Vertrieb durch / distributed by:

DKS GmbH
Engineering & Vertrieb
www.dks-engineering.de
info@dks-engineering.de
+49 35952 4294-66

messkonzept
ANALYTICAL TECHNOLOGY

FTC300

Fast Thermal Conductivity Analyzer

Operating Manual

Version 1.02 © Messkonzept GmbH
Date of issue: 04th July 2014

Messkonzept GmbH
Analytical Technology
Niedwiesenstr. 33
60431 Frankfurt
Germany

Fon +49 69 53056444
Fax +49 69 53056445

info@messkonzept.de
www.messkonzept.de

Geschäftsführer
Dr. Axel-Ulrich Grunewald
Gerichtsstand Frankfurt
HRB 49940
USt-ID: DE211207233

Frankfurter Volksbank
Konto: 7000903005
BLZ: 50190000
Swift-BIC: FFVBDEFF
IBAN: DE03501900007000903005

Thank you for using the FTC300 from Messkonzept. It has been designed and manufactured using highest quality standards to give you trouble free and accurate measurements.

© Copyright Messkonzept GmbH 2014

This document is protected by copyright. Neither the whole nor any part of it or the information contained in may be adapted or reproduced in any form except with the prior written approval of Messkonzept.

The product described in this manual and products for use with it are subject to continuous developments and improvement. All information of technical nature and particulars of the product and its use (including the information in this manual) are given by Messkonzept in good faith. However, it is acknowledged that there may be errors or omissions in this manual.
For the latest revisions to this manual contact Messkonzept or visit www.Messkonzept.de
Messkonzept welcome comments and suggestions relating to the product and this manual.

Note!
The design of this instrument is subject to continuous development and improvement. Consequently, this instrument may incorporate minor changes in detail from information contained in this manual.

Important!
In correspondence concerning this instrument, please specify the type number and serial number as given on the type label on the right side of the instrument.

All correspondence should be addressed to:

Messkonzept GmbH
Niedwiesenstr. 33
60431 Frankfurt
Germany
Tel: +49(0)69 53056444
Fax: +49(0) 69 53056445
email: info@messkonzept.de
http: www.messkonzept.de

This manual applies to:	**FTC300**
Date of Release:	**May 2014**
Software Version:	**1.030**

1. Operator safety 5
1.1 Notes on Safety Conventions and Icons 5
1.2 Warning Notices 6
1.3 Safety Instructions 7
2. Determining Concentrations via Thermal Conductivity 8
2.1 Principle of Measurement 8
2.2 Principle of Operation 9
2.3 Measuring Gases and Ranges 10
3. Assembly of the Instrument 11
3.1 FTC300 Detector Unit 11
3.2 Installation of the FTC 300 12
3.3 Gas Ports 12
3.4 Electrical Connectors and Earth 13
3.4.1 Requirements for electrical connectors 15
3.4.2 Ground 15
3.4.3 RS-232 Interface 16
3.5 Particular Features of the FTC300 17
4. The Front Panel 18
4.2 System Alarm Indicator (red) 19
4.3 System Maintenance Indicator (yellow) 19
4.4 Operation Indicator (green) 19
4.5 RIGHT / Selection Key 19
4.6 UP / Selection Key 19
4.7 ENTER / Termination Key 19
5. Switching on the device 20
5.1 Warm up Screen 20
5.2 Operation Screen 21
5.3 Top Level Main Menu 21
6. Calibration 22
6.1 Set Offset Gas Concentration 22
6.2 Set Gain Gas Concentration 23
8.3 Offset Calibration 24
6.4 Gain Calibration 24
7. Diagnosis 25
7.1 Parameter Menu 25
7.2 Errors 26
8. Setup 27
8.1 Unit Setup 28
8.1.2 Measuring Gas Setup 29
8.1.3 Response Time Setup 30
8.1.4 Multi Gas Mode List (useful with Option MGM only) 31
8.2 Relays 32
8.2.1 Relay 1 Mode 32
8.2.2 Relay 1 Threshold 33
8.2.3 Relay 1 Hysteresis 33
8.2.4 Relay 1 Failsafe / Not failsafe 34
8.2.5 Relay 1 active/frozen during Calibration 34

8.2.6 Relay 2 Mode 35
8.2.7 Common Relay 36
8.3.1 Current Loop 37
8.3.2 Analog Output 1 39
8.3.4 Adjust Loop 40
10.4 Expert Setup 41
10.4.1 Parameter 41
10.4.2 Access Modes 42
8.4.3 Reset Functions 43
8.4 .4 Test of Relays, Analog Outputs and Connections 44
Note! 45
Appendix A System Errors 46
Appendix B Specifications 48
B.1 Performance 48
B.3 Environmental conditions 50
B.4 Dimensions 50
Appendix C EG-Konformitätserklärung 50
Appendix D Menu Tree 53

1. Operator safety

This section provides information and warnings which must be followed to ensure safe operation and retain the instrument in safe condition. Read this section carefully before beginning to install and use the instrument.

1.1 Notes on Safety Conventions and Icons

Warning!
"Warning" draws attention to application errors or actions that can lead to safety risks including the injury to persons or malfunctions – possibly even destruction of the device.

Note!
"Note" indicates an additional function or hint.

1.2 Warning Notices

The manufacturer does not assume liability for inappropriate handling of the device. Malfunctions caused by inappropriate handling may lead to hazards.

This device is not suited for the operation in areas exposed to explosion hazards!

Never lead explosive gases or gas mixtures into the device!

Dependent on the model the device flammable gases may be led in the device. Check item “Glass ball filling” in the device protocol. Flammable gases may be led in devices filled with glass balls.
Here, the inside space of the housing is densely filled with glass balls (Ø 0.6mm). In the unlikely case that a leakage caused an explosive atmosphere, the small spaces between the glass balls prevent a coincidental ignition caused by a further malfunction of the device from propagating.

Never open the housing of the FTC300, especially because of the loose glass balls. When the device had been opened it may not work safely with flammable gases.

Disconnect the device from the power supply to prevent an unintended start of the device, if a safe operation of the device is not guaranteed.

For operation of the device in the field a rain protection is recommended.

1.3 Safety Instructions

Caution!
For safe operation of the device please pay regard to all instructions and warnings in this manual.

Only put the device into operation after it has been installed properly.

A competent and authorised person is required for installation, connection and operation of the device. This person has to read the manual and follow all instructions. Keep the manual to look up questions that can occur later on.

Make sure that the electric installation protection against accidental contact agree to the applicable safety regulations.
The protective earth connection must be made before all other connections. Any interruption in the protective earth can cause danger.

Pay regard to the local regulations and circumstances regarding electric installations.

Repairs may only be done by Messkonzept.

2. Determining Concentrations via Thermal Conductivity

2.1 Principle of Measurement

Thermal Conductivity Detectors (TCD) were used in the chemical industry since the 1920s as the first process gas analyzer for the quantitative composition of gas mixtures. Each gas has a typical heat conductivity governed by its molar mass and viscosity.
The measurement is based on the principle that the thermal conductivity of a mixture of gases is dependent on the thermal conductivity of the gas components and their fractional amount in the gas mixture. Thus, the fraction of the different components can be determined. It is one of the main advantages of the TCD principle that, unlike the wide spread infrared technique, it is not limited to gases with a permanent dipole moment. It can identify noble gases (He, Ar, Ne, etc.) as well as homonuclear gases like H_2 and N_2. Furthermore, it is robust and cost effective.

