 to E016	• Failure contact active • Error current at current output 1 and 2 (as specified, see chapter 11.1.2) • Limit contacter output contacts passive (NO contacts open, NC contacts closed) • DIAG LED red
Maintenance required	E036 to E052	• Maintenance contact active if configured in the “System set-up / Output relays” menu • DIAG LED red
Process Fault	E055 to E078	• Maintenance contact active if configured and error has been assigned to maintenance • DIAG LED red
Warning	E080 to E149	• DIAG LED red

11.1.2 Error List and Error Logbook

Error List
The instrument controls up to 30 active errors in a list. The error with the highest priority is at the top of the list. When the list is full and another error is to be added, the error with the lowest priority is deleted. Errors are displayed in plain text. The error number as well as the date and time the error occurred are also displayed.

You can scroll up and down in the list by pressing the ↓ and ↑ keys.

The entries in the error list cannot be edited or deleted by the user. If an error is no longer acute, the corresponding entry in the error list is automatically removed.

Error Logbook
From the error list, you can access the error log by pressing the E key.

The error log records every activation and deactivation of an error message in chronological order in a list with up to 50 entries. You can use the ↓ and ↑ keys to scroll through the list entry by entry. The entries in the error list cannot be edited or deleted by the user. When the capacity of the list is exhausted, the oldest entry is deleted to make room for a new entry.

Only the ten most recent entries in the error log are retained in the event of a power failure. Press the E key once more to return to the “Diagnostics” menu.

11.1.3 Error Table

Failure		
No.	Display	Remedy
E001	Internal communication error	Return the instrument to your Endress+Hauser sales agency to be repaired or request service assistance.
E002	Data ERROR in EEPROM	
E003	Invalid configuration	Check slot configuration
E004	Configuration changed	Set new configuration with “set config” in “Service / Factory settings” menu
E005	Unknown card identifier	Check modules in slots
E006	Checksum error in EEPROM	Perform checksum correction in “Special functions” menu
E007	Transmitter defective	Return instrument to your Endress+Hauser sales agency for repair or request service assistance
E010	Temperature sensor defective	Check temperature measurement and connections; check instrument and measuring cable with temperature simulator if necessary
E011	Temperature sensor 2 defective	
E015	Current loop 1 open	Check connections, cables and any connected instruments
E016	Current loop 2 open	
Maintenance Required		
E036	Calibration range of meas. cell 1 exceeded	Recalibrate measuring cell; check measuring cell and connections; check instrument and measuring cable with temperature simulator
E037	Below calibration range of meas. cell 1	
E038	Calibration range of meas. cell 2 exceeded	
E039	Below calibration range of meas. cell 2	
E040	TC table invalid	Correct temperature compensation table; check temperature measurement and connections; if necessary, check instrument and measuring cable with temperature simulator
E041	Substance table invalid	Correct substance table
E049	Adaptation factor range for meas. cell 1 exceeded	
E050	Below adaptation factor range for meas. cell 1	
E051	Adaptation factor range for meas. cell 2 exceeded	
E052	Below adaptation factor range for meas. cell 1	

Continued on the next page...

Disturbances		
No.	Display	Remedy
E055	Below display range of meas. value	Check measurement, control and connection; if necessary, check instrument and measuring cable with simulator
E056	Below display range of meas. value 2	
E057	Display range of measured value exceeded	
E058	Display range of measured value 2 exceeded	
E059	Below temperature range	
E060	Below temperature range 2	
E061	Temperature range exceeded	
E062	Temperature range 2 exceeded	
E063	Current limiting, 0/4 mA, output 1	Check the configuration in the “Current outputs” menu; check measurement, control and connections; if necessary check instrument and measuring cable with simulator
E064	Current limiting, 20 mA, output 1	
E065	Current limiting, 0/4 mA, output 2	
E066	Current limiting, 20 mA, output 2	
E067	Limit or setpoint 1 exceeded	Check configuration in “Relay contacts” menu; check measurement, control and connections; if necessary, check instrument and measuring cable with simulator
E068	Limit or setpoint 2 exceeded	
E073	Below TC range	Check configuration in “Temperature” menu; check measurement, control and connections; if necessary, check instrument and measuring cable with simulator
E074	Below TC range of channel 2	
E075	TC range exceeded	
E076	TC range of channel 2 exceeded	
E077	Temperature outside TC table range	Check temperature compensation table and correct if necessary, check temperature measurement and connections; if necessary, check instrument and measuring cable with temperature simulator
E078	Temperature 2 outside TC table range	
Warnings		
E080	Range for current output 1 too small	Increase range in “Current outputs” menu
E081	Range for current output 2 too small	
E142	Break point outside range, current output 1	Correct configuration in “Current outputs” menu
E143	Break point outside range, current output 2	
E144	Range of current output 1 for selected MR (= measuring range) too small	Increase range in “Current outputs” menu
E145	Range of current output 2 for selected MR (= measuring range) too small	
E148	Break point outside range of current output 1 MRX (= current measuring range)	Correct configuration in “Current outputs” menu
E149	Break point outside range of current output 2 MRX (= current measuring range)	

11.2 Instrument Information

11.2.1 Information List

The “info list” menu item displays two information windows in succession. Window 1 displays when the instrument as last started up, its name and the number of output contacts. Press the E key to go on to the logbook.

11.2.2 Logbook

Window 2, the “logbook”, contains a list of the last 30 operating events with the date and time of day. The most recent event is at the top of the list. When the list is full, and a new entry is to be added, the oldest entry is removed. The following events are recorded:

- all configuration changes
- all simulations activities (unspecific)

Entries in the logbook can neither be changed nor deleted by the user.

11.3 Air Set Information (Toroidal)

The Air Set adjustment permits a zero calibration of a sensor connected. Channel 1 and channel 2 can be calibrated separately (in the case of difference measuring instruments).

To calibrate, the sensor is removed from the measuring solution and held up in the air without contacting the solution. The toroidal Mycom CLM 152 transmitter then waits for the measured value to stabilize and, when stable, stores it as the calibration value.

This Air Set value is subsequently used in the normal computation of the measured value. The Air Set value can only be reset using the Service data default function!

11.4 Calibration History

Through the Diagnostics and Calibration history menu items, the Mycom CLM 152 transmitter provides access to automatically recorded logs permitting convenient evaluation of the measuring cell status:

- date/time
- cell constant
- adaptation factor
- Tc value*
- Conductivity-value*
- Temperature*

*with wet calibration


Caution!

Caution!
Changing the operating mode or resetting the instrument with “Default calibration data” will erase the entire calibration history!

11.5 Service

→ Service
Operator Level
Advanced Level
→ Simulation ☞ Chapter 11.5.1
→ Internal data ☞ Chapter 11.5.2
→ Factory settings ☞ Chapter 11.5.3
→ Instrument check ☞ Chapter 11.5.4
→ Special functions ☞ Chapter 11.5.5

11.5.1 Simulation

Function	Selection
Setting of present current value for current output 1	0.00 to 22.00 mA
Setting of present current value for current output 2	0.00 to 22.00 mA
Setting of current relay statuses (the number of contacts displayed depends on the modules installed and the configuration)	The contacts are selected with the ↑ and ↓ keys. The selected contact is opened/closed with the → key.
Measured value simulation main measured value	Can be set to any value within configured measuring range. Current outputs and relay states change according to configuration.
Measured value simulation, temperature	–31 to +482°F (–35.0 to +250.0°C) Current outputs and relay states change according to configuration.

Note!
The displayed current output value or relay state immediately appears in the "Simulation" menu. If the value in the window is changed, the current output or relay state immediately changes accordingly. The simulation function is deactivated by leaving the window.

11.5.2 Internal Data

Function	Selection
Display of the device number	No selection
Display of the software version	No selection
Display of the software version of FCL1 module (conductivity signal processor), channel 1	No selection
Display of software version, channel 2	No selection
Display of the hardware configuration in several consecutive windows; assembly (module), installation date, slot information	No selection
Order code	Alphanumeric entry, may include numbers from 0 to 9 and characters from a to Z
Reset counter	0 to 255, display only

11.5.3 Factory Settings

Function	Selection
Factory settings (Instrument reset)	Cancel (no reset), Hardware config (acknowledge changed slot occupation), Config data only, Calibration data only, All data, (Service data, logbook, reset counter ⇒ accessible to authorized service personnel only)
Hardware	The hardware equipment is checked and a change in slot configuration is acknowledged when the E key is pressed.
Reset config data only	When the E key is pressed, all calibration data is reset to the factory settings. Caution! **Caution!** **All previous instrument configuration data is lost!**
Reset calibration data only	When the E key is pressed, all calibration data is reset to the factory settings. Caution! **Caution!** **All previous calibration data is lost!**
Factory Reset	When the E key is pressed, the configuration and calibration data is reset to the factory settings. Caution! **Caution!** **All previous configuration and calibration data is lost!**

Caution!

Caution!
If the calibration data is reset, the measuring system must be recalibrated.

11.5.4 Instrument Check

Function	Description
Type of test	Selection: keyboard, display, RAM EPROM, EEPROM
Keyboard	Graphic presentation of the keyboard layout. Press all the keys in succession. If the key is working, an acknowledgment appears in the corresponding display field. Press the E key to return to the test type selection menu.
Display	A chessboard pattern and its inverted image are shown alternately. Check the display to see if any dots are missing. Press the E key to return to the test type selection menu
RAM	Self-test. At the end of the testing period, the result is displayed. Press the E key to return to the test type selection menu.
EPROM	
EEPROM	

11.5.5 Special Functions

Function	Selection
Selection of special functions	Optimization, Checksum correction, Reset
For “Optimization” selection	
Determination of temperature coefficient	Determination of temperature coefficient Tc of a medium.
Request sample 1	Immerse the measuring cell and temperature sensor in a medium sample. The temperature of the sample should be as close as possible to the reference temperature used.
Measurement of conductivity and temperature	Press the E key when both values are stable.
Request sample 2	Heat the sample by at least 10 Kelvin. Immerse the measuring cell and temperature sensor in the sample.
Measurement of conductivity and temperature	Press the E key when both values are stable.
Display of temperature coefficient	Note result for further use.
Sensor preparation	Hold sensor in air
Calibration runs	Value is controlled for stability, next step is started automatically
Air set information	Displays OK/fail
Entry air set value channel 1	–180.0 µS/cm to 180.0 µS/cm
Entry air set value channel 2	–180.0 µS/cm to 180.0 µS/cm
For “Checksum correction” selection	
Checksum correction	In the case of checksum error E006, this function permits an elimination of the error without resetting the instrument to the factory settings.  Warning! **Warning!** Check all settings when this function has been used. Data loss is possible!
For “Reset” selection	
Warm boot	The instrument acts in the same way as when it is switched off and then back on again.

