

MCS100E

Multicomponent Analysis System

Conversion M&A Thermo-FID to GMS811 FIDOR with internal catalyst

SICK
Sensor Intelligence.



Described product

Product name: MCS100E
Variant: MCS100E HW

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Original document

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1 Important Information

1.1 About this document



NOTICE:

The conversion may only be carried out by trained personnel!

For this purpose, it is important to be familiar with the respective MCS100E software/SOPAS ET (FIDOR).

These instructions are Retrofit Instructions and must not be considered as MCS100E device documentation. These Retrofit Instructions should be included with the relevant conversion kit. They contain the description of all service work (conversion) that can be performed by trained personnel. The valid Operating Instructions (OI) contain basic information on measuring method, design and function of the measuring system and its components as well as device use so that only additional information required to understand the function is given here. The Retrofit Instructions are therefore only to be used in combination with the valid Operating Instructions.



NOTICE:

Always read the Operating Instructions before starting any work! Be sure to observe all safety and warning information!

1.2 Preliminary note



NOTICE:


First check whether a MERCEM or a downstream analyzer with additional sample gas line is present / installed in the analyzer cabinet.

- **MERCEM:**
 - Replace the PTFE lines to the mixing chamber with longer lines (lay the PTFE lines under the FIDOR)
 - Each 3.5 m long, 4 mm and 6 mm PTFE tube
- **Sample gas line to a further analyzer:**
 - Check that sufficient space is available - sample gas line / FIDOR

The kits for conversion from M&A Thermo-FID to GMS811 FIDOR are:

- 2071188 GMS811 FIDOR with internal catalyst, 230 V version
- 2071189 GMS811 FIDOR with internal catalyst, 115 V version

2 Tools

Auxiliary means required	Part number	Required for
Drill		Installation
4.5 mm drill bit		Installation of FIDOR mounting plate, page 9
8 mm socket wrench/insert		Installation of self-tapping screws, page 9
Blind rivet pliers for M6 blind rivet nuts 9.1 mm drill bit		Installation of FIDOR without mounting plate, page 11
Set of ratchets		Installation
Spirit level, short		Installation of FIDOR, page 9
BARRIERTA High-temperature paste	5602979	Retaining screw for temperature transmitter, page 7
Hole cutter, analyzer cabinet before 2004		Installation of temperature transmitter, page 7
19 mm jaw wrench		Installation of condensate outlet, page 13
Ferrule pliers		Electrical connection, page 16
Leak detection spray		Check of H ₂ connections for leaks, page 23
Ambient pressure gauge		Check of FIDOR pressure sensors, page 23
SOPAS ET software, network cable		Commissioning
Keypad for MCS100E		Commissioning
FastLynx software, 9-pole serial/null modem cable		Backup of MCS100E, page 25
Sealing plug 6 mm 	5310552	For temporarily closing off the MCS100E cell outlet to the FID, page 7 , page 25

3 Conversion from M&A Thermo-FID to FIDOR

Conversion of M&A Thermo-FID to FIDOR with internal catalyst on MCS100E

3.1 Removal of M&A Thermo-FIDs

- 1 **NOTICE! Inform the measuring station that the MCS100E analyzer and any possible downstream analyzer systems will be switched off.**
- 2 Set the analyzer cabinet to maintenance with the maintenance switch.
- 3 Set the MCS100E analyzer to standby and check the zero gas throughflow.
- 4 The M&A Thermo-FID of the 19" electronic control unit can be switched off on the rear side after 20 minutes (analyzer cabinet door).
- 5 Close off the gas cylinders for H₂-hydrogen, test gas (propane) and instrument air supply FID.
- 6 **NOTICE! Switch off the M&A Thermo-FID circuit breaker. (Check the location of the circuit breaker in the Manual/Installation Plan!)**
- 7 Disconnect the cable connections from the 19" electronics and the detector unit
- 8 Remove the 19" electronics from the door
- 9 Disconnect the hose connections on the detector unit.

PTFE connection:

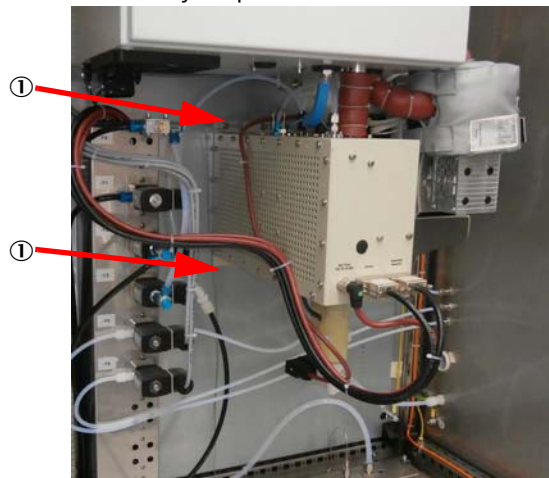
- ▶ Unscrew the MCS100E cell outlet to the detector unit:



CAUTION: Risk of burns (185 °C)

- ▶ If forced purging of the CAT is fitted:
 - Remove the PTFE line and, if necessary, replace the existing PVDF T-piece by a straight PVDF screw fitting.
 - ▶ Pull out the test gas PTFE line on the cartridge connection.
 - ▶ Unscrew the H₂-hydrogen line on the cartridge connection, remove the capillaries from the analyzer cabinet.
 - ▶ Unscrew the vent line on the cartridge/bulkhead fitting of the analyzer cabinet panel.
 - ▶ Unscrew the condensate line on the condensate separator/bulkhead fitting of the analyzer cabinet panel.
- 10 Loosen the 3 retaining screws of the detector unit and take the detector unit out of the analyzer cabinet. (Use a 5 mm Allen key with extension)
Then remove the retaining screws and store them safely for possible later use.