The principle of thermal conductivity measurement works best, if the different gas components have clearly different thermal conductivity and in addition one of the following conditions is met:

1. The mixture contains only two components (binary mixture), e.g. CO_2 in N_2 or H_2 in N_2.
2. The mixture contains more than two components, but only the concentration of two components vary.
3. The thermal conductivity of two or more components is similar, e.g. when measuring H_2 or He in a mixture of H_2 and N_2 (quasi binary mixture).

The thermal conductivity of gases is rising with temperature and the slope of the increase with temperature is different for different gases. On customer request it can be checked whether the temperature of heat sink and/or source can be changed in order to improve the sensitivity of the measurement or to avoid cross-sensitivity effects.

Cross-sensitivity means the sensitivity of the measurement on other gases than the measured component. Perturbation-sensitivity means the sensitivity of the measurement on other influences than the gas-composition, e.g. the gas pressure.

2.2 Principle of Operation

The FTC300 sensor determines the quantitative composition of gas mixtures by measuring the thermal conductivity between a heat source and a heat sink through the gas mixture.
The measuring gas is conducted to the sensor through a stainless steel block that is kept at a constant temperature of 60°C. This temperature a stabilized using a control loop such that the block can be used as heat sink.
A thin membrane of micro-mechanical silicon chip serves as heat source. Two thin film resistors are integrated into the membrane, one is used for both the membrane the other for measuring its temperature. A second control loop stabilizes the membrane temperature at 135°C. Above and below the membrane two small cavities are etched into the silicon, which are filled by diffusion with the measuring gas.
The surfaces opposite to the membrane are thermally connected with the heat sink. Dependent on the thermal conductivity of the gas more or less energy is led off the membrane. The voltage needed to keep the temperature of the membrane constant is a measure for the thermal conductivity of the gas.
Both resistors on the membrane are protected by an inert coating in order to prevent chemical reactions with the measuring gas.

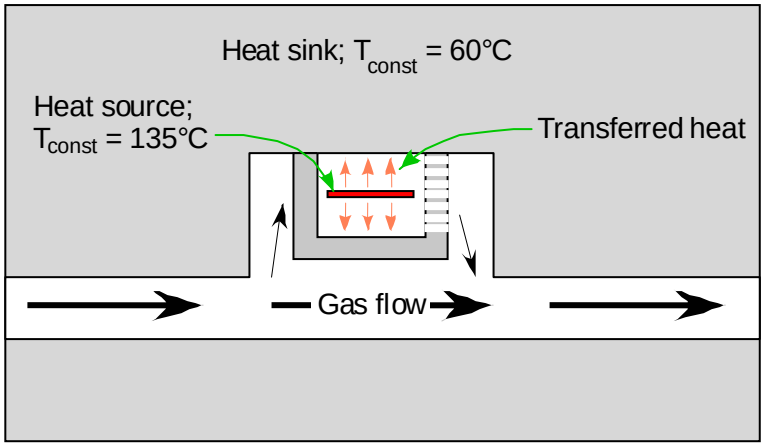


Figure 3.0 Thermal Conductivity Detector (principle)

2.3 Measuring Gases and Ranges

Depending on the gas pair the measurement is possible within certain mixing ratios.

Measuring Gas	Carrier Gas	Basic range	Smallest range	Smallest suppressed zero range	Multi Gas Mode
H_2	N_2 or air	0% - 100%	0% - 0.5%	98% - 100%	Yes
H_2	Ar	0% - 100%	0% - 0.4%	99% - 100%	Yes
H_2	He	20% - 100%	20% - 40%	85% - 100%	On request
H_2	CH_4	0% - 100%	0% - 0.5%	98% - 100%	On request
H_2	CO_2	0% - 100%	0% - 0.5%	98% - 100%	On request
He	N_2 or air	0% - 100%	0% - 0.8%	97% - 100%	Yes
He	Ar	0% - 100%	0% - 0.5%	98% - 100%	Yes
CO_2	N_2 or air	0% - 100%	0% - 3%	96% - 100%	Yes
CO_2	Ar	0% - 60%	0% - 10%	-	Yes
Ar	N_2 or air	0% - 100%	0% - 3%	96% - 100%	Yes
Ar	CO_2	40% - 100%	-	80% - 100%	Yes
CH_4	N_2 or air	0% - 100%	0% - 2%	96% - 100%	Yes
CH_4	Ar	0% - 100%	0% - 1.5%	97% - 100%	Yes
O_2	N_2	0% - 100%	0% - 15%	85% - 100%	Yes
O_2	Ar	0% - 100%	0% - 2%	97% - 100%	Yes
N_2	Ar	0% - 100%	0% - 3%	97% - 100%	Yes
N_2	CO_2	0% - 100%	0% - 4%	96% - 100%	On request
NH_3	H_2	0% - 100%	0% - 5%	95% - 100%	On request
NH_3	N_2	0% - 100%	0% - 10%	60% - 100%	On request
CO	H_2	0% - 100%	0% - 2%	99% - 100%	On request
SF_6	N_2 or air	0% - 100%	0% - 2%	96% - 100%	On request

Other gases and ranges on request

The FTC300 must not be used with explosive gases. Flammable gases as H_2 and CH_4 may only be used in devices filled with glass balls. A gas mixture of a flammable gas with an inert gas in a mixing ratio such, that it is still inflammable for any amount of air added is called totally inertised. Totally inertised gases can also be used in devices without glass balls.

"Basic range" is the largest possible measuring range and is set by default. The linearization is performed over the basic range. The smallest measuring ranges at the beginning and the end of the basic range can be deduced from calibration. The smallest possible range between the basic range and the smallest ranges at the end beginning and the end of the range can be estimated by linear Interpolation.

Measuring ranges are set in the "Current Loop" Menu, see Chapter Analog Out.

The Multi Gas Mode (MGM) is a configuration that allows for the consecutive measurement of different gas pairs. The gas pair can be switched at via the control panel or via the RS232-interface. Gas pairs labeled "Yes" in the table above are commonly used. Gas mixtures labelled "On request" can also be implemented with little effort.

3. Assembly of the Instrument

3.1 FTC300 Detector Unit

The FTC300 detector unit consists of a hermetically sealed pressure proofed stainless steel block with a gas duct, which is suited for pressures up to 20 bar. Sample gas entering through the gas inlet is guided to the micromechanical thermal conductivity sensor and further downstream to the outlet port. In particular the pneumatics is designed to minimize the influence of a changing gas flow. The operating temperature of 60°C is stabilized by a highly accurate PI control loop. In order to avoid electrical interference on the measuring output the high performance analog adaption circuit is directly mounted on top of the stainless steel block. The piggyback-mounted processor board digitizes the signal in a 24bit A/D converter. The μ-controller performs all calculations, as linearization, calibrations and cross sensitivity compensation directly on the detector unit.