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12 Maintenance and Service

12.1 Cleaning

For cleaning of keys and housing, we recommend surface-active, non-abrasive, neutral cleaning agents.

Warning!
We do not guarantee resistance to concentrated acids or lyes, benzyl alcohol, methylene chloride and high-pressure steam.

Warning!

12.2 Fuse Replacement

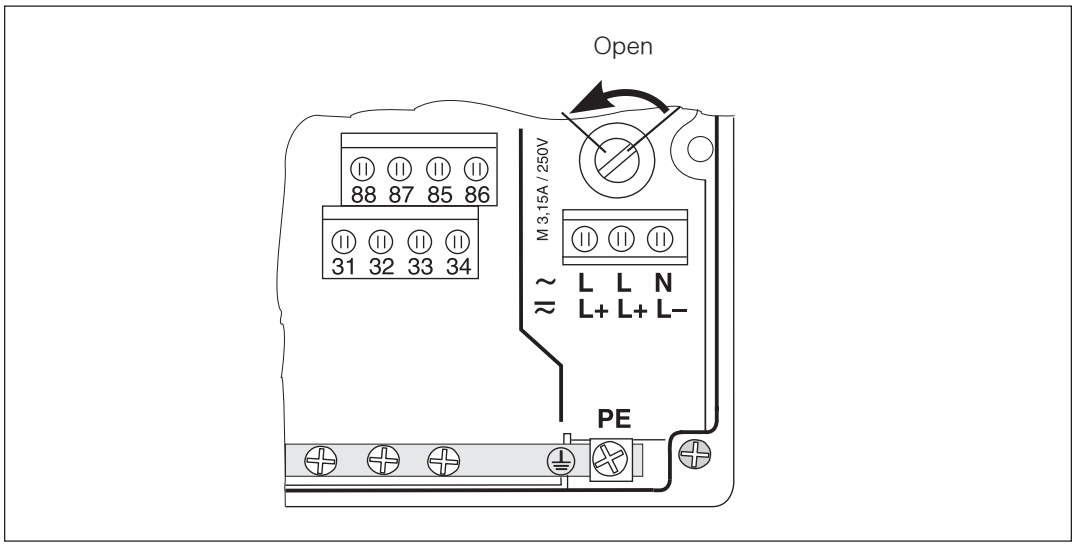

Figure 12.1
Fuse holder of non-Ex version

Non-Ex Version:

Turn fuse holder in the direction of the arrow with a screwdriver to open (see figure 12.1) and replace blown fuse with a new type M 3.15 A / 250 V fuse.

Ex-Version:

Replacement of the fuse module must be done by authorized service personnel only.

Order No.:

50076930	100V to 230 VAC
50076931	24 VAC
50087807	24 VDC

12.3 Repairs

Repair work must be carried out directly by the manufacturer or by the Endress+Hauser Service Organization. See the back cover of these operating instructions for a list of the Endress+Hauser service representatives.

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13 Appendix

13.1 Technical Data (Toroidal)

13.1.1 Technical Data with CLS 50

General Specifications	Manufacturer	Endress+Hauser
	Equipment designation	CLS 50
	Measuring range	5 µS/cm to 2000 mS/cm
	Cell constant	Approx. 2 cm^{-1}
	Storage temperature	–4 to 176°F (–20 to +80°C)
	Protection type (DIN 40050)	NEMA 4X / IP 65
	Deviation of measured value at 68 to 212°F (20 to100°C)	± (5 µS/cm +0.5%) of measured value
	Deviation of measured value > 212°F (100°C)	± (10 µS/cm +0.5%) of measured value
Continuous Operating Temperature	Instrument version xxx**1**	–4 to +266°F (–20 to +130°C)
	Instrument version **A**x**B5**	–4 to +356°F (–20 to +180°C)
Pressure Resistance	Instrument version xxAx	232 psi (16 bar) across entire temperature range
	Instrument version x**3**xx	232 psi (16 bar) across entire temperature range
	Instrument version x**1B**x or x**2B**x	290 psi (20 bar) across entire temperature range
Temperature Measurement	Temperature sensor	Pt 100, Class A acc. to DIN IEC 751
	Temperature response time T_{90}	90% of max. temp. value: 10-15 min. (according to DIN 746-1)
Measuring Cell Material	**PFA Version with G 3/4 Connection and ANSI 2" (DN 50) Flange**	
	Material in contact with medium	PFA (Sensor), PTFE (sealing washer for ANSI 2" (DN 50) flange), fluorelastomer (flat gasket)
	PEEK Version	
	Material in contact with medium	PEEK (sensor), Viton (flat gasket)
Installation	Required pipe diameter	> ANSI 3" (DN 80) (Adaptation factor adjustment required for pipe diameters < DN 110)
	Installation in reduced pipe	≥ ANSI 2" (DN 50)

Technical data subject to change without prior notice

13.1.2 Technical Data with CLS 52

General Specifications	Manufacturer	Endress+Hauser
	Equipment designation	Mycom CLS 50
Conductivity Measurement	Measuring ranges (uncompensated)	0 to 6000 mS/cm
	Display range (compensated)	0 to 1000 mS/cm
	Lower Measuring range limit (uncompensated)	10 µS/cm
	Measurement deviation (acc. to DIN IEC 746, at 77°F (25°C))	
	Transmitter	± 0.5% of measured value ± 3 digits
	Reproducibility	± 0.2% of measured value ± 3 digits
	Response time (T_{90})	< 3 seconds across entire meas. range (one-circuit unit) < 6 seconds across entire meas. range (two-circuit unit)
	Cable length	max. 197 ft. (60 m) (with junction box and extension cable)
	Current output characteristic	Linear, bilinear
Concentration Measurement	NaOH	0 to 15%
	HNO_3	0 to 20%
	H_2SO^4	0 to 20%
	H_3PO_4	0 to 12%
	User-programmable (1 - 4)	0 to 99.99%
Temperature Compensation	Range for linear and user-programmable Tc values	–31 to 482°F (–35 to +250°C)
	Range for NaOH	32 to 185°F (0 to 85.0°C)
	HNO_3	32 to 167°F (0 to 75.0°C)
	H_3PO^4	32 to 167°F (0 to 75.0°C)
	H_2SO_4	32 to 176°F (0 to 80.0°C)
Temperature Measurement	Temperature sensor	Pt 100 Class A acc. to DIN IEC 751
	Temperature response time	t_{90} to < 15 s
	Measuring ranges (also in °F and K)	–31 to 482°F (–35 to +250°C)
	Display resolution	0.1°C
	Measurement deviation (acc. to DIN IEC 746)	± 0.5% of measuring range
	Reproducibility	± 0.1% of measuring range
	Current output range	Δ 28.5°C to Δ 285°C, adjustable
Specifications for sensor CLS 52	Cell constant k (measurement deviation ±0.5%)	5.9 cm^{-1}
	Ambient temperature	14 to 158°F (–10 to +70°C)
	Storage temperature	–13 to 176°F (–25 to +80°C)
	Humidity	5 to 95% rel.
	Protection type (DIN 40050)	NEMA 6 / IP 67
	Deviation of measured value at 23 to 212°F (–5 to 100°C)	± 10 µS/cm
	Deviation of measured value at 23 to 284°F (–5 to 140°C)	± 30 µS/cm
	Medium Temperature	
	For sterilization	+284°F/+140°C (max. 30 min.)
	Pressure	Max. 232 psi (16 bar) (20°C)
	Measuring cell material	PEEK
	Peak-to-valley height	ra ≤ 0.5 µm
	Thermal conductivity socket with Pt 100	
	Material	V4A (1.4571)
	Seal	O-ring, EPDM (FDA-approved)
	Required pipe diameter (also see chapter 9.1.4 Adaptation factor)	
	Dairy fitting, clamp fitting G 1½"	≥ DN 65
	APV, Varivent connection	≥ ANSI 1½" (DN 40)

Technical data subject to change without prior notice

13.1.3 Technical Data with Contacting Electrodes (Subject to change without notice)

Conductivity/Resistance/ Concentration Measurement

Measuring and display ranges for conductivity

Cell constant k	Measuring range (MR) [1]	Display range (DR)
0.01 cm^{-1}	0.000 µS/cm to 600.0 µS/cm	0.000 µS/cm to 200.0 mS/cm
0.1 cm^{-1}	0.00 µS/cm to 6.000 mS/cm	0.00 µS/cm to 2.000 mS/cm
1.0 cm^{-1}	0.0 µS/cm to 60.0 mS/cm	0.0 µS/cm to 20.0 mS/cm
10 cm^{-1}	0 µS/cm to 600.0 mS/cm	0 µS/cm to 200.0 mS/cm

Measuring and display ranges for Resistance

Cell constant k	Measuring range (MR)	Display range (DR)
0.01 cm^{-1}	20.0 kΩcm to 20.0 MΩcm	20.0 kΩcm to 37.99 MΩcm
0.1 cm^{-1}	2.00 kΩcm to 2 MΩcm	2.00 kΩcm to 3799 MΩcm
1.0 cm^{-1}	0.2 to 200 kΩcm	0.200 to 379.90 kΩcm

Measuring and display ranges for Concentration

Selection	Measuring range (MR)	Display range (DR)
NaOH	0.0 mS/cm to 410 mS/cm	0 to 15%
HNO_3	0.0 mS/cm to 781 mS/cm	0 to 20%
H_2SO_4	0.0 mS/cm to 723 mS/cm	0 to 20%
H_3PO_4	0.0 mS/cm to 73 mS/cm	0 to 12%
USER 1 - 4 [2]	0.0 µS/cm to 2000 mS/cm	0 to 99.99%

[1] The instrument has four internal switching steps in each measuring range. Maximum accuracy and resolution are automatically achieved as a result.