- ① 3 retaining screws
2 above, 1 below the cartridge

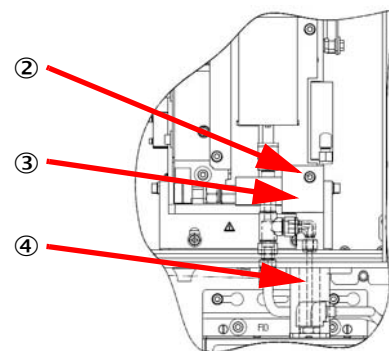
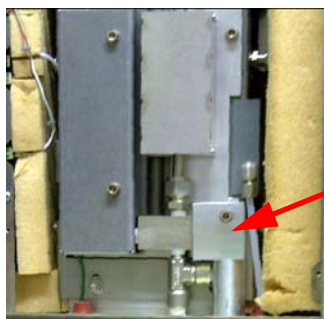


- 11 If the sample gas inlet of the FID detector unit was installed between the sample gas pump and cell inlet, fit a new 6 mm PTFE line between the sample gas pump and cell inlet. (Use 4 mm support sleeves.)
- See Section 15, Page 7, Installing the FID parts set.
- 12 If the sample gas inlet of the detector unit was installed on the cell outlet, the cell outlet to the FID should be closed off temporarily with 6 mm Swagelok hose terminal.
- Option: Put the MCS back into operation again during the FIDOR installation phase.
If available, deactivate program "External Control":
Here: Program #: 84
 - Deactivate Ext. Control Thermo-FID
Program #: 27
- 13 After the MSC100E has been initialized, set the measuring system back to MEASURE again using the maintenance switch.
- NOTICE! Measurement is active!**
- 14 If no temperature transmitter was installed on the outlet of the PTFE line:
- ▶ Preinstall the cell/FIDOR.
 - ▶ If required, use a hole cutter to enlarge the bore of the photometer outlet.

Tools

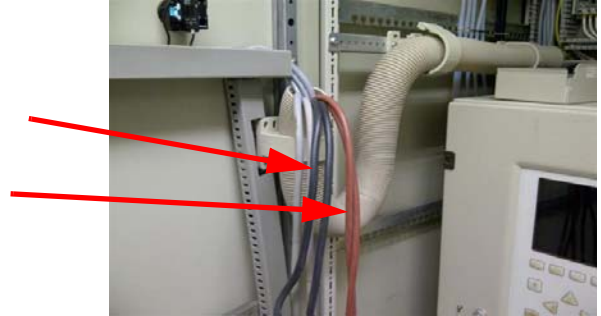
Auxiliary means required	Part number	Required for
Drill		Installation
Hole cutter Ø 32.5 mm, from 2004, standard hole		Installation of temperature transmitter
BARRIERTA High-temperature paste	5602979	Retaining screw for temperature transmitter
Cable clips		Insulating tube

- 15 **NOTICE! Apply a coat of Barrierta to the screw thread.**



- ① Temperature transmitter
- ② 1 x 5305733 screw, hexagon socket screw M6 x 45-A2
1 x 5310226 washer A6
- ③ 1 x 4040026 FID temperature transmitter
- ④ PTFE line cell/FIDOR

16 Pull the cable connections 19" electronics / detector unit and IEC plug power supply 19" electronics out of the assembly hose.



17 Leave the signal cable (M&A Thermo-FID) analog X2 / digital X5.

3.2 Installing FIDOR in the analyzer cabinet



It is important that the sample gas outlet after the cell is directly above the sample gas inlet of the FIDOR! Use a spirit level if required!

There are two options for installation of the FIDOR:

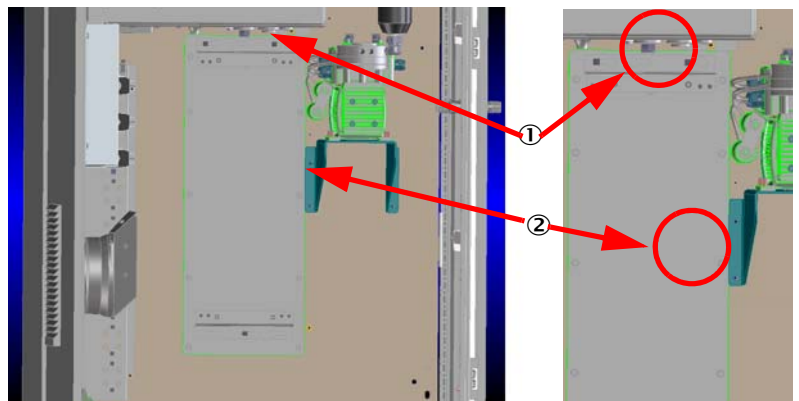
- Installation with the delivered installation plate
- Installation of FIDOR with only 3 screws

3.2.1 Installation with the delivered installation plate

Tools

Auxiliary means required	Part number	Required for
Drill		Installation
4.5 mm drill bit		Installation
8 mm socket wrench/insert		Installation
Set of ratchets		Installation
Spirit level, short		Installation

- ① Installation plate stop at the top of the MCS100E mounting bracket
- ② Installation plate stop at the right on the left pump bracket



- 1 The 10 holes for the installation plate should be drilled with a 4.5 mm drill bit, afterwards the installation plate is screwed with 10 x 5310373 “Screw M 5x10 hexagon” with self-tapping thread to the assembly panel of the analyzer cabinet with an 8 mm socket wrench/insert.