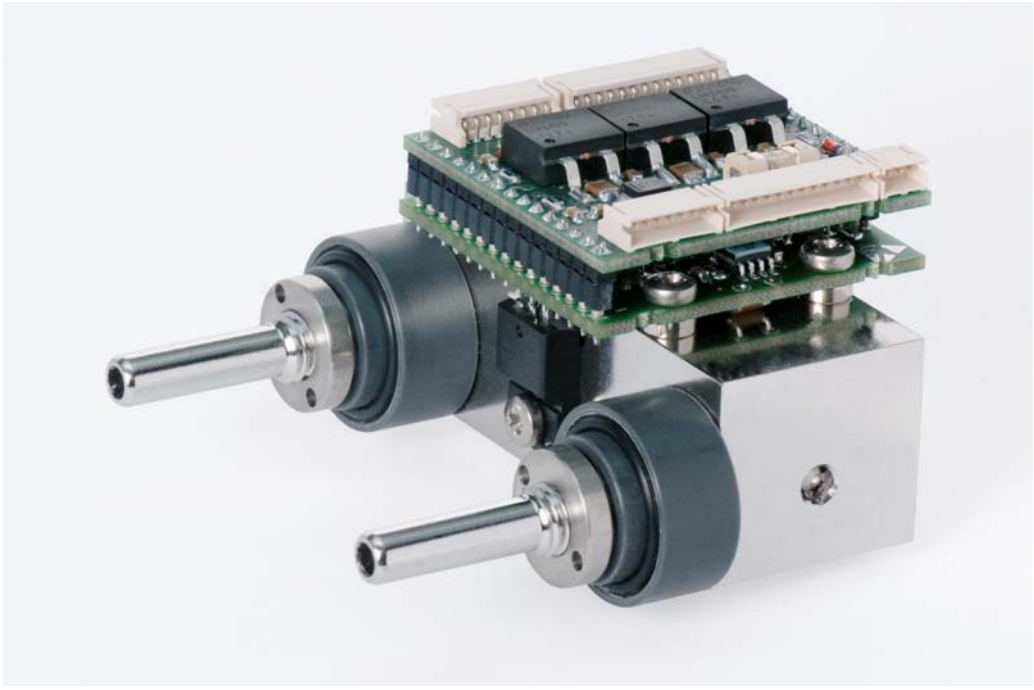


Figure 3.0 FTC300 Detector Unit

3.2 Installation of the FTC 300

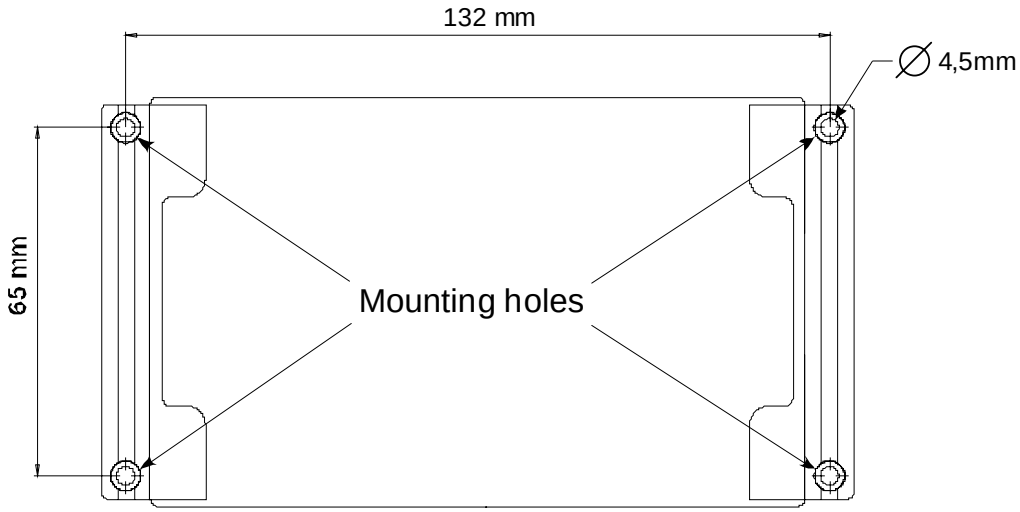


Figure 3.1 Mounting holes shown from the reverse side of the housing

The FTC300 is designed for wall fastening. The four mounting holes are shown in the picture above. M4 cylinder head bolts are suitable.

3.3 Gas Ports

On the bottom of the FTC300 housing two tubes with 6mm outer diameter for gas connection are located. They are labeled with “GAS IN” and “GAS OUT”. For low requirements regarding gas tightness and resistance to pressure the tubes can be used as hose connector. For permanent gas and pressure tightness compression fittings are recommended (e.g. by “Swagelok”©).

A leakage test after connecting the gas ports is recommended.

3.4 Electrical Connectors and Earth

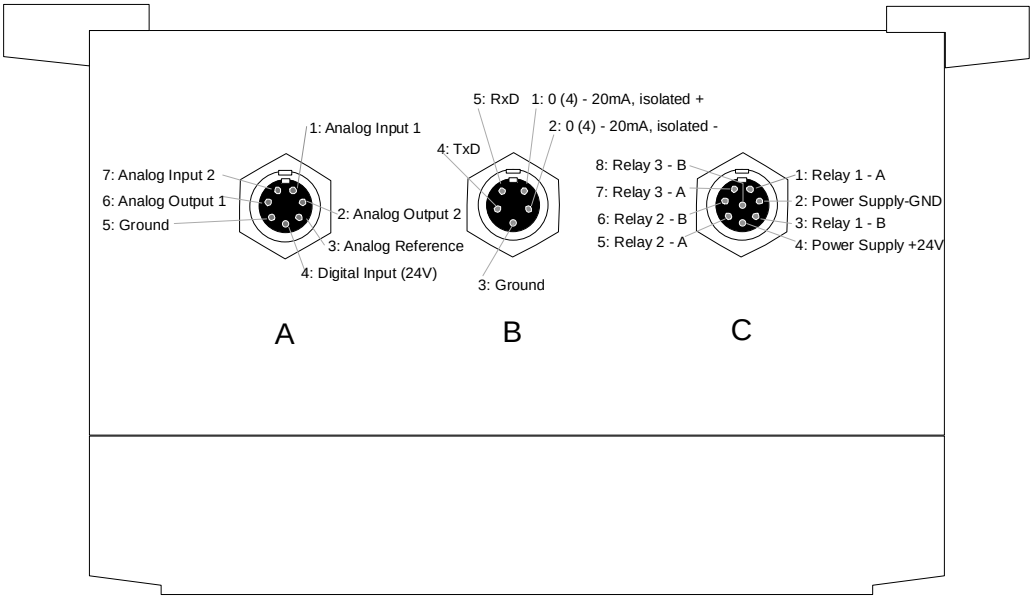


Figure 3.2 Electrical Connectors, view from top on the device

The electric contacts are joined in three plug connectors, see Figure above. For details on the function of each contact, see Table below. The cables (712, IP67) with an extruded connector plug and a length of two meters (five meters available on request) are part of the purchased parts package. The cables have open ends the cross-section of the conductors in cable A and C is 0,14mm^2, for cable B 0,25mm^2.

The protection class of the device is only effective with all cables attached. In case cable A is not used, connector plug A has to be closed with an end fitting.

Connector A (7-pins)

Pin No.	Conductor colouring	Function	Description
1	white	Analog Input 1	0 to 10V, 24 bit resolution
2	brown	Analog Output 2	0 to 10V, 16 bit resolution
3	green	GND	GND for pins 1, 2, 6, 7
4	yellow	Digital Input (DIN)	low:<4.6V; high;11.4V
5	grey	GND	GND for pin 4
6	pink	Analog Output 1	0 to 10V, 16 bit resolution
7	blue	Analog Input 2	0 to 10V, 24 bit resolution

Connector B (5-pins)

Pin No.	Conductor colouring	Function	Description
1	white	Current Loop send	0 (4) to 20mA, floating, isolated
2	brown	Current Loop return	±500V to ground, max. 800 Ohm burden, 16 bit resolution
3	black	Serial Interface RS232	GND for pin4, 5
4	blue	Serial Interface RS232	TxD (transmit)
5	grey	Serial Interface RS232	RxD (receive)

Connector C (8-pins)

Pin No.	Conductor colouring	Function	Description
1	white	Relay 1	isolated contact; 36V, max.1A
2	brown	Power Supply -	GND
3	green	Relay 1	isolated contact; 36V, max.1A
4	yellow	Power Supply +	+ 24V (18V to 36V), max. 700mA
5	grey	Relay 2	isolated contact; 36V, max.1A
6	pink	Relay 2	isolated contact; 36V, max.1A
7	blue	Common Relay 3	isolated contact; 36V, max.1A
8	red	Common Relay 3	isolated contact; 36V, max.1A

3.4.1 Requirements for electrical connectors

Before using the device make sure that the power supply is in accordance with the specifications of the device and that all electric connections correspond to the information given in this manual.