[2] USER 1 to 4 can be programmed as required

[3] According to DIN IEC 746 part 1, for nominal operating conditions

Continued on the next page...

13.1.3 Technical Data with Contacting Electrodes (continued)

(Subject to change without prior notice)

	Measurement deviation [3], display	± 0.5% ± 2 digits of measured value
	Reproducibility [3]	± 0.1% ± 2 digits of measured value
	Reference temperature	Adjustable, –35 to +250°C, typ. +25°C
	Measuring frequency	128 to 1024 Hz
	Measuring voltage	≤ 150 mV
	Conductivity signal output	
	Current range	0/4 to 20 mA
	Measurement deviation [3]	Max. 0.2% of upper current range value
	Load	Max. 600Ω (Ex: max. 500Ω)
	Output characteristic	Linear, bilinear, logarithmic, table
	Maximum cable length for MΩ	Max. 2 nF (corresponds to approx. 66 ft/20 m)
	Maximum cable length for cond./concentration	Max. 10 nF (corresponds to approx. 328 ft/100 m)
Temperature Measurement	Temperature sensor	Pt 100 (3-wire connection)
	Measuring range (MR, can also be displayed in °F or K)	–35 to +250°C
	Measured value resolution	0.1 °C
	Measurement deviation, temp. output (according to DIN IEC 746)	Max. 0.5% of MR
	Reproducibility	Max. 0.1% of MR
	Temperature signal output	
	Current range	0/4 to 20 mA
	Measurement deviation [3]	Max. 0.2% of upper current range value
	Load	Max. 600Ω (Ex: max. 500Ω)
	Temperature signal output range	Adjustable, Δ 28.5 to Δ 285°C
Limit and Alarm Functions	Function	Limit contacter
	Function type	MIN or MAX
	Setpoint settings (in absolute values)	0 to 100% of DR
	Hysteresis for switched contacts (in absolute values)	1 to 10% of DR
	Pickup/dropout delay	0 to 7200 s
	Alarm threshold	0.5 to 100% of DR
	Alarm delay	0 to 6000 s
Electrical Data and Connections	Power supply, AC	24/100/115/200/230 V +10 / –15%
	Frequency	47 to 64 Hz
	Power supply, DC	24 V, +20 / –15%
	Power consumption	Max. 10 VA
	Contact outputs (optional)	Potential-free contacts (Ex version: optocouplers), configurable as NO or NC contacts
	Switching current	Max. 3 A (Ex: ≤ 100 mA)
	Switching voltage	Max. 250 VAC / 125 VDC (Ex: ≤ 30V)
	Switching power	Max. 750 VA (Ex: ≤ 750 mW)
	Signal outputs	2 x 0/4 to 20 mA, isolated from other circuits but not from each other
	Isolation voltage	276 V_{rms}
	Terminals, maximum cable cross section	2.5 mm^2

1) The instrument has four internal switching steps in each measuring range. Maximum accuracy and resolution are automatically achieved as a result.

2) USER 1 - 4 can be programmed as required.

3) According to DIN IEC 746 part 1, for nominal operating conditions

Continued on the next page...

13.1.3 Technical Data with Contacting Electrodes (continued)

(Subject to change without prior notice)

General Technical Data	Measured value display	Illuminated LC display with 128 x 64 dot matrix
	Electromagnetic compatibility (EMC)	
	Emitted interference	acc. to EN 50081-1, 01.92
	Interference resistance	acc. to EN 50082-2, 03.93
	Nominal operating conditions	
	Ambient temperature	14 to 131°F (–10 to +55°C)
	Relative humidity	10 to 95% non-condensing
	Limit operating conditions	
	Ambient temperature	–4 to 140°F (–20 to +60°C)
	Storage and transport temperature	–22 to +176°F (–30 to +80°C)
	Ex approval	
	F Version:	Class I, Div. 2; Group A, B, C, D
		Class II, III, Div. 1; Group E, F, G
		Class I, Zone 2; Group IIC.T4, NI outputs
	G Version:	Class I, Div. 2; Group A, B, C, D
		Class II, III, Div. 1; Group E, F, G
		Class I, Zone 1; Group IIC.T4, IS outputs
Physical Data	Dimensions (HxWxD)	9.72 x 6.57 x 4.37" (247x167x111 mm)
	Weight	Max. 13.23 lbs (6 kg)
	Protection type	NEMA 4X, IP 65
	Materials	
	Housing	Diecast AlSi 12 (Mg content < 0.05%), plastic-coated
	Front	Polyester, UV-resistant

13.1.4 General Technical Data

(Subject to change without prior notice)

Limit and Alarm Functions	Function	Limit Contacter
	Function type	MIN or MAX
	Setpoint settings (in absolute values)	0 to 100% of DR
	Hysteresis for switched contacts (in absolute values)	1 to 10% of DR
	Pickup / dropout delay	0 to 7200 s
	Alarm threshold	0.5 to 100% of DR
	Alarm delay	0 to 6000 s
Electrical Data and Connections	Power supply, AC	24/100/115/200/230 V +10 / –15%
	Frequency	47 to 64 Hz
	Power supply, DC	24 V, +20 / –15%
	Power consumption	Max. 10 VA
	Contact outputs (optional)	Potential-free changeover contacts (Ex version: optocouplers), configurable as NO or NC contacts
	Switching current	Max. 3 A
	Switching voltage	Max. 250 VAC / 125 VDC
	Switching power	Max. 750 VA
	Signal outputs	2 x 0/4 to 20 mA, isolated from other circuits but not from each other
	Isolation voltage	276 V_{rms}
	Current output	
	Current range	0/4 to 20 mA
	Measurement deviation	0.2% of upper current value
	Load	Max. 600Ω
	Terminals, maximum cable cross section	2.5 mm^2
General Technical Data	Measured value display	Illuminated LC display with 128 x 64 dot matrix
	Electromagnetic compatibility (EMC)	
	Emitted interference	acc. to EN 50081-1, 01.92
	Interference resistance	acc. to EN 50082-2, 03.93
	Nominal operating conditions	
	Ambient temperature	14 to 131°F (–10 to +55°C)
	Relative humidity	10 to 95% non-condensing
	Limit operating conditions	
	Ambient temperature	–4 to 140°F (–20 to +60°C)
	Storage and transport temperature	–13 to +185°F (–25 to +85°C)
Physical Data	Dimensions (HxWxD)	9.72 x 6.57 x 4.37" (247x167x111 mm)
	Weight	Max. 13.23 lbs (6 kg)
	Protection type	NEMA 4X, IP 65
	Materials	
	Housing	Diecast AlSi 12 (Mg content < 0.05%), plastic-coated
	Front	Polyester, UV-resistant

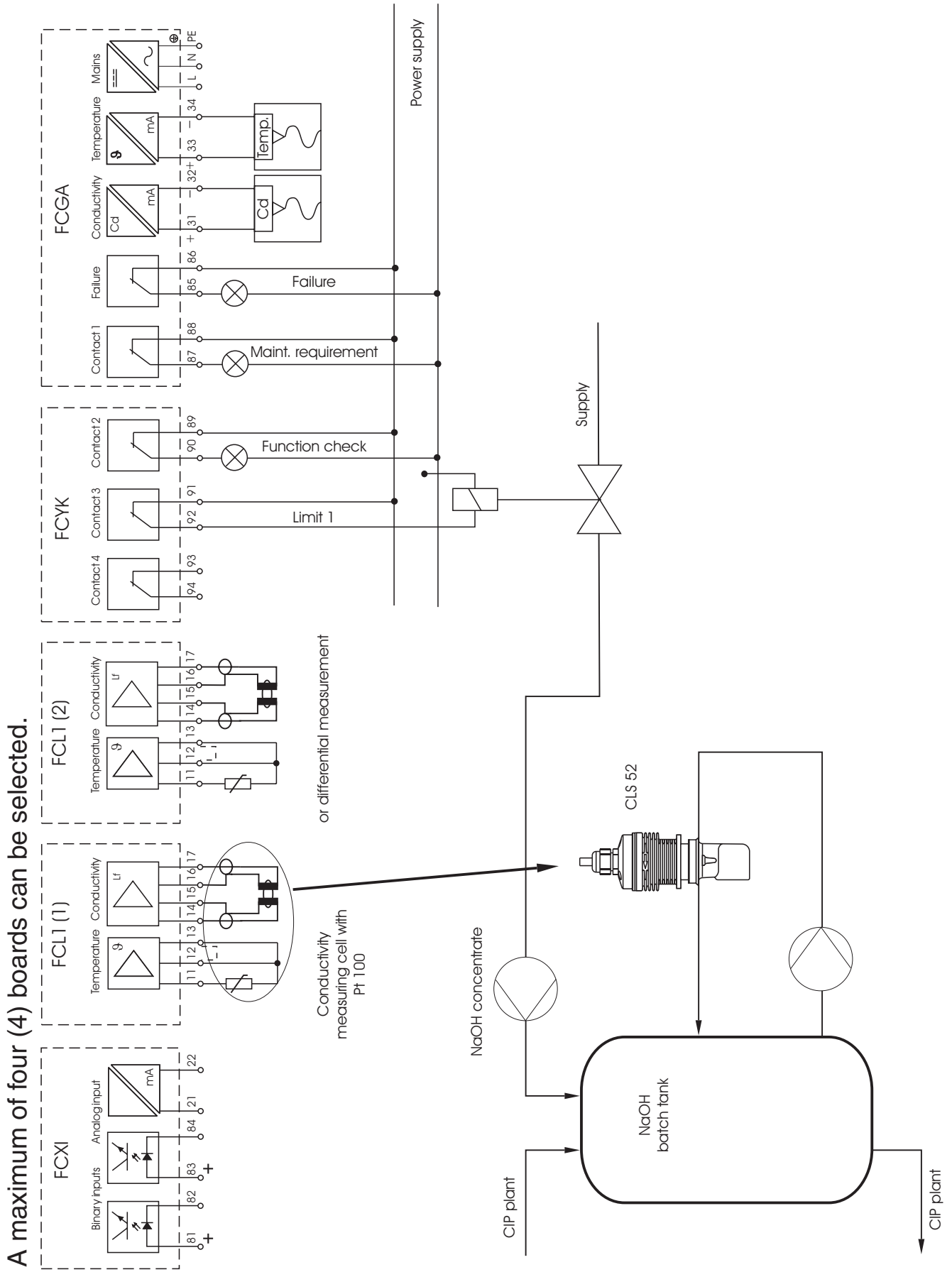
13.2 Profibus PA

(Subject to change without prior notice)