- 2 Installation of FIDOR on the MCS100E photometer (red: PTFE connection)



- 3 Screw the mounting bracket to the FIDOR.



- 4 Screw the installation plate below the photometer to the assembly panel of the analyzer cabinet.



- 5 When the assembly panel has been fastened:
Continue with [see "Installing the mounting brackets", page 12](#)

3.2.2 Installation of FIDOR with only 3 screws

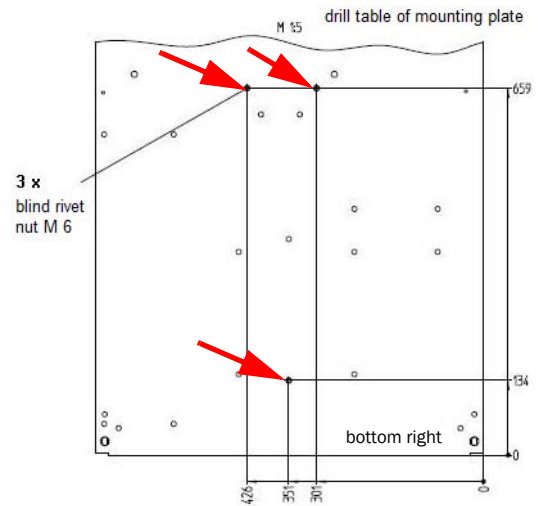
Tools

Auxiliary means required	Part number	Required for
Drill		Installation
4.5 mm/9.1 mm drill bit		Installation
Blind rivet pliers for M6 blind rivet nuts	5309312	Installation of blind rivet nut
8 mm socket wrench/insert		Installation
Set of ratchets		Installation

- 1 3 retaining screws are required to install the FIDOR.
 - 2 at the top and 1 at the bottom centered to the two top screws
- 2 Drill holes for the blind rivet nuts in the assembly panel.

Dimensions:

 - See drilling plan
 - Press 3 x 5309312 blind rivet nut M 6 x 15.3 into the assembly panel.



- 3 Set holes for the 3 locking nuts (9.1 mm) and then pull the 3 M6 locking nuts in tight with a special tool (blind rivet pliers for locking nuts).

3.3 Installing the mounting brackets

- 1 If present, unscrew the 2 mounting brackets from the front of the FIDOR.



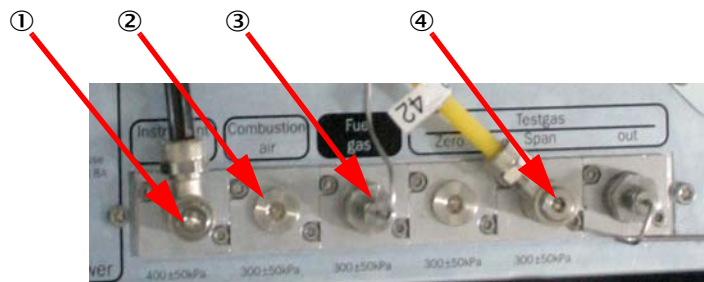
- 2 Screw 2 mounting brackets to the FIDOR housing fitting (6 mm slotted hole drilling, FIDOR housing).



- ① Mounting bracket
- ② 5700371 screw, hexagon socket screw, M6x16
5700391 spring washer
5310226 washer

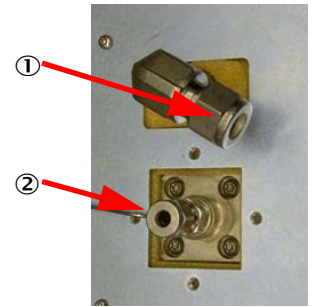
3.4 Installing the gas connections on the FIDOR rear panel

- 1 Screw in the H₂ screw fitting with the washer provided.
- 2 Screw in the inlet screw fitting on the sample gas inlet with the washer provided.
- 3 Screw the hose nipple in.



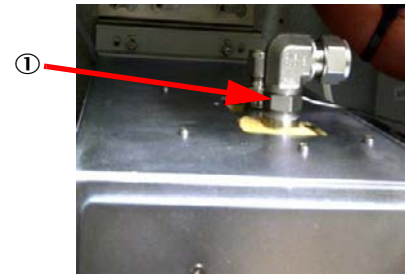
- ① Screw in 2 connection nipples for instrument air
 - ② Dummy screw connection
 - ③ Insert 1 seal and tighten the H₂-screw fitting
 - ④ Screw in 2 connection nipples for test gas
- 4 The connection nipples are sealed with an O-ring and can turn freely on their own axis. Screw the nipple screw fittings in with a 4 mm hexagon key wrench.
 - 5 **NOTICE!** The “Combustion air” connection has internal piping and is now supplied with a dummy screw connection.