The FTC300 is a device with protection class III. Relay contacts and inputs should only be operated with safety extra low voltage (SELV;4kV).
The power supply has to comply with the PELV specification (protective extra low voltage) according to EN 60204-1.
Unlike SELV, PELV may be grounded at the output side.

3.4.2 Ground

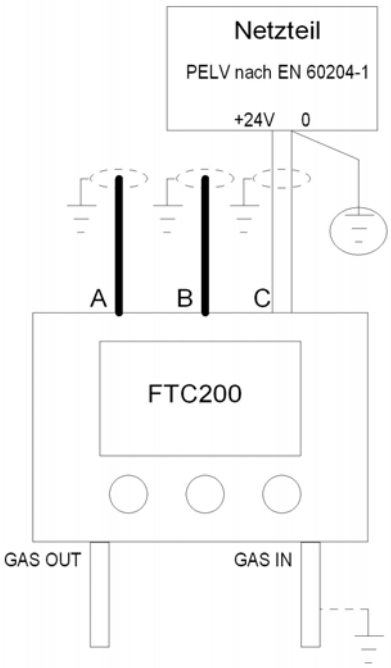


Figure 3.3 Connection to ground

To comply with EN 60204-1, the device has to be installed such that the power supply (PELV) is connected to ground with only its ground conductor, see Figure above.
The shielding of cable A, B and C has to be connected to the functional ground. Dependent on the circumstances gas inlet and gas outlet can be grounded in addition.

Connections to ground should be made with low-resistant, large diameter, short cables to one neutral point.

3.4.3 RS-232 Interface

For setting up the RS-232 interface the wires ends for RxD, TxD and GND from cable B have to be connected to the appropriate pins of a D-sub plug. The D-sub plug can directly be connected to the plug socket of the PC or via an USB-serial adapter to an USB port.
Typically the connected PC adopts to the requires settings of the RS232 interface. If this is not the case, see Appendix B2-Interface and insert the parameters by hand.

Finding the COM port the device is connected to require trial and error.

The RS232 interface allows to operate the device via SetApp, see www.messkonzept.de for more information.

3.5 Particular Features of the FTC300

* Accurate and long term stable thermal conductivity measurement
* High sensitivity (e.g. measuring range 0 Vol.% to 0.5Vol.% H_2 in N_2)
* Fast response with a T90 time of less than 1 sec (dependent on flow rate)
* Low noise (<10ppm H_2 in N_2)
* Precise linearization for binary gas mixtures of H_2, He, CO_2, CH_4 in N_2 or Ar and N_2 in Ar are preset
* Additional customized linearization with polynomial up to sixth order available
* Isolated 0/4-20mA output, start and end point can be set to any concentration
* Conventional 2-point calibration or simple one-gas calibration
* Display indication in ppm or Vol.%
* Pressure proof and vacuum leak tight stainless steel 1.4571) gas duct
* Three isolated relays for indication of alarms and instrument status
* Small and robust transmitter in powder-coated aluminum housing for field use (IP65)
* Access to all values and parameters via RS 232 interface
* Digital output with 1ppm resolution over the whole 100Vol.% range
* PC-based service program SetApp offers easy to operate calibration routines, diagram of measured concentration vs. time and possibility to write data to a log file.
* Compensation for cross sensitivity and interfering components
* Multi Gas Mode allows sequential measurement of up to 16 binary gas mixtures
* Dimensions: Width 145mm, Height 80mm plus connectors, Depth 85mm
* Power supply 18V to 36V DC / 700mA

4. The Front Panel

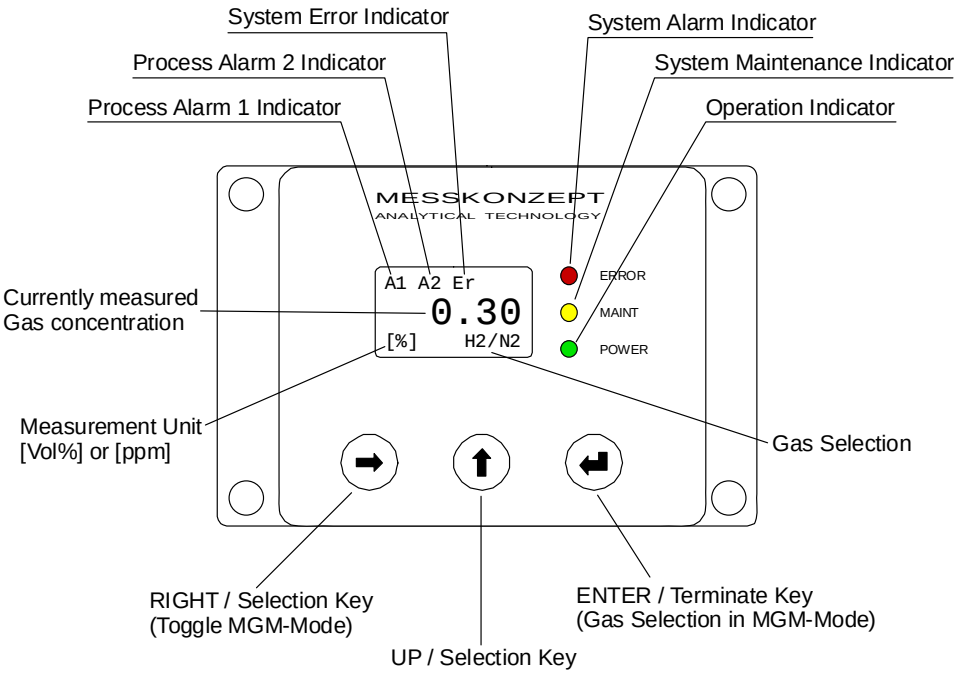


Figure 4.0 Front Panel

4.1 Alarms and System Error Indicators

The alarms “A1” and “A2” indicate the status of relay 1 and relay 2. The description how to set the conditions upon which these relays triggers can be found in Chapter 8.2. The System Error “Er” is indicated by the flashing red LED “System Alarm Indicator”. Setting of the conditions to trigger this relay is described in chapter 8.2.7. It is recommended to configure the “Error matrix” such that system errors of the device, see Appendix A, trigger the Status Alarm.

4.2 System Alarm Indicator (red)

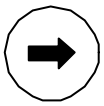
The flashing red LED indicates a system. Dependent on the configuration of the “Alarm matrix”, see chapter 8.2.7 Common Relay, also other errors can be shown.

4.3 System Maintenance Indicator (yellow)

The flashing yellow LED indicates that the instrument demands maintenance. It still works but the specifications given in Appendix B1 “Performance” may not me met anymore.

4.4 Operation Indicator (green)

The flashing green LED indicates that power is supplied and the internal processor works properly.



4.5 RIGHT / Selection Key

The <RIGHT> key enables the operator to scroll through the various menu items of menus and submenus. The currently selected menu item is marked by black background and is called with the <ENTER> key.
In submenus requiring numerical inputs, the <RIGHT> key scrolls to the next digit and to “ESC / OK” at the end.