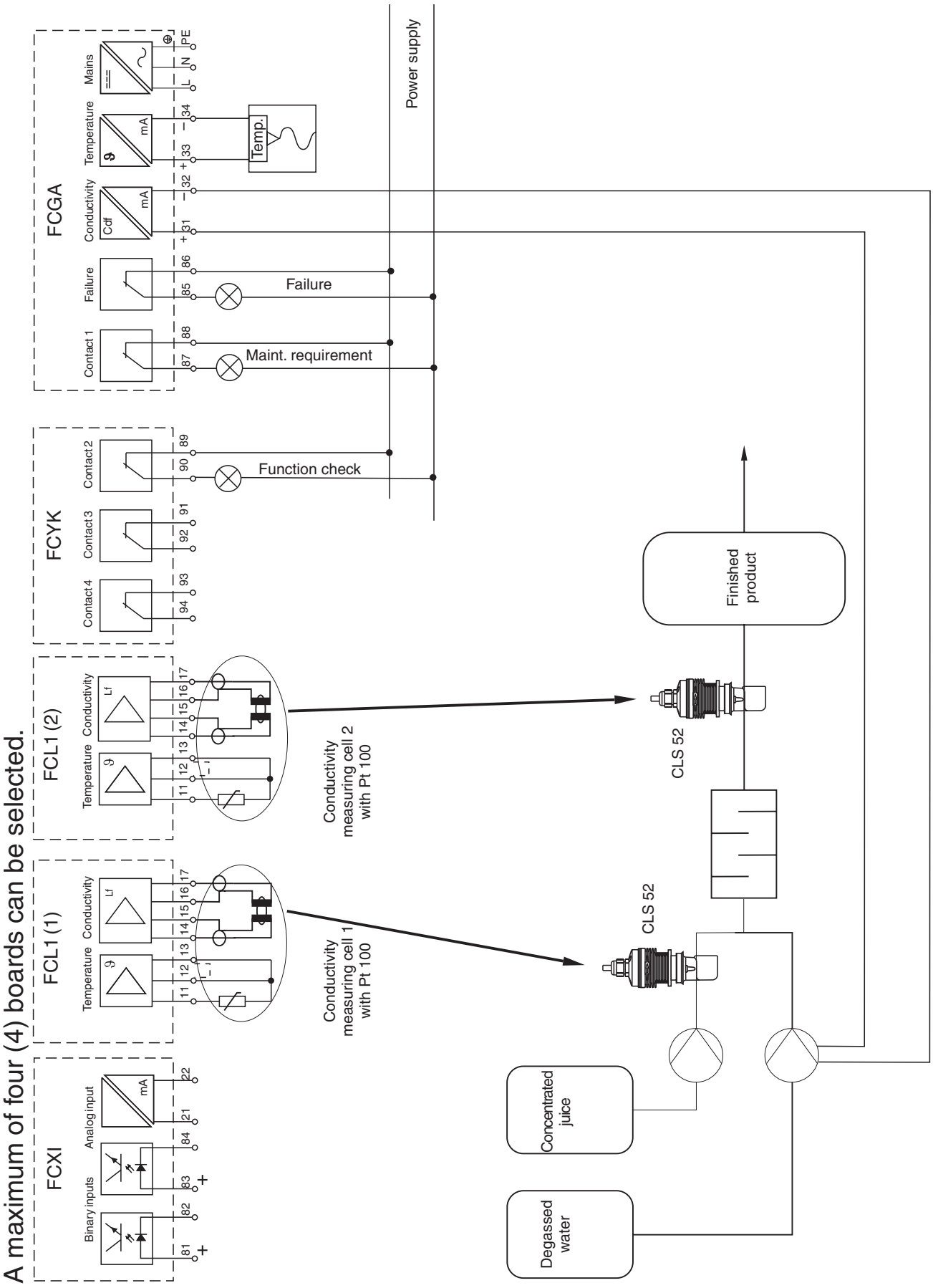
Output Specifications	Output signal	Digital communication signal, PROFIBUS PA
	PA function	Slave
	Response: Slave	Approx. 20 ms
	PLC	Approx. 600 ms for approx. 30 devices
	Failure signal	PROFIBUS PA: signal status bit is set, last valid measured value is held
	Integration time	0 to 99 s, default 0 s
	Communication resistance	None, separate PROFIBUS PA terminating resistor
	Physical layer	IEC 1158-2
	Integrated overvoltage protection	25 VAC / 250 A
Display and User Interface	Remote control	Via PROFIBUS PA with operating program Commuwin II
	Communication interface	PROFIBUS PA
Power Supply	Supply voltage	9 to 32 VDC
	Current consumption	10 mA ± 1 mA
	Inrush current	Corresponds to table 4, IEC 1158-2