- ① 10 mm sample gas outlet
- ② 6 mm sample gas inlet, with sealing washer

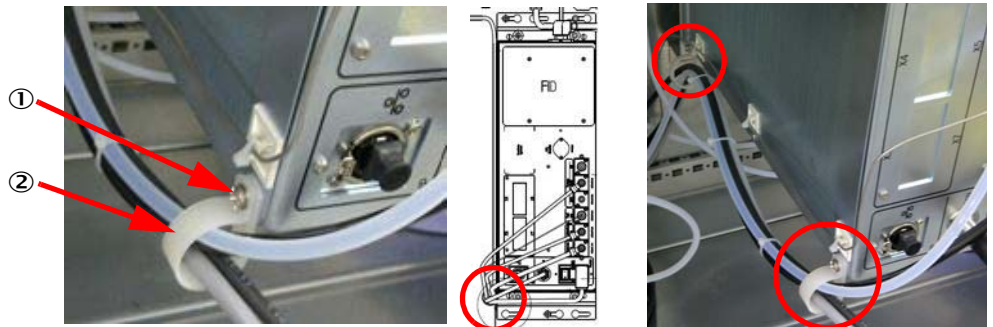


6 Loosen the counternut of the 90° bracket screw fitting on the sample gas outlet. Position the screw fitting so that the drain-off 10 mm PTFE line including support sleeve has the shortest distance to the bulkhead fitting in the analyzer cabinet (to left / right analyzer cabinet panel), then tighten the counternut

- ① Counternut
Width across flats – 19 mm
Loosen: Turn to the left



7 Screw the cable clip onto the side of the FIDOR housing. This clip holds the PTFE tubes, H2 line and the electric line.



- ① 2 x 5310337 Complete screw assembly M4x12
- ② 2 x 6024229 Cable clip

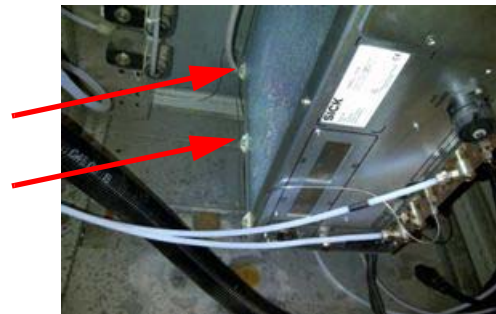
3.5 Screwing the FIDOR tight on the assembly panel



- ① Top mounting bracket
- ② Bottom mounting bracket

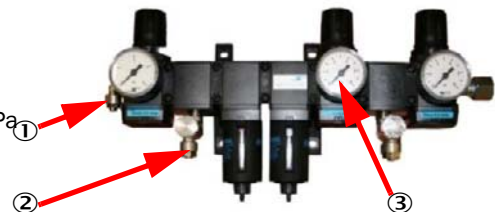


- 1 Replace the 1/16" stainless steel H₂ line and lay it, without kinks, with an adequate radius in the analyzer cabinet.
If the stainless steel line is too long, lay excessive length as ring on the inlet screw fitting of the analyzer cabinet.
- 2 Make sure that both openings of the capillary are not crushed.
- 3 - Fasten the stainless steel line with attachment base (for cable strap) on the left outer FIDOR panel.



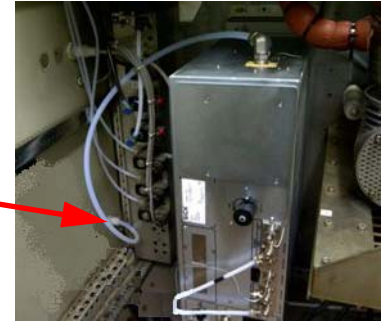
- 4 Pressure control unit/tube connections
 - ▶ Replace 5315576 instrument air pressure control unit, 3-stage, with 4 outlets by the 2-stage pressure control unit.
 - ▶ Connect the instrument air line Tecalan tube (black) or PTFE 8 mm from the instrument air conditioning (middle outlet 4 bar ±0.2 bar) to the FIDOR inlet "Instrument Air". ("Combustion air" now has internal piping in the FIDOR.)

- ① Zero gas MCS100E
- ② Instrument Air FIDOR connection
- ③ Set the middle pressure regulator to 4 hPa



- ▶ Set the middle pressure regulator to 4 bar.
 - ▶ Extend/renew the test gas line, PTFE 6 mm, inside the analyzer cabinet and connect to the FIDOR "Testgas Span".
- 5 Lay the new PTFE lines
 - ▶ If possible, lay all tubes and lines in the cable clips.

- 6 Lead the sample gas outlet out of the analyzer cabinet via a 10 mm PTFE bulkhead fitting.
Here: Left analyzer cabinet panel, to do this, widen the existing opening to 10 mm bulk-head fitting (drilling: 15.5 mm).



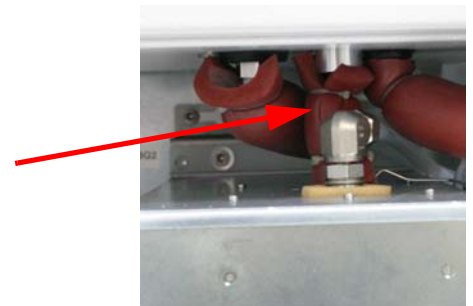
NOTICE! Check that no overpressure can occur in other outlets due to the induction air (collecting line for analysis systems, condensate outlet MCS100E)

- 7 PTFE line between MCS100 cell outlet and FIDOR inlet:
 - ▶ Fit a new 6 mm PTFE line with 4 mm support sleeves and insulate with the red insulation tube using cable ties.