4.6 UP / Selection Key

In menus or submenus the <UP> key quits the recent menu and changes to the superior menu and ultimately to the main menu.
To quit menus with an “ESC”/”OK” option, select one of these fields with the <RIGHT> key and confirm with <ENTER>.
In submenus requiring numerical inputs, the <UP> key changes the selected digit.

4.7 ENTER / Termination Key

The <ENTER> calls the item, that is marked as selected by the black background. Menu items are selected by the <RIGHT> key. In submenus with an “ESC”/”OK” option the <ENTER> key confirms the selection of “ESC” or “OK”.

Optional: Devices with Multi Gas Mode (MGM)
The <ENTER> gives fast access from the measured value display to changing the gas mixture. This mode is indicated by highlighting the currently selected gas pair. Pressing <ENTER> selects the next entry of the MGM list. Pressing <RIGHT> again deactivates fast access mode of the mixture selection. See chapter “Multi Gas Mode List” for a description how to modify the MGM list.

5. Switching on the device

This chapter describes switching on the device. The warm up screen, see Figure 5.0, shows the block temperature while the block warms up. After the warm up, the device switches to the operation screen, see Figure 5.1, from here the operation screen the main menu is opened.
The device can be run in two different modes, the safety mode and the normal mode. In the safety mode every action has to be confirmed by the operator code (default: 111.000). In both modes some actions require an expert code, for example changing the operator code and changing between normal and safety mode. This manual refers to the device operated in normal mode.

5.1 Warm up Screen

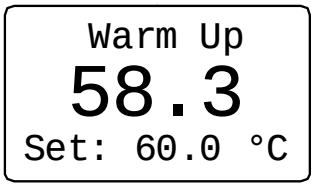


Figure 5.0 Warm up Screen

The warm up screen shows the current block temperature during warm up in the center of the screen, see Figure above. The target value of the block temperature, here 60°C, are shown in the bottom line of the screen.
The current loop, relays and analog outputs are deactivated during warm up. When the difference between the measured temperature and the target value is smaller than 0.3 °C, the device switches to the operation screen.

Pressing the <UP> key during warm up switches directly to operation screen and activates the current loop. The displayed concentration value is not precise until the block is warmed up.

5.2 Operation Screen

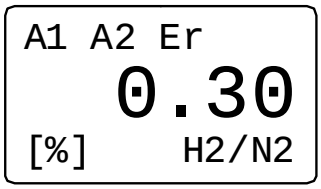


Figure 5.1 Operation Screen

After the warm up of the block the operation screen is shown, see Figure above. The first line provides the status information. Alarms are indicated by “A1” and “A2”, system errors are indicated by “Er”, see chapter “Relays” and Appendix A.
The third line shows the unit of the measurement, ppm or Vol.% and the currently selected gas pair, in the example above hydrogen in nitrogen. The display resolution in ppm is 1ppm, the number of digits displayed in Vol.% indication is set according to the customers wish and can be changed in the Expert menu in the parameter menu.
Press the <UP> key to get access to the top level main menu.

5.3 Top Level Main Menu

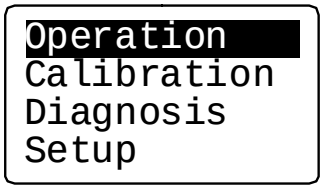


Figure 5.2 Top Level Main Menu

The main menu is the origin of the menu tree that gives access to the submenus, see Appendix E.
Selecting “Operation” as shown above and pressing <ENTER> or <UP> returns to the Operation screen. To access the submenus, select the desired submenu and press <ENTER>.
The menu paths given in the following chapters start at the main menu.

6. Calibration

For devices operated in “safety mode”, the operator code is required to access the calibration menu. By default the operator code is set to 111.000.
The goal of the calibration is that the measured concentration is in agreement with the given test gas concentration.
To obtain this, two calibration parameters that correspond to the gain and the offset of a linear equation are available.
A two-point calibration requires two test gases. Both calibration parameters, offset and gain, are adjusted. The concentration of the test gases does not have to meet the beginning and the end of the measuring range, a difference of ±10% is permitted.

The menu sequence is designed such that prior to a gain always an offset calibration has to be done first.
Usually a single point calibration determining a new offset value is sufficient to obtain a good calibration. In this case a test gas of any concentration in the measuring range is feasible.
For two point calibrations it is preferable to use the lower concentration for the offset calibration and the higher concentration for the gain calibration.

Use of substitute gases
Instead of using toxic or explosive gases for calibration the use of substitute gases is possible. A substitute gas has at a certain concentration the same thermal conductivity as the test gas it is substituting, such it can also be used for the calibration instead. Please contact Messkonzept for details.

6.1 Set Offset Gas Concentration

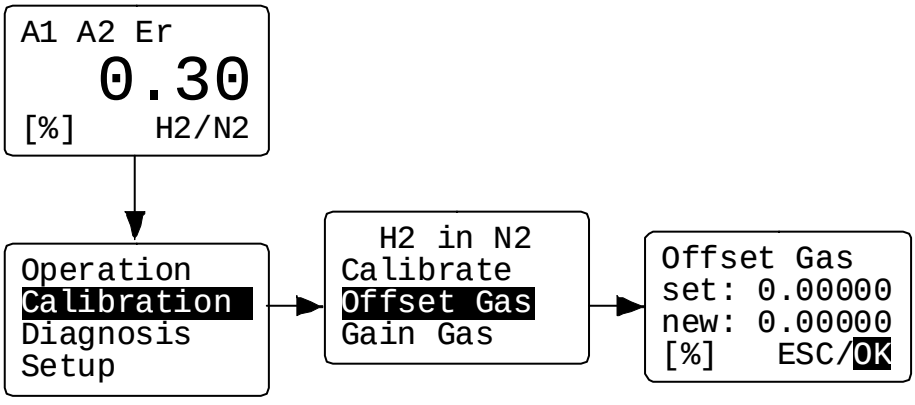


Figure 6.0 Offset Gas Menu

Before performing a calibration, the concentration of the used test gases have to be set.
In the submenu “Offset Gas” the used concentration of the offset gas has to

be entered. Select the submenu “Offset Gas” by pressing the <RIGHT> key and press <ENTER> to open the menu for the numerical entry.
Enter the value by changing each digit to the desired number. The position of the curser in the number is moved by the <RIGHT> key, the value of the digit at the current position of the curser is changed with the <UP> key. When the correct value is set move the cursor to “OK” and confirm with <ENTER>.

6.2 Set Gain Gas Concentration

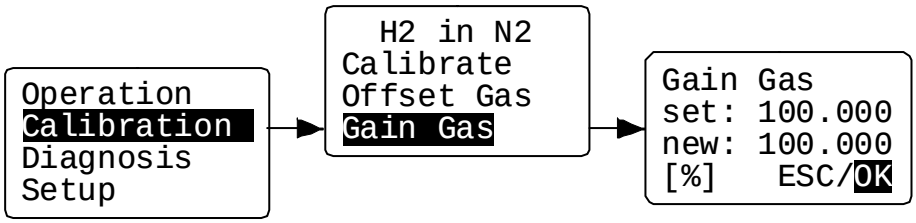


Figure 6.1 Gain Gas Menu

Prior to a two point calibration the gain gas concentration has to be set in the submenu “Gain Gas”.
This menu is operated analogously “Offset Gas” menu described above.