13.3 Connection Examples (Toroidal)

13.3.1 Lye-Acid Recycling with Concentration Measurement

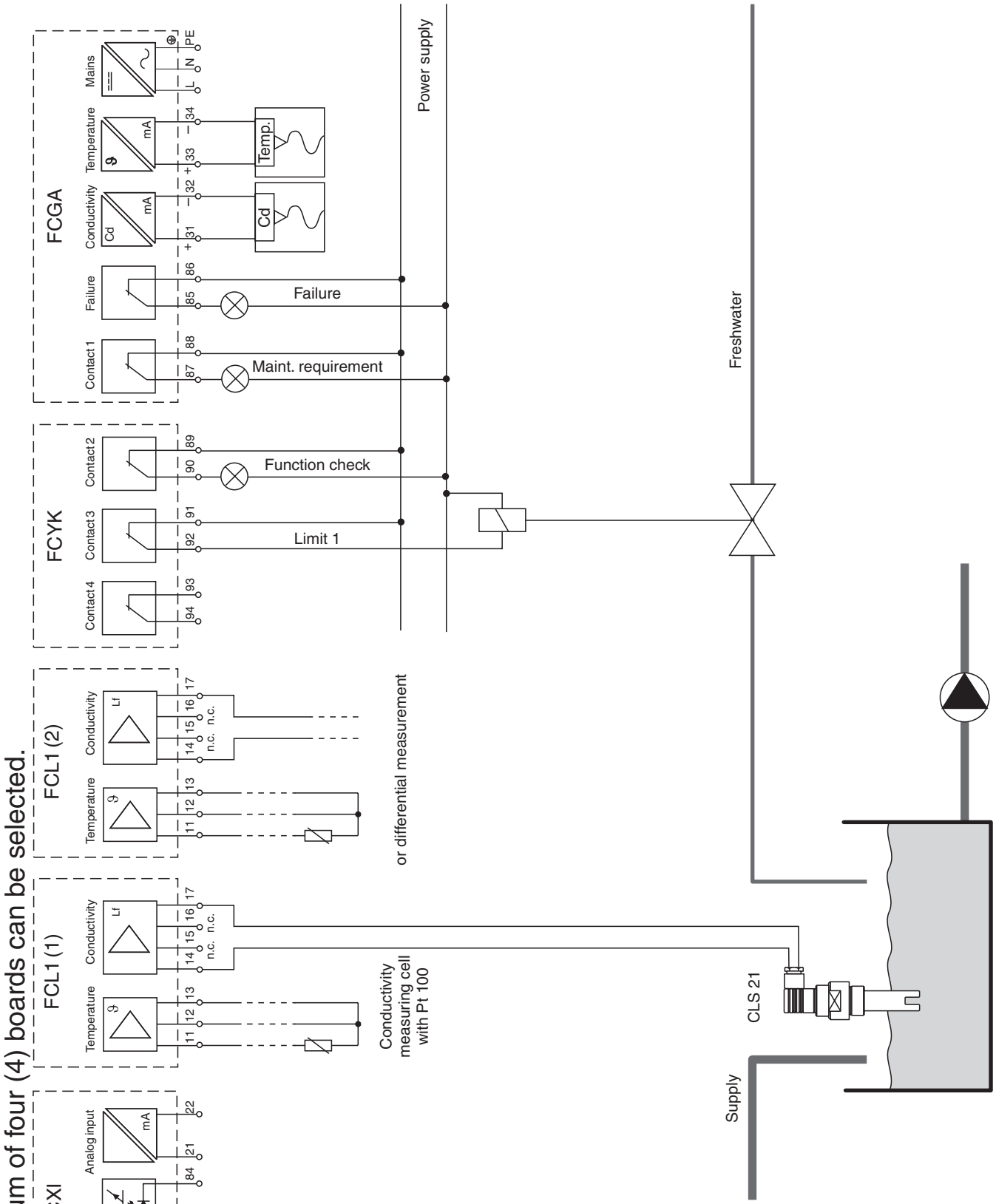


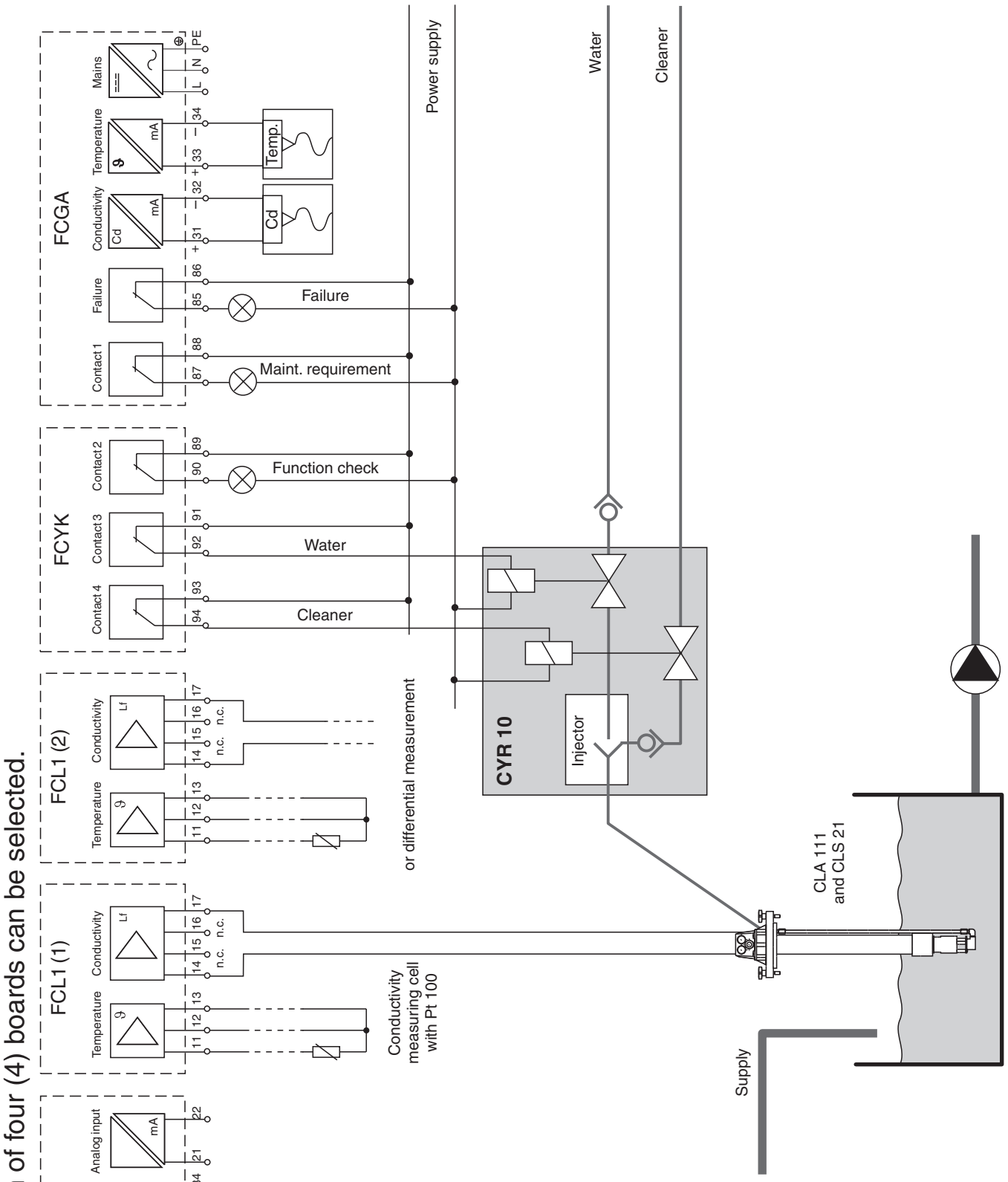
13.3.2 Difference Measurement for Juice Production



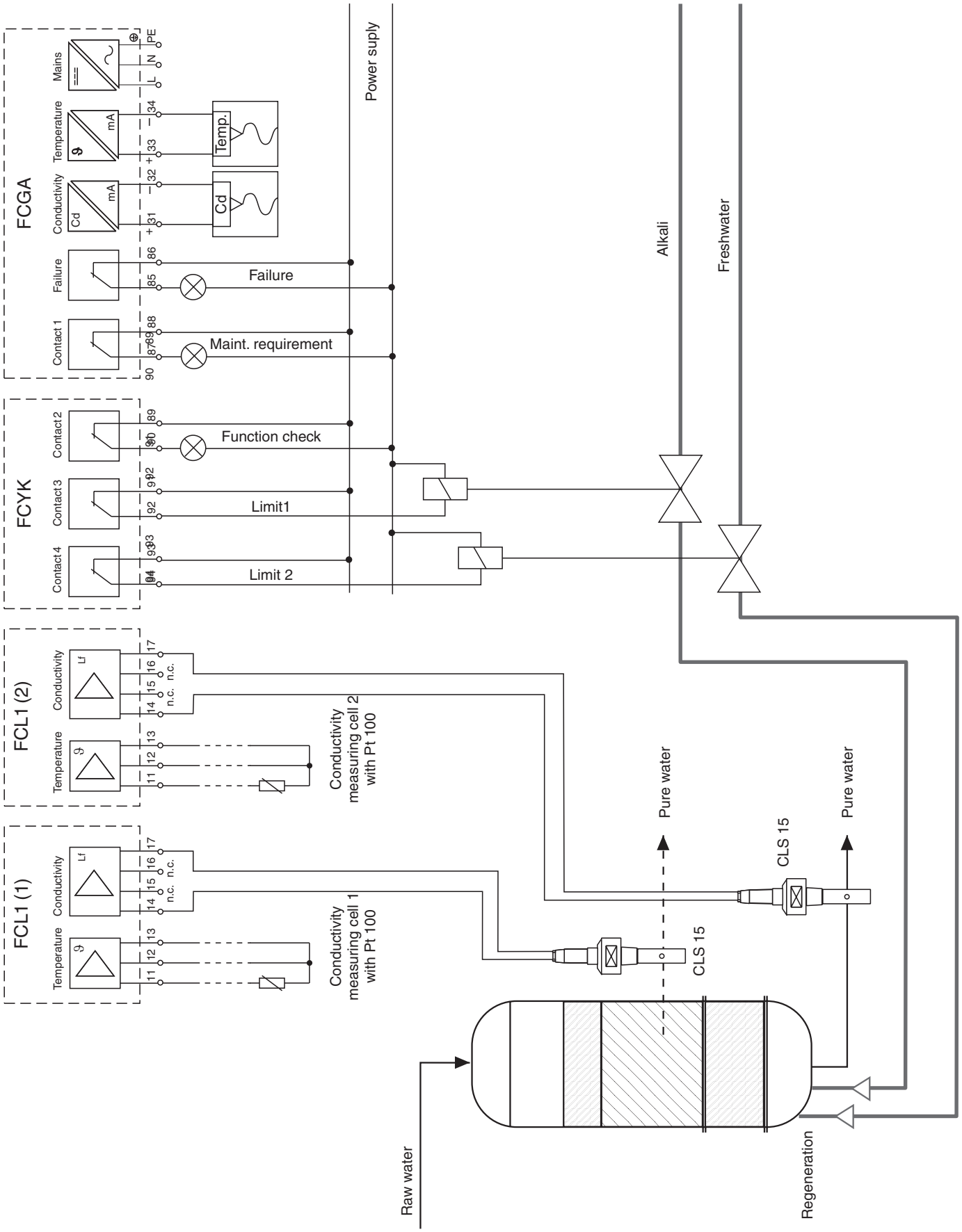
13.4 Connection Examples (Contacting)

13.4.1 Limit Contacter, NAMUR Contacts




A maximum of four (4) boards can be selected.
FCXI
Contact inputs
Analog input
mA
81
82
83
84
21
22
FCL1 (1)
Temperature
Conductivity
Lf
11
12
13
14
15
16
17
n.c.
FCL1 (2)
FCYK
Contact 2
Contact 3
Contact 4
89
90
91
92
93
94
Function check
Water
Cleaner
FCGA
Contact 1
Failure
Conductivity
Cd
Temperature
Mains
85
86
87
88
31
32
33
34
L
N
PE
Failure
Maint. requirement
Cd
Temp.
Power supply
or differential measurement
Conductivity measuring cell with Pt 100
CYR 10
Injector
Water
Cleaner
CLA 111 and CLS 21
Supply