Completed installation of the FIDOR in the analyzer cabinet



- 8 Insulate the 6 mm PTFE tube to the FIDOR sample gas inlet well with the red insulation tube!
5310233 tube, insul. 22x10

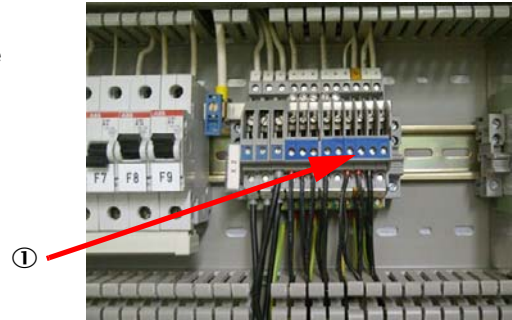


3.6 Electrical connection of FIDOR

Tools

Auxiliary means required	Part number	Required for
Various ferrules		Installation
Ferrule pliers		Installation

① Terminal strip X2:3- block terminals on the assembly panel in the analyzer cabinet

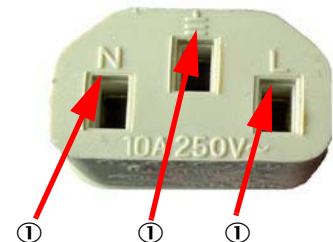


CAUTION: Hazards through electric voltages

Disconnect the analyzer cabinet from the power supply.

- 1 FID circuit breaker should be switched off.
(Check the number of the FID circuit breaker in the manual!)
- 2 Check whether the last 3-block terminal on the X2 (previously M&A Thermo-FID) is suitable for the FIDOR
- 3 Lay the FIDOR power cable
 - FIDOR: Screw the electrical supply line (3x1 mm²) with ferrules to the 6023312 IEC sleeve and from the X2 assembly panel (from the FID circuit breaker, 1st 3-block terminal) to the FIDOR.
 - Guide (fix) the electrical supply line in the cable clamps.
- 4 If possible, use the electrical supply line from the M&A Thermo-FID.

① IEC plug connections



- 5 The following applies to the installation of stranded wires at SICK AG and worldwide:
 - Use of ferrules in different sizes.
 - Use ferrule pliers to crimp the ferrules.



①

- ① Ferrules
- ② Incorrect installation
- ③ Correct installation



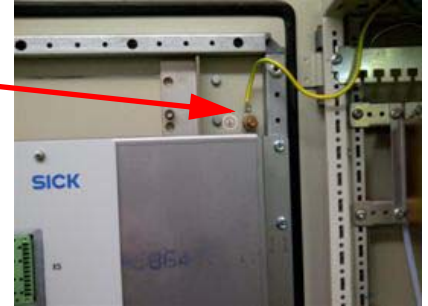
②



③

3.7 Installing the control unit BCU FIDOR

- 1 Screw a dummy plate to the outside of the analyzer cabinet door instead of the 19" control unit M&A Thermo-FID.
- 2 If necessary, twist the protective conductor cable upwards to the top right corner of the analyzer cabinet door.



- 3 Screw the BCU control panel mounting frame on the inside of the analyzer cabinet door onto the mounting carriers on the left and right. (Use the 3rd. opening from the top for the first tapping screw, - use 8 x 5310373 tapping screws.)

- ① Use the third opening in the door frame for the top screw in the mounting frame.
- ② BCU holding frame



- 4 Position the control unit in the mounting frame and screw tight with 4 complete screw assemblies (4 x 5310335 screw).
- 5 **NOTICE! The SN of the BCU must match the SN of the FIDOR!**

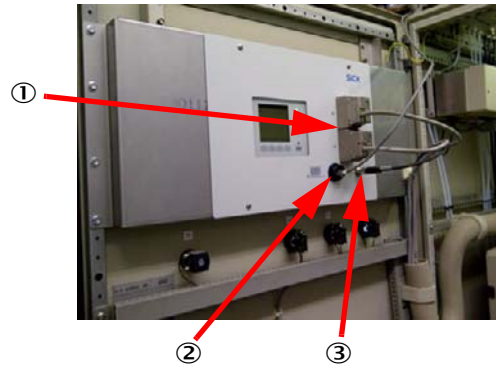
- ① 4 complete screw assemblies



- 6 Fasten the CAN bus cable to the U-profile on the analyzer cabinet and connect to FIDOR
- 7 Screw the analog cable tight on the Phoenix contact.

8 Screw the digital cable tight on the Phoenix contact.

- ① Digital/analog Phoenix contact
- ② Ethernet (SOPAS ET) connection
- ③ CAN bus plug



3.8 Configuring the analog and digital connections



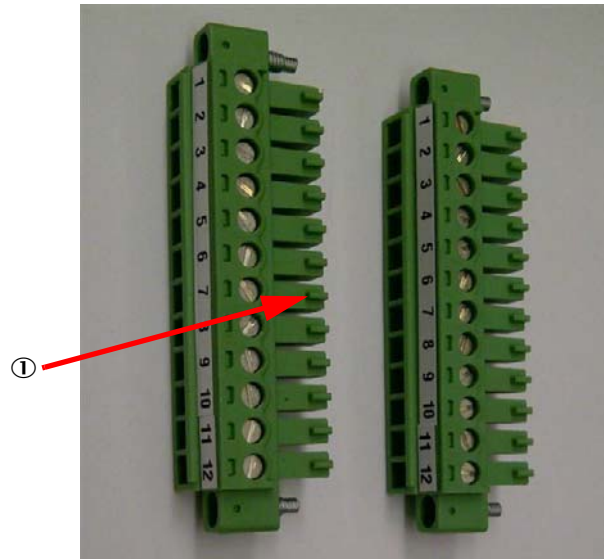
NOTICE: Always check against the Installation plan!

The contact strips have different codings: Cutting off a coding lug shows the coding.