8.3 Offset Calibration

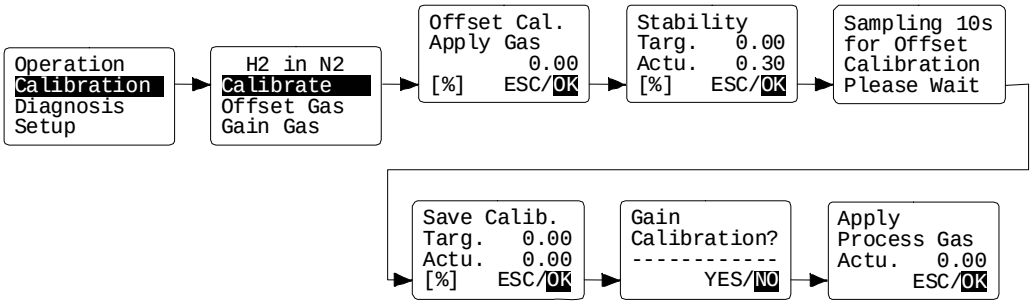


Figure 6.2 Offset Calibration Menu

When opening the menu “Calibrate”, the user is asked to apply the offset test gas. The third line of the display shows the test gas concentration as set as in the “Offset Gas” menu described in chapter 6.1. Confirming with “OK” leads to the menu “Stability”. The second line contains the set test gas concentration (“Targ.”), the third line the actually measured concentration (“Actu.”). Wait for a sufficient running-in time after the test gas had been applied until the value of the actually measured concentration reaches a constant final value. To confirm this, select “OK” and press <ENTER>. The sampling phase of 10s is started. Based on the average measured concentration the new offset is determined such that the actually measured (and calibrated) value accords with the given test gas concentration within the specifications of the device. Repeat the calibration in case the measured concentration after calibration is not in in agreement with the test gas concentration. By selecting “ESC” and pressing <ENTER> the offset calibration is repeated. With “OK” the calibrations is confirmed as correct and the new offset value saved. The following menu offers the option to proceed with the gain calibration. Choosing “NO” quits the calibration routine with the note to apply process gas again. Choosing “YES” leads to the gain calibration menu described below.

6.4 Gain Calibration

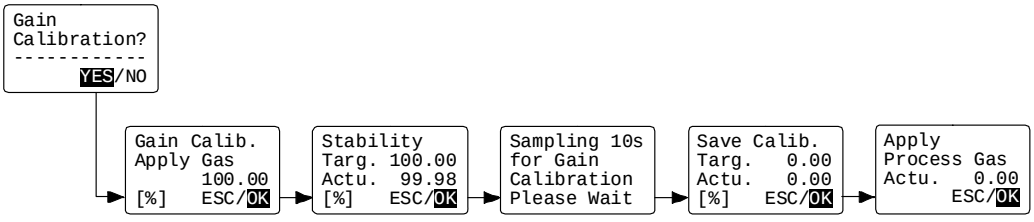


Figure 6.3 Calibrate Span Menu

The menu structure is designed such that the gain calibration procedure is

only accessible after an offset calibration. The steps of the gain calibration correspond to the offset calibration described above. The gain calibration can be canceled in any submenu by selecting “ESC”, not changing the gain.

7. Diagnosis

For devices operated in “safety mode”, the operator code is needed to access the diagnosis menu. By default the operator code is set to 111.000.

The menu provides two useful functions for the diagnosis of the device.

7.1 Parameter Menu

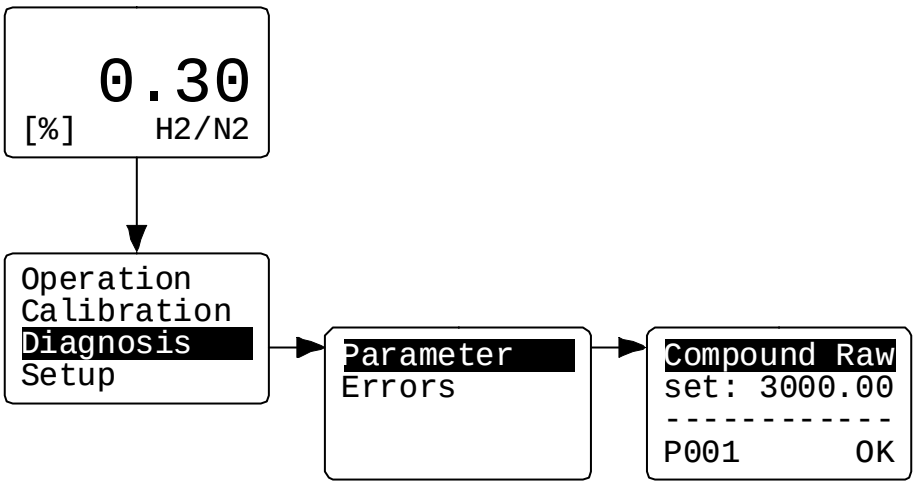


Figure 7.0 Parameter Menu

The configuration of the device is defined by about 170 parameters. The “Parameter” menu gives read-only access to these parameters.
This may help an experienced user to diagnose malfunction caused by wrong settings.
The parameter menu gives enables to scroll through the entire parameter list. Contact Messkonzept for detailed information on the parameter. The first line contains the name of the parameter, the last line its number. To move forward in the list, press <ENTER>, to move backwards, press <Up>.
To leave the parameter menu mark <OK> by pressing <RIGHT> and confirm with <ENTER>.

Some parameters can be changed in the expert setup, see chapter 8.4.1.

7.2 Errors

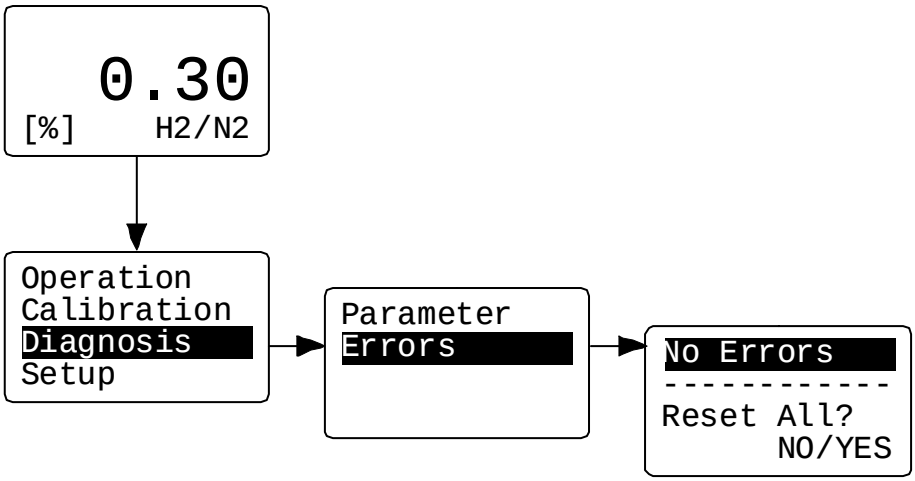


Figure 7.1 Error Menu

When the device is in the measuring mode or calibrating several parameters are continuously checked for plausibility. The parameters checked, the list of possible errors and the ranges defining a plausible value can be found in Appendix A.
Errors are indicated by a flashing red line on the front panel and “Er” written in the first line of the display. In the default setting in this case also the status relay signalizes the error externally.
The menu “Errors” gives access to the list of current errors. “No Errors” indicates that no error is pending, for pending errors the name of the error according to Appendix A is written. Pressing <ENTER> proceeds to the next pending error and <UP> to the previous error.
To leave the parameter menu press <RIGHT> and <ENTER>.
A reset of the errors is not necessary as errors that are no longer pending are immediately removed from the error list.

8. Setup

For devices operated in “safety mode”, the operator code is required to access the setup menu. By default the operator code is set to 111.000.