13.4.3 Difference Measurement, Limit Contacter, NAMUR Contacts



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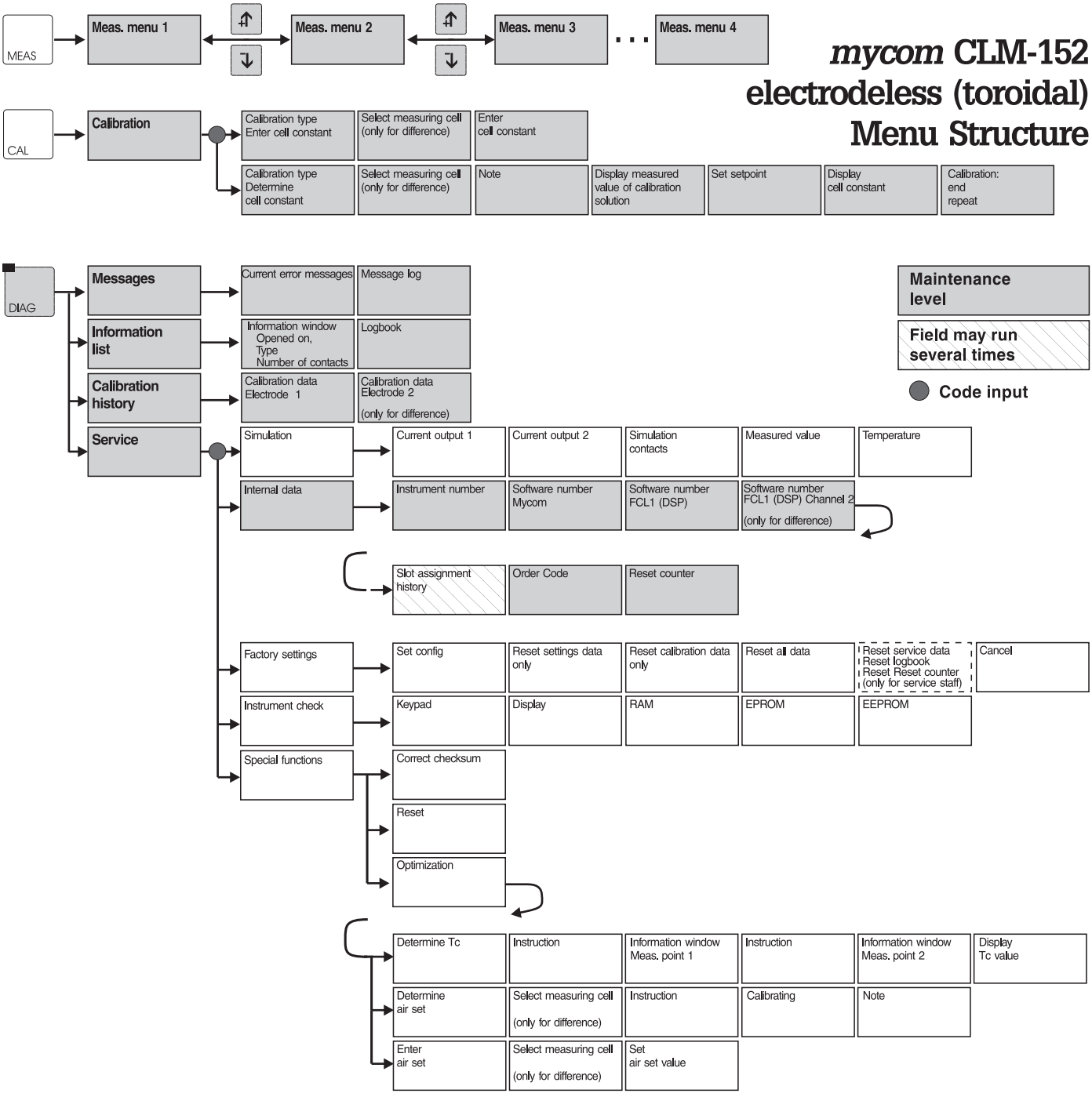
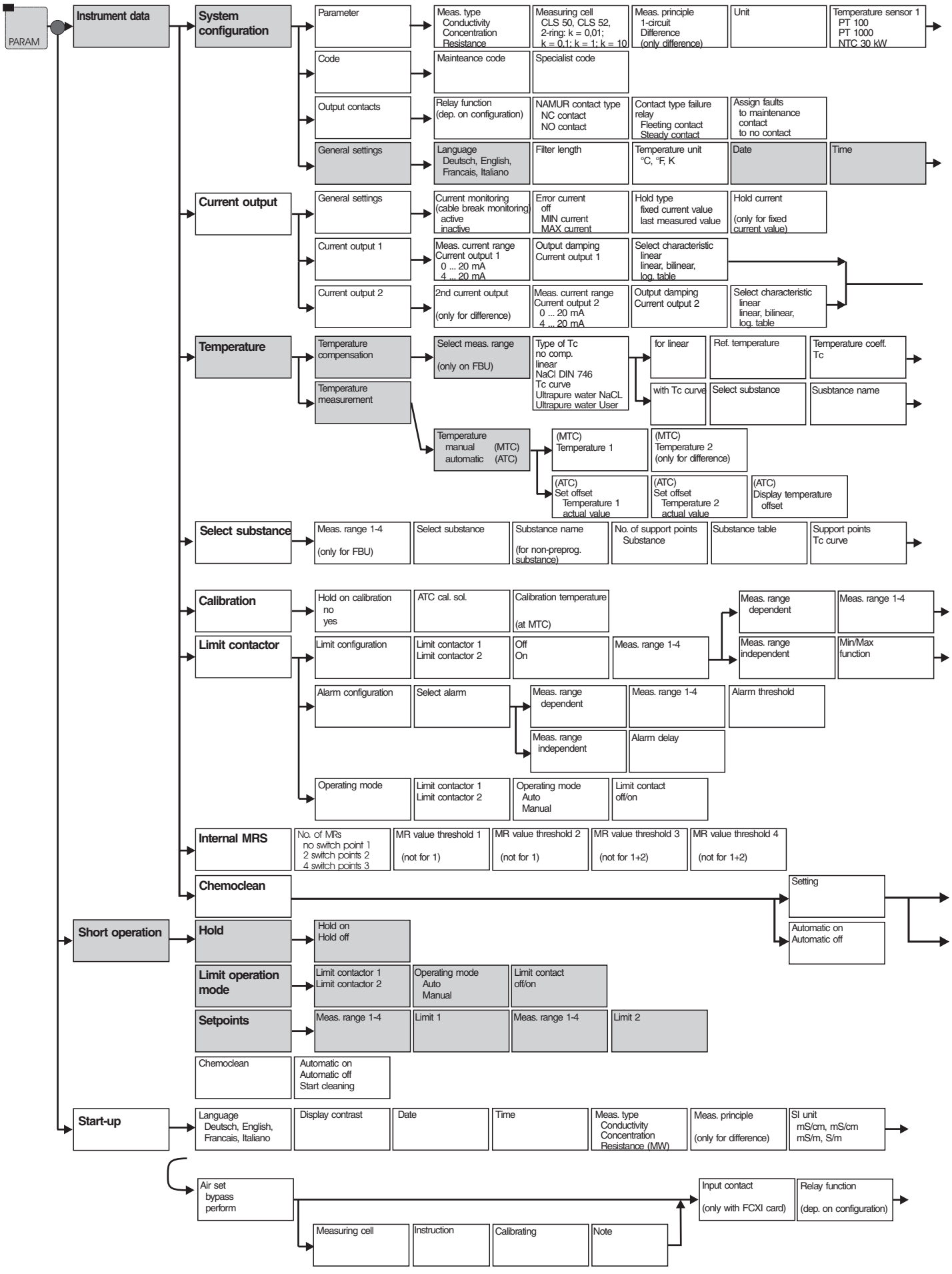
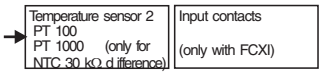
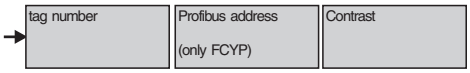
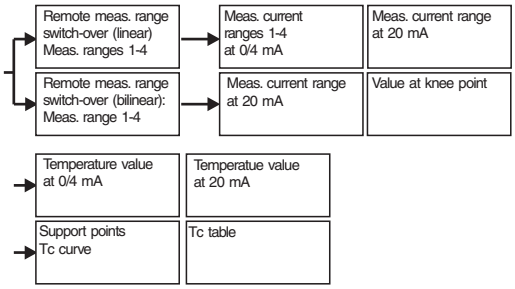
mycom CLM-152 electrodeless (toroidal) Menu Structure

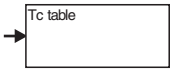


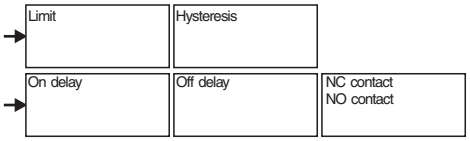

PARAM
Instrument data
System configuration
Parameter
Meas. type
Conductivity
Concentration
Resistance
Measuring cell
CLS 50, CLS 52,
2-ring: k = 0,01;
k = 0,1; k = 1; k = 10
Meas. principle
1-circuit
Difference
(only difference)
Unit
Temperature sensor 1
PT 100
PT 1000
NTC 30 kW
Code
Mainteance code
Specialist code
Output contacts
Relay function
(dep. on configuration)
NAMUR contact type
NC contact
NO contact
Contact type failure relay
Fleeting contact
Steady contact
Assign faults
to maintenance contact
to no contact
General settings
Language
Deutsch, English,
Francais, Italiano
Filter length
Temperature unit
°C, °F, K
Date
Time
Current output
General settings
Current monitoring
(cable break monitoring)
active
inactive
Error current
off
MIN current
MAX current
Hold type
fixed current value
last measured value
Hold current
(only for fixed current value)
Current output 1
Meas. current range
Current output 1
0 ... 20 mA
4 ... 20 mA
Output damping
Current output 1
Select characteristic
linear
linear, bilinear,
log. table
Current output 2
2nd current output
(only for difference)
Meas. current range
Current output 2
0 ... 20 mA
4 ... 20 mA
Output damping
Current output 2
Select characteristic
linear
linear, bilinear,
log. table
Temperature
Temperature compensation
Select meas. range
(only on FBU)
Type of Tc
no comp.
linear
NaCl DIN 746
Tc curve
Ultrapure water NaCL
Ultrapure water User
for linear
Ref. temperature
Temperature coeff. Tc
with Tc curve
Select substance
Susbtance name
Temperature measurement
Temperature
manual (MTC)
automatic (ATC)
(MTC)
Temperature 1
(MTC)
Temperature 2
(only for difference)
(ATC)
Set offset
Temperature 1
actual value
(ATC)
Set offset
Temperature 2
actual value
(ATC)
Display temperature offset
Select substance
Meas. range 1-4
(only for FBU)
Select substance
Substance name
(for non-preprog. substance)
No. of support points
Substance
Substance table
Support points
Tc curve
Calibration
Hold on calibration
no
yes
ATC cal. sol.
Calibration temperature
(at MTC)
Limit contactor
Limit configuration
Limit contactor 1
Limit contactor 2
Off
On
Meas. range 1-4
Meas. range dependent
Meas. range 1-4
Meas. range independent
Min/Max function
Alarm configuration
Select alarm
Meas. range dependent
Meas. range 1-4
Alarm threshold
Meas. range independent
Alarm delay
Operating mode
Limit contactor 1
Limit contactor 2
Operating mode
Auto
Manual
Limit contact
off/on
Internal MRS
No. of MRs
no switch point 1
2 switch points 2
4 switch points 3
MR value threshold 1
(not for 1)
MR value threshold 2
(not for 1)
MR value threshold 3
(not for 1+2)
MR value threshold 4
(not for 1+2)
Chemoclean
Setting
Automatic on
Automatic off
Short operation
Hold
Hold on
Hold off
Limit operation mode
Limit contactor 1
Limit contactor 2
Operating mode
Auto
Manual
Limit contact
off/on
Setpoints
Meas. range 1-4
Limit 1
Meas. range 1-4
Limit 2
Chemoclean
Automatic on
Automatic off
Start cleaning
Start-up
Language
Deutsch, English,
Francais, Italiano
Display contrast
Date
Time
Meas. type
Conductivity
Concentration
Resistance (MW)
Meas. principle
(only for difference)
SI unit
mS/cm, mS/cm
mS/m, S/m
Air set
bypass
perform
Input contact
(only with FCXI card)
Relay function
(dep. on configuration)
Measuring cell
Instruction
Calibrating
Note