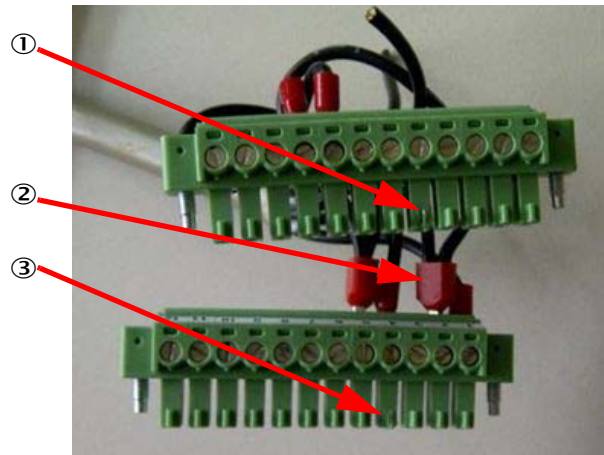
- 1 Analog output: X7 contact strip
 - Coding X7: Cut lug off pin 7
 - Analog output 1: Pin 5
 - Analog output 1: Pin 6 (0/2/4 20 mA)
 - If required 2nd analog output
 - Analog output 2: Pin 7
 - Analog output 2: Pin 8 (0/2/4 20 mA)
 - 2 Digital outputs: X4 contact strip
 - Coding X4: Cut lug off pin 4
 - Malfunction: Pin 3 (DO1) → DI 29, MCS
Pin 2 (DO1), GND
 - Maintenance request: Pin 6 (DO2) → DI 30, MCS
Pin 5 (DO2), GND
 - 3 Digital outputs: X5 contact strip
 - Coding X5: Cut lug off pin 5
 - Maintenance: Pin 7 (DO7) → DI 31; MCS
Pin 8 (DO7), GND
- Option:**
- 4 Digital outputs: X5 contact strip
 - Coding X5: Cut lug off pin 5
 - Adjustment: Pin 6 (DO6) → DI 28, MCS
Pin 5 (DO6), GND
 - 5 Digital input: X3 contact strip
 - Coding X3: Cut lug off pin 3
 - Start Cal: Pin 3 (DIC) (contact of e.g. DO16, pin 13 - MCS)
Pin 11 (DI7) (contact of e.g. DO16, pin 14 - MCS)

3.9 Configuring the Phoenix contact on the BCU

- ① X7 – coding:
Cut lug off pin 7

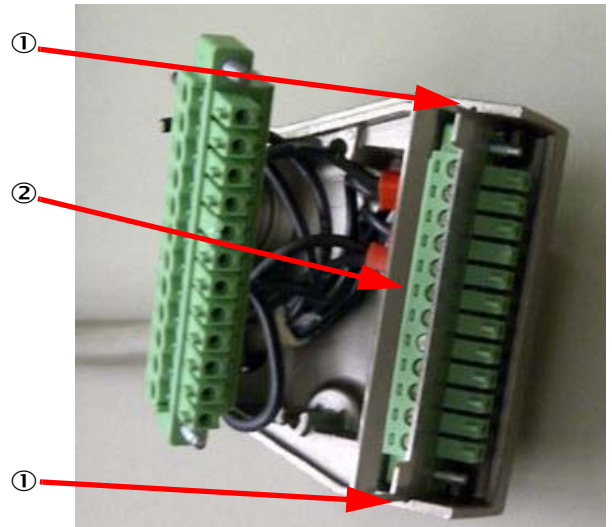


- ① Coding X5
- ② Twin ferrules
- ③ Coding X4



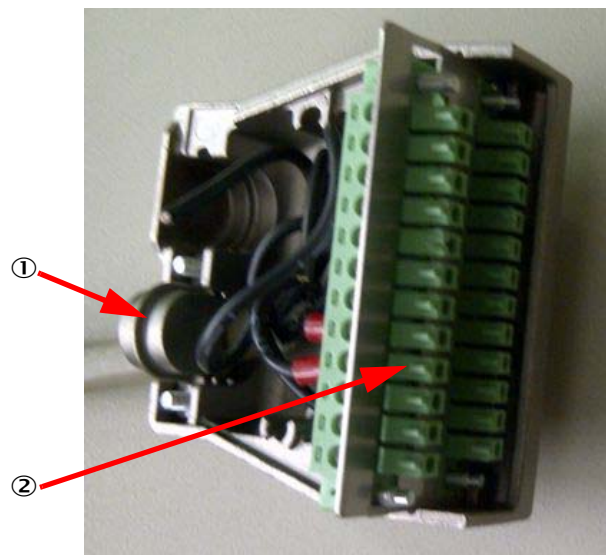
► Insert two cables (common GND) in twin ferrules.