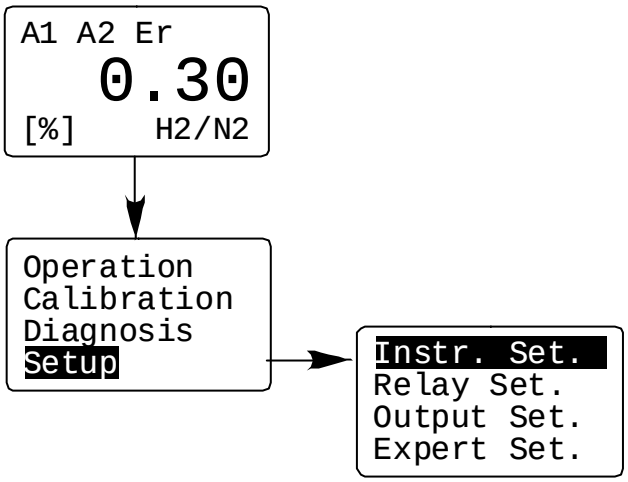


Figure 8.0 Setup Menu

The “Setup” menu contains four submenus.

- The “Instrument Setup” selects the measured gas pair, the units and the T90 response time of the exponential filter.
- The “Relay Setup” defines the conditions to trigger the relays.
- In the “Output Setup” the properties of the external signal channels are set.
- The “Expert Setup” gives write access to the parameters, reset functions, access modes and codes and test signals for subsequent connected equipment.

8.1 Unit Setup

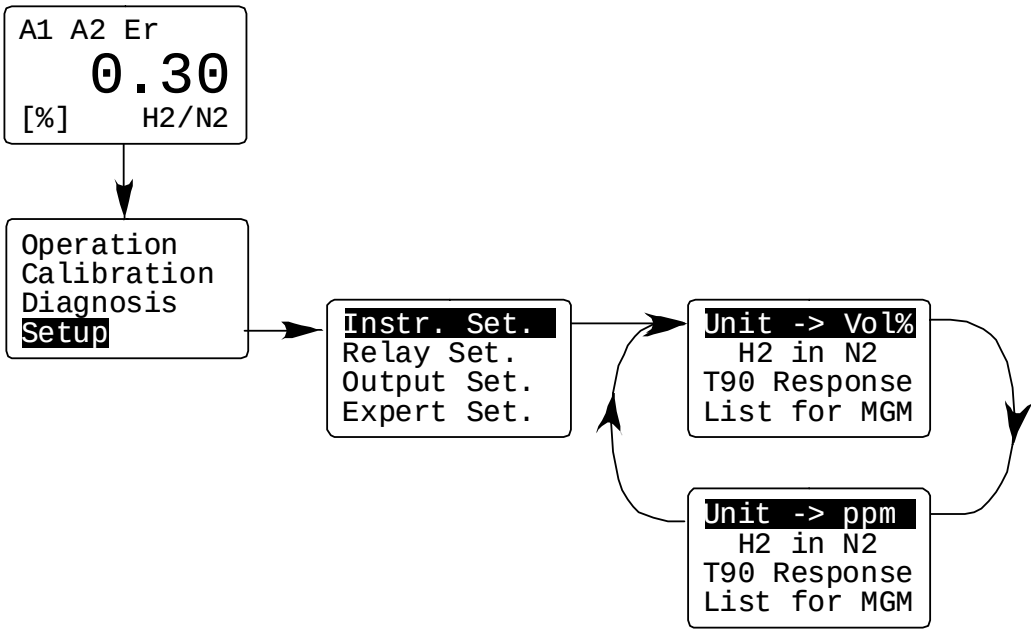


Figure 8.1 Unit Setup Menu

The first point of the submenu allows to select the unit. Pressing <ENTER> the alternates the displayed unit between ppm and Vol.%. Quit the menu with the <UP>key.
The value of P76 (see Chapter 8.4.1 Parameter) fixes the number of digits after the point between 1 and 4 when displaying Vol.%. The resolution in ppm is always 1ppm.

All internal calculations are done in ppm. Access of measuring values via the RS-232 interface will always give the numbers in ppm with 1ppm resolution.

8.1.2 Measuring Gas Setup

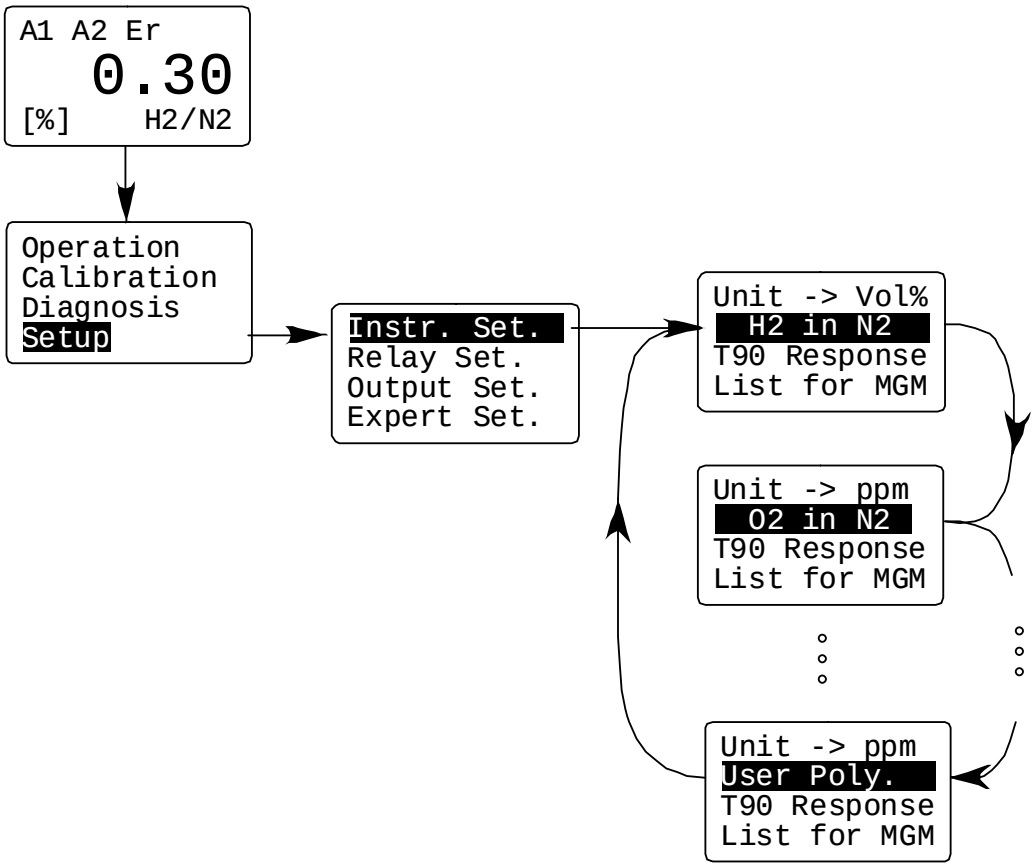


Figure 8.2 Measuring Gas Setup Menu

In the second line in the “Instrument Setup” indicates the currently measured binary gas mixture.
For devices with Multi-Gas-Mode (MGM) pressing <ENTER> changes to the next binary gas mixture included in the device. Up to 16 binary gas mixtures can be included.

For every binary gas mixture the corresponding set of linearization parameters and a set of calibration values is automatically used.
The settings of relays, the scaling of the analog outputs and the measuring range do not change when using a different binary gas mixture.