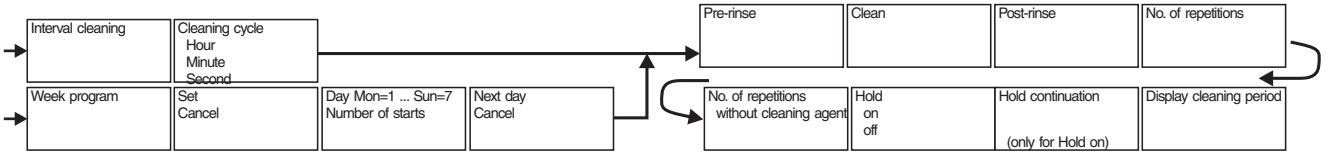

Temperature sensor 2
PT 100
PT 1000 (only for NTC 30 kΩ difference)
Input contacts
(only with FCXI)

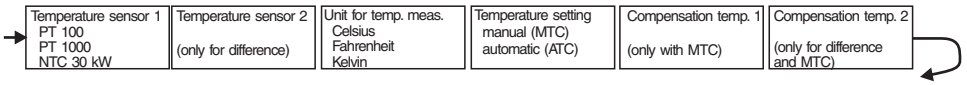

tag number
Profibus address
(only FCYP)
Contrast

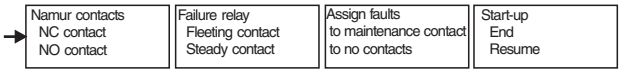

Remote meas. range switch-over (linear)
Meas. ranges 1-4
Meas. current ranges 1-4 at 0/4 mA
Meas. current range at 20 mA
Remote meas. range switch-over (bilinear):
Meas. range 1-4
Meas. current range at 20 mA
Value at knee point
Temperature value at 0/4 mA
Temperatue value at 20 mA
Support points Tc curve
Tc table


Tc table


Limit
Hysteresis
On delay
Off delay
NC contact
NO contact


Interval cleaning
Cleaning cycle
Hour
Minute
Second
Pre-rinse
Clean
Post-rinse
No. of repetitions
Week program
Set
Cancel
Day Mon=1 ... Sun=7
Number of starts
Next day
Cancel
No. of repetitions without cleaning agent
Hold
on
off
Hold continuation
(only for Hold on)
Display cleaning period


Temperature sensor 1
PT 100
PT 1000
NTC 30 kW
Temperature sensor 2
(only for difference)
Unit for temp. meas.
Celsius
Fahrenheit
Kelvin
Temperature setting
manual (MTC)
automatic (ATC)
Compensation temp. 1
(only with MTC)
Compensation temp. 2
(only for difference and MTC)


Namur contacts
NC contact
NO contact
Failure relay
Fleeting contact
Steady contact
Assign faults
to maintenance contact
to no contacts
Start-up
End
Resume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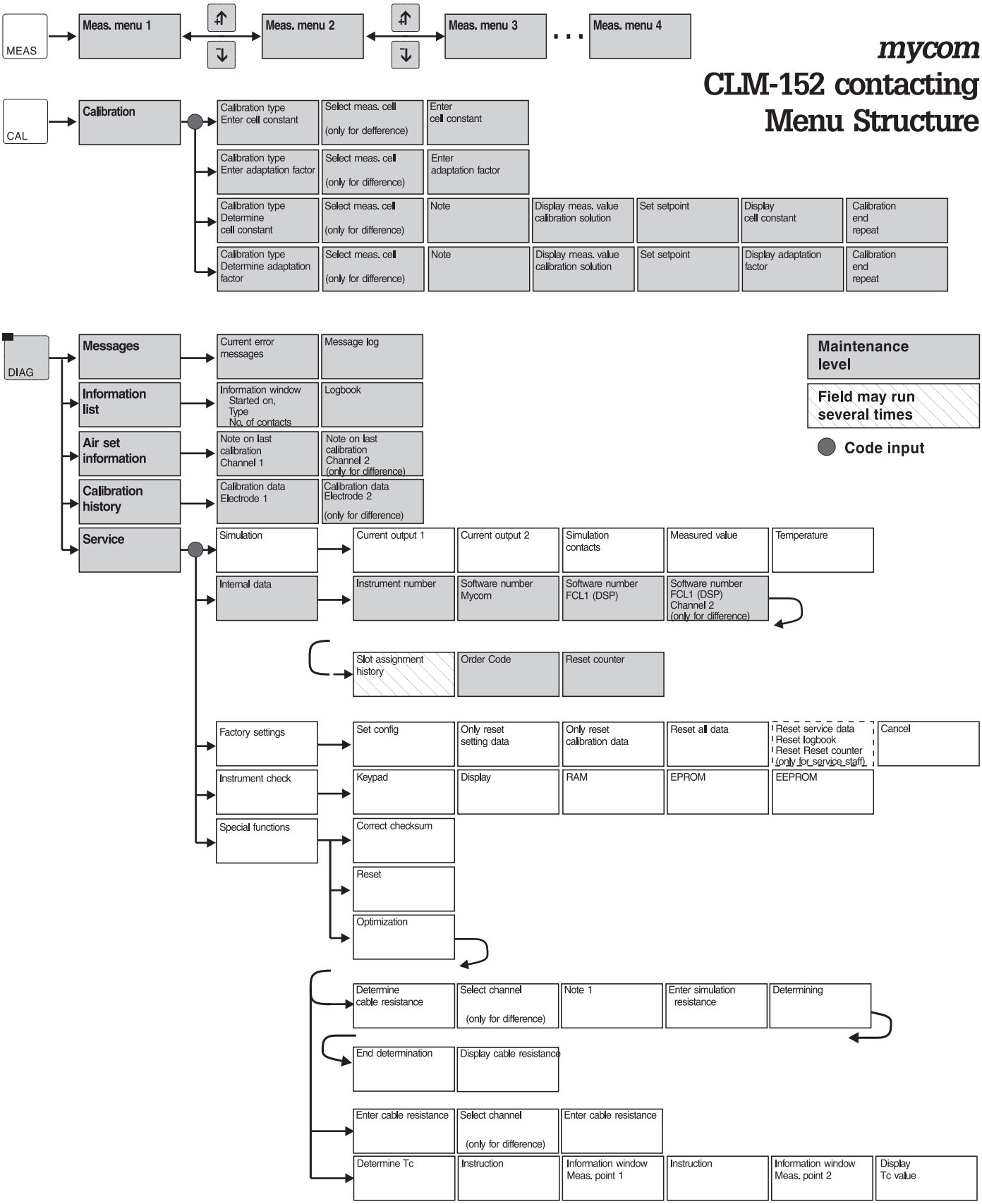
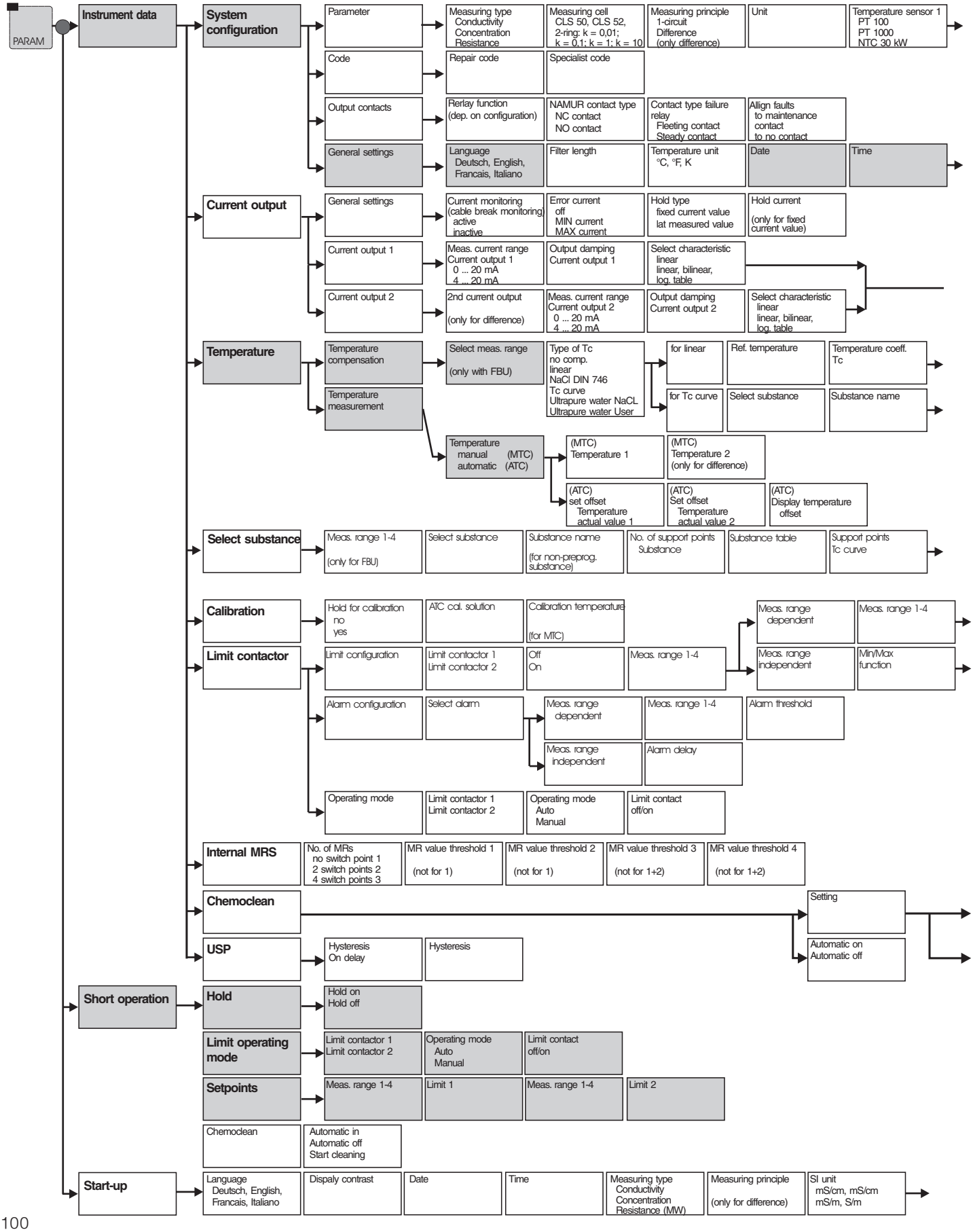
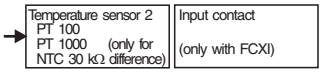
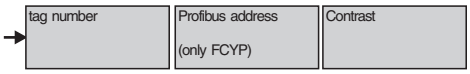
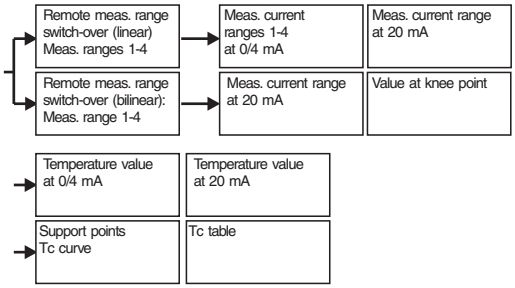
mycom CLM-152 contacting Menu Structure