- ① Contact strip holder
- ② Half shell of the contact housing



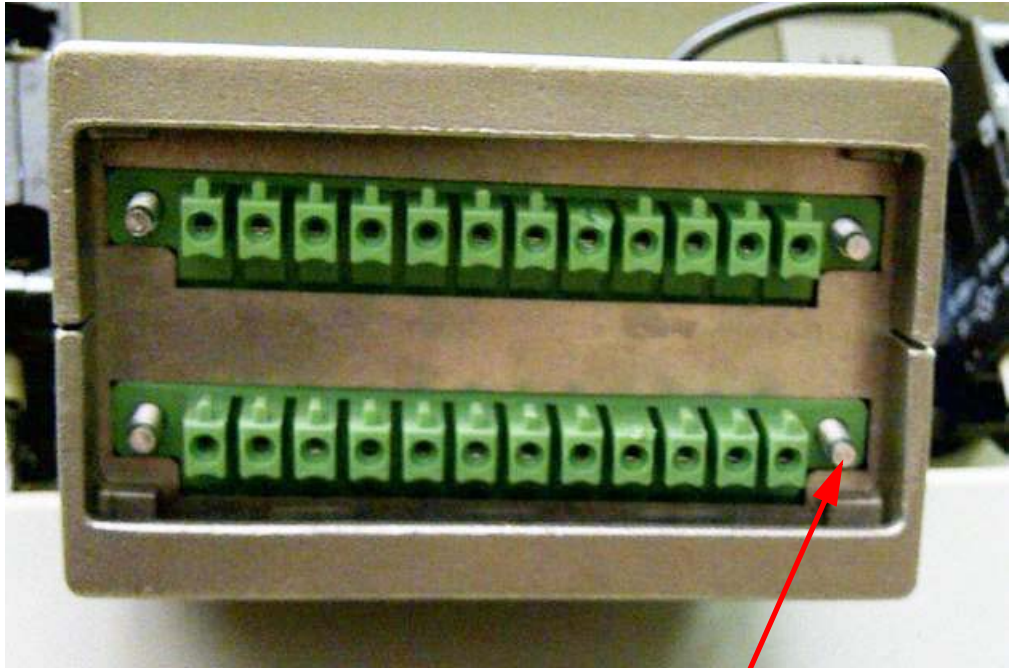
- ▶ Screw cable using the strain relief tight onto the half shell of the contact housing.
- ▶ Insert the prepared contact strips into the contact strip holder.

- ① Strain relief
- ② Contact strip holder



- ▶ Insert the contact strip holder into the grooves of the contact housing.
- ▶ Insert prepared contact strips into the contact strip holder.

Phoenix contact screwed in completely



① Screw

①

► 4 screws serve to screw the strip tight on the BCU.

3.10 Commissioning the FIDOR

Tools

Auxiliary means required	Part number	Required for
Leak detection spray		Installation of H ₂ connections
Laptop		Commissioning
SOPAS ET		BCU/FIDOR
Network cable		SOPAS ET
Keyboard		MCS100E
FastLynx software		Backup of MCS100E
9-pole-Sub-D serial cable	2023047	Backup of MCS100E
Null modem cable		Backup of MCS100E
Adapter cable		Backup of MCS100E

The FIDOR is ready for operation in 2 hours!

- 1 Switch the FID circuit breaker on.
- 2 Switch the FIDOR main power switch on.
 - The display on the BCU FIDOR goes on.
- 3 Connect the BCU/FIDOR with the network cable to the laptop and start the SOPAS ET software.
- 4 Check the FIDOR temperatures
 - using SOPAS ET/FIDOR Diagnosis/Hardware/Temperature (4)
- 5 Check the pressures of the pressure control module with ambient pressure.
 - ▶ Instrument air feed to the FID must be closed off
NOTICE! P1 – P5 must display the ambient pressure, ±5 hPa using SOPAS ET / FIDOR Diagnosis / Hardware / Pressure (5)
 - ▶ Open the instrument air feed again.
- 6 Open the utility gases, check pressures (instrument air - 4 bar, H₂ - 3 bar, test gas - 3 bar).
- 7 **NOTICE! Check hydrogen line H₂ and test gas line propane with leak detection spray for leak tightness.**
- 8 Configure the test gas and measuring range
 - Test gas concentration:
 - FIDOR/Parameter test gas
 - Measuring range:
 - FIDOR/Parameter/Measuring range
 - BCU/Parameter/I/O/Analog output (AOi)

3.11 Configuring the MCS100E



Always check against the Installation plan!

Configuring can deviate from system to system.

An example - **additions in red**, **deletions in blue**

P22 External control FID (program active)

di64&f150:f46 % !di31:?F170 % !di30:?f171 % !di29:?f172,-ti22,?f174 %
!f174:ti22 % t22>10:-f172 % **!di28:?f175 % !di27:?f176 \$** Kal Start ext.
/ maintenance / warning / malfunction / malfunction good /**adjustment FID/**
temperature error CAT

P72 Start Cal Auto FID (program active)

f95:-p72,f46

P73 Kal FID (program active)

f46:?ti72,do16 % t72>5:-f46,-do16

P84 Status message FID (program active)

!f1|f170|f173:?tx43 % f171:?tx44 % f172|f175|f109:?tx45 % **F175:?tx48**
% f176:?tx46
\$ Maintenance / warning / malfunction / adjustment FID /temperature error CAT

P87 Lamps (program active)

(...&!tx43...)|...tx44:?do1 %f173|tx43|tx41|tx44|**tx48**?do2 %
tx42|tx45|**tx46**?do3 \$ measure/maintenance/malfunction

P88 Measuring range 2 active (program active)

- When 2 FID measuring ranges are present: No change

P93 Release Cal Auto (program active)

- No change

Text additions – in menu “Messages and corresp. relays” :

tx43:Maintenance/tx44:Maintenance request /tx45: Malfunction /
tx46:Temperature error CAT/tx48:Cal FID/tx53:Measuring range 2 Cges active

Also check:

Signal output mA / graphic display / results on MCS100E

Additions to DI, Flags in Notebook

- **DI 27: FID adjustment**

- **DI 28: Temperature error CAT**

- **f175: FID adjustment**

- **f176: Temperature error CAT**

3.12 Supplementing the installation plan/program files in the MCS100E Customer Manual

3.13 Have drawings updated in Überlingen



Must be part of the offer!