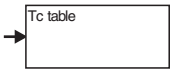


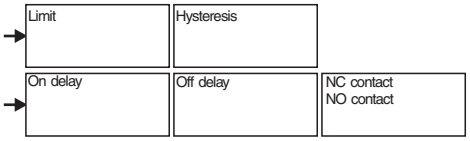

PARAM
Instrument data
System configuration
Parameter
Measuring type
Conductivity
Concentration
Resistance
Measuring cell
CLS 50, CLS 52,
2-ring: k = 0,01;
k = 0,1; k = 1; k = 10
Measuring principle
1-circuit
Difference
(only difference)
Unit
Temperature sensor 1
PT 100
PT 1000
NTC 30 kW
Code
Repair code
Specialist code
Output contacts
Rerlay function
(dep. on configuration)
NAMUR contact type
NC contact
NO contact
Contact type failure relay
Fleeting contact
Steady contact
Allign faults
to maintenance contact
to no contact
General settings
Language
Deutsch, English,
Francais, Italiano
Filter length
Temperature unit
°C, °F, K
Date
Time
Current output
General settings
Current monitoring
(cable break monitoring)
active
inactive
Error current
off
MIN current
MAX current
Hold type
fixed current value
lat measured value
Hold current
(only for fixed current value)
Current output 1
Meas. current range
Current output 1
0 ... 20 mA
4 ... 20 mA
Output damping
Current output 1
Select characteristic
linear
linear, bilinear,
log. table
Current output 2
2nd current output
(only for difference)
Meas. current range
Current output 2
0 ... 20 mA
4 ... 20 mA
Output damping
Current output 2
Select characteristic
linear
linear, bilinear,
log. table
Temperature
Temperature compensation
Select meas. range
(only with FBU)
Type of Tc
no comp.
linear
NaCl DIN 746
Tc curve
Ultrapure water NaCL
Ultrapure water User
for linear
Ref. temperature
Temperature coeff.
Tc
for Tc curve
Select substance
Substance name
Temperature measurement
Temperature
manual (MTC)
automatic (ATC)
(MTC)
Temperature 1
(MTC)
Temperature 2
(only for difference)
(ATC)
set offset
Temperature
actual value 1
(ATC)
Set offset
Temperature
actual value 2
(ATC)
Display temperature offset
Select substance
Meas. range 1-4
(only for FBU)
Select substance
Substance name
(for non-preprog. substance)
No. of support points
Substance
Substance table
Support points
Tc curve
Calibration
Hold for calibration
no
yes
ATC cal. solution
Calibration temperature
(for MTC)
Limit contactor
Limit configuration
Limit contactor 1
Limit contactor 2
Off
On
Meas. range 1-4
Meas. range dependent
Meas. range 1-4
Meas. range independent
Min/Max function
Alarm configuration
Select alarm
Meas. range dependent
Meas. range 1-4
Alarm threshold
Meas. range independent
Alarm delay
Operating mode
Limit contactor 1
Limit contactor 2
Operating mode
Auto
Manual
Limit contact
off/on
Internal MRS
No. of MRs
no switch point 1
2 switch points 2
4 switch points 3
MR value threshold 1
(not for 1)
MR value threshold 2
(not for 1)
MR value threshold 3
(not for 1+2)
MR value threshold 4
(not for 1+2)
Chemoclean
Setting
USP
Hysteresis
On delay
Hysteresis
Automatic on
Automatic off
Short operation
Hold
Hold on
Hold off
Limit operating mode
Limit contactor 1
Limit contactor 2
Operating mode
Auto
Manual
Limit contact
off/on
Setpoints
Meas. range 1-4
Limit 1
Meas. range 1-4
Limit 2
Chemoclean
Automatic in
Automatic off
Start cleaning
Start-up
Language
Deutsch, English,
Francais, Italiano
Dispaly contrast
Date
Time
Measuring type
Conductivity
Concentration
Resistance (MW)
Measuring principle
(only for difference)
SI unit
mS/cm, mS/cm
mS/m, S/m

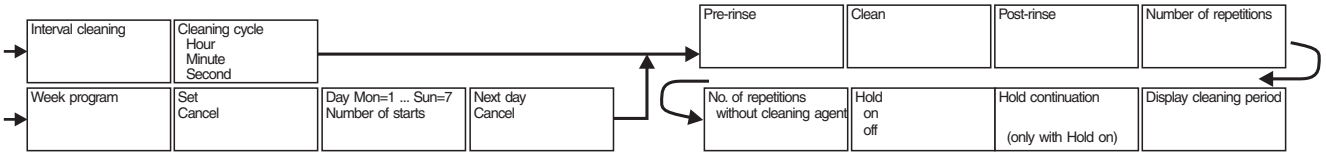

Temperature sensor 2
PT 100
PT 1000 (only for
NTC 30 kΩ difference)
Input contact
(only with FCXI)

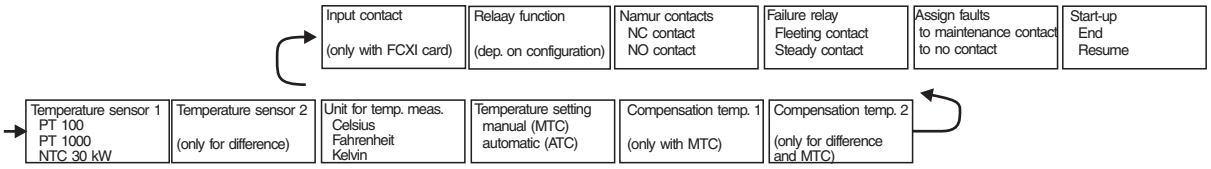

tag number
Profibus address
(only FCYP)
Contrast


Remote meas. range
switch-over (linear)
Meas. ranges 1-4
Meas. current
ranges 1-4
at 0/4 mA
Meas. current range
at 20 mA
Remote meas. range
switch-over (bilinear):
Meas. range 1-4
Meas. current range
at 20 mA
Value at knee point
Temperature value
at 0/4 mA
Temperature value
at 20 mA
Support points
Tc curve
Tc table


Tc table


Limit
Hysteresis
On delay
Off delay
NC contact
NO contact


Interval cleaning
Cleaning cycle
Hour
Minute
Second
Pre-rinse
Clean
Post-rinse
Number of repetitions
Week program
Set
Cancel
Day Mon=1 ... Sun=7
Number of starts
Next day
Cancel
No. of repetitions
without cleaning agent
Hold
on
off
Hold continuation
(only with Hold on)
Display cleaning period


Input contact
(only with FCXI card)
Relaay function
(dep. on configuration)
Namur contacts
NC contact
NO contact
Failure relay
Fleeting contact
Steady contact
Assign faults
to maintenance contact
to no contact
Start-up
End
Resume
Temperature sensor 1
PT 100
PT 1000
NTC 30 kW
Temperature sensor 2
(only for difference)
Unit for temp. meas.
Celsius
Fahrenheit
Kelvin
Temperature setting
manual (MTC)
automatic (ATC)
Compensation temp. 1
(only with MTC)
Compensation temp. 2
(only for difference
and MTC)

United States

Endress+Hauser
2350 Endress Place
Greenwood, IN 46143
Phone: (317) 535-7138
1-800-428-4344
FAX: (317) 535-8498

Regional Office
Endress+Hauser
600 Kenrick, Ste. B-14
Houston, TX 77060
Phone: (281) 999-1991
FAX: (281) 999-1891

Regional Office
Endress+Hauser
P.O. Box 901
Harvey, LA 70059
Phone: (504) 366-3264
FAX: (504) 366-3816

Sterling IPC
Div. of Endress+Hauser
68950 Powell Road
P.O. Box 604
Romeo, MI 48065
Phone: (810) 752-0700
FAX: (810) 752-0705

Canada

Endress+Hauser
Canada Ltd.
1440 Graham's Lane
Unit 1, Burlington
Ontario, L7S 1W3
Phone: (905) 681-9292
1-800-668-3199
FAX: (905) 681-9444

Endress+Hauser
Canada, Ltd.
18103 - 105 Ave. NW #101
Edmonton, AB T5S 2L5
Phone: (780) 486-3222
FAX: (780) 486-3466

Endress+Hauser
Canada Ltée
6800 Côte de Liesse, Ste. 100
St. Laurent, Québec
Canada H4T 2A7
Téléphone: (514) 733-0254
Télécopieur: (514) 733-2924

Mexico

Endress+Hauser
Calle Camino Sta. Teresa 1384
C.P. 10200 Mexico D.F.
Phone: (525) 568 9658
FAX: (525) 568 4183

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