3.14 Carry out a backup

- ▶ Send backup MCS100E/project file FIDOR for filing to Überlingen (frank.kroschewski@sick.de, andrea.strehl@sick.de)
- ▶ Carry out backup with the laptop and the Fastlyx software with the serial adapter cable/ cross-over cable (null modem) on the COM4 interface of the MCS100E CPU.

3.15 Complete start-up

- ▶ Check signals with the customer up to the measuring station.
- ▶ Check the measured value with the customer.

3.16 Customer instruction

- ▶ Instruct the customer in the FIDOR analysis system
 - Familiarization with SOPAS ET
 - Backup of project and logbook

3.17 Tests

- ▶ With test gas CO, N₂, feed on sample gas inlet of the FIDOR – concentration display should be -0.5 mgC --> FID is leak-proof!

2 leak tightness check options:

- Quick test
- Leak tightness test

3.17.1 Quick test

- ▶ Feed with test gas xx in N₂ (except CO, CO₂, propane) via the MCS100E cell:
 - The Cges concentration should then display a value of ~ -0.5 mgC
 - > FID is leak-proof!



Ambient air concentration: ~ 1.5 – 3 mgC

3.17.2 Leak tightness test

- ▶ Remove the FIDOR from the assembly panel.
- ▶ Close the sample gas inlet of the FIDOR (6 mm sealing plug).
- ▶ The FIDOR must then be set to maintenance.
- ▶ Select the hardware test in the factory settings and then set pressures P1 to 650 hPa, P2, P4 and P5 to 0. Make sure that zero gas and ref. gas test are disabled.
 - The ejector now starts suctioning and there should be approximately the same pressure for P2, P3 and P5 as for P1.

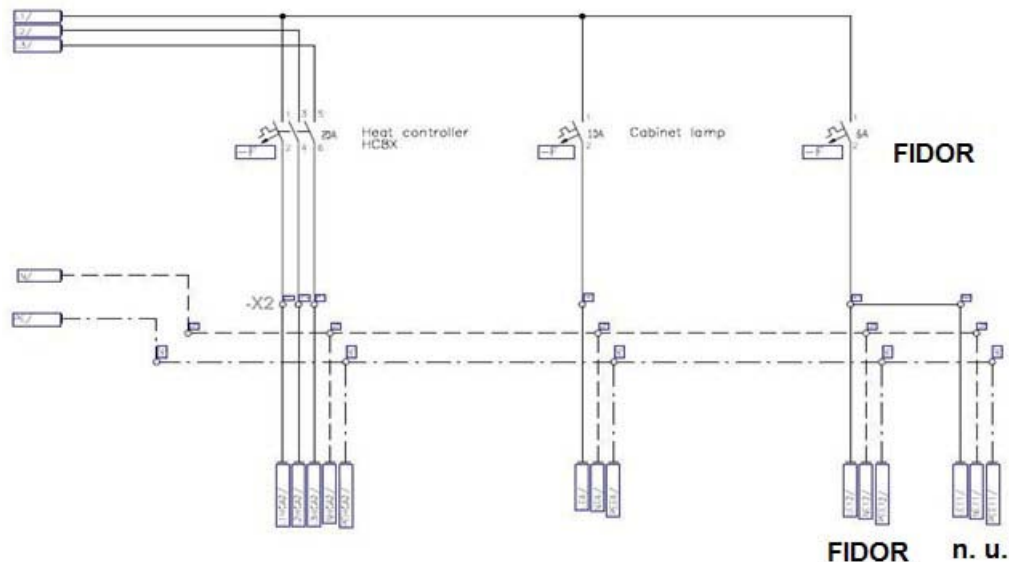
Hardware test

The screenshot displays the 'Hardware test' configuration interface. It includes several rows of controls for heaters (PAA, det., SGL, cat.), pressures (P1, P2, P4, P5, P3, diff.), and temperatures (flame, electr., PAA, det., SGL, cat.). A red box highlights the pressure settings for P1 (650 hPa), P2 (750 hPa), P4 (1100 hPa), and P5 (942 hPa). Another red box highlights the 'Zero gas test' and 'Ref. gas test' checkboxes, which are currently unchecked. Other parameters like 'Tst suction voltage' (400 V), 'Ignition curr.' (0 A), and '3.3V' (3.3 V) are also visible.

4 Annex

4.1 Wiring diagram

Fig. 1: Wiring diagram FIDOR voltage supply in the MCS100E analyzer cabinet



The wiring plan must be checked!

4.2 Additional information

Conversion of M&A Thermo-FID to FIDOR on the MCS100E

4.2.1 MERCER connection

With a MERCER connection on the MCS100E:

- Replace each 3.5 m long, 4 mm and 6 mm PTFE tube
 - 5310241 tube, PTFE D2/4
 - 5310243 tube, PTFE D4/6

4.2.2 Conversion of sample gas outlet after cell

If the sample gas outlet to the FID is between the sample gas pump and the cell.

When the M&A Thermo-FID detector unit is installed between the sample gas pump and the MCS100E cell, the FIDOR sample gas connection must be moved from the sample gas pump to the cell outlet:

- 1 x 2031192 parts set FID with O2 sensor
- or
- 1 x 2031191 parts set FID without O2 sensor

- PTFE line, DM 4/6 (50 cm)
- 2 x 5310471 support sleeve, 4 mm
- 2 x 5310523 cap nut, 6 mm SS
- 2 x 5309814 rear clamp ring, 6 mm SS
- 2 x 5310595 front clamp ring, 6 mm SS
(PTFE line sample gas pump/cell)

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