8.1.3 Response Time Setup

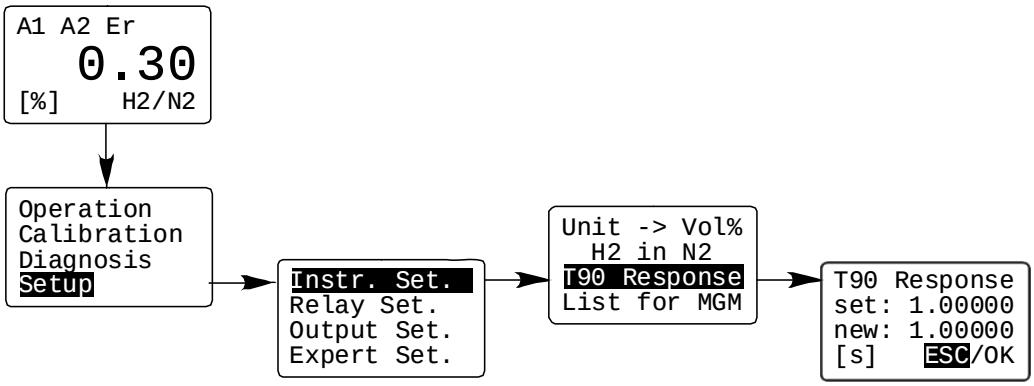


Figure 8.3 Response Time Menu

In the menu “T90 Response” the response time of the exponential filter is adjusted. This filter reduces the influence of fast variations of the raw signal. The numerical entry gives value in seconds. The range between 0s and 100s is permitted for this value, reasonable values lie between 0.5s to 10s.

Setting “T90 Response” to 0.0 turns off the exponential filter.
The true response time is influenced by the gas exchange time which depends on the pneumatic installation and flow rate of measuring gas. A gas flow of 80l/h leads to a gas exchange time of under 0.5s measured from the gas inlet of the device.

8.1.4 Multi Gas Mode List (useful with Option MGM only)

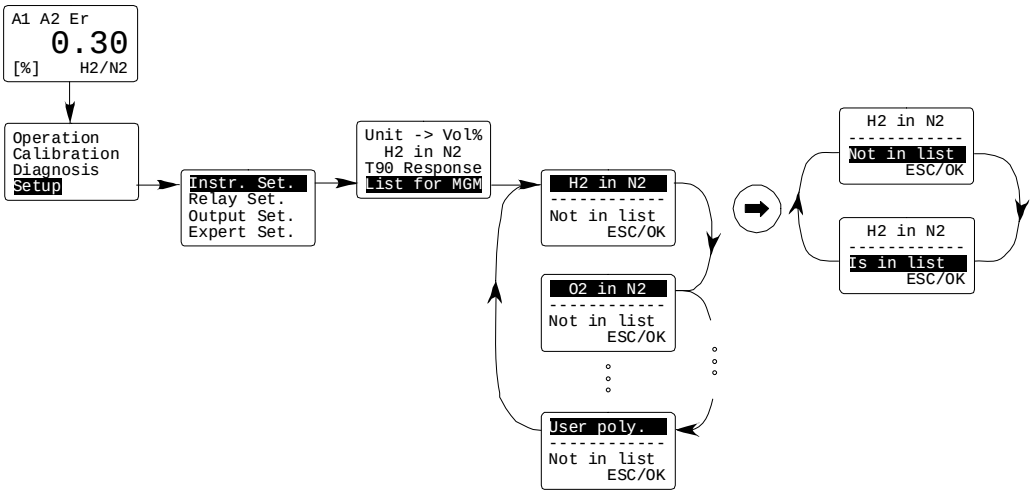


Figure 8.4 Multi-Gas-Mode Menu

Devices supporting the Multi Gas Mode (MGM) can measure in succession up to 16 different binary gas mixtures that are selected after the customers wish at purchasing order.
From the list of all available binary gas mixtures, a short list for the short-key access from the operational screen can be edited, further called “List for MGM”.
Binary gas mixtures can be added to or removed from the “List for MGM”; gas mixtures labelled with “Is in list” are included in the short list, “Not in List” if this is not the case.
The binary gas mixture to be added or removed to or from the list is selected with the <UP>. The <RIGHT>key changes to the third display line, where the <ENTER> key switches between “Is in list” and “Not in List”. Press <RIGHT> to select “OK” to confirm the selection.

Using the Multi Gas Mode list (MGM list)
For devises with MGM the MGM list can be accessed from the operation screen by pressing the <RIGHT> key. This is indicated by the active gas mixture. By pressing <ENTER> the next binary gas mixture from the “List for MGM” is selected.
Pressing <RIGHT> again deactivates the gas mixture selection.

8.2 Relays

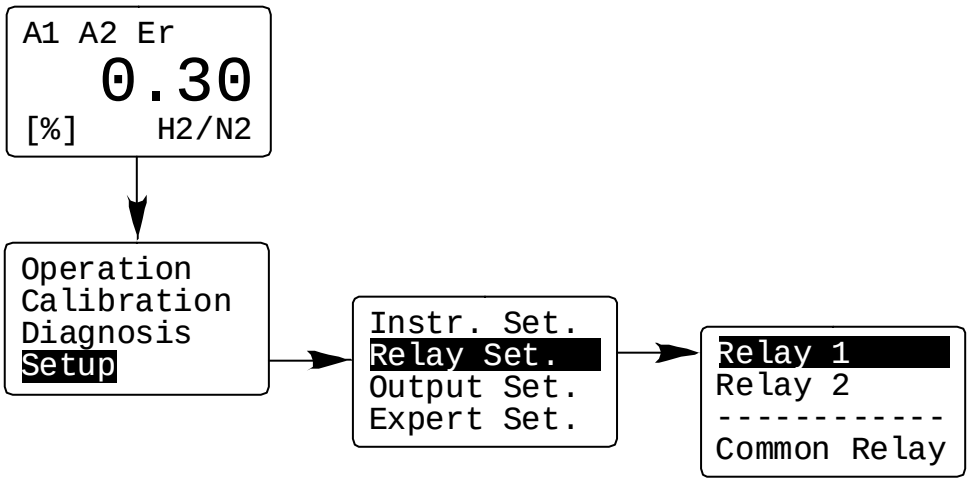


Figure 8.5 Relays Menu

The menu “Relay Setup” gives access to the configuration of the two process alarm relays “Relay 1“, “Relay2” and the status alarm relay “Common Relay”. The thresholds and hysteresis for “Relay 1” and “Relay 2” can be set. The status relay indicates a malfunction of the device, but can also indicate the threshold alarms.
Each relay may be configured as failsafe or not failsafe.

The threshold relays are indicated by “A1” respectively “A2” in the first display line.

The common relay is indicated by “Er” in the first display line and by the flashing red LED on the front panel.

8.2.1 Relay 1 Mode

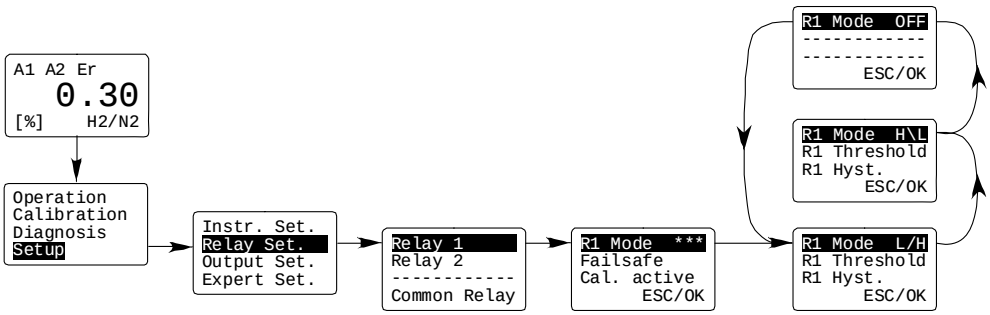


Figure 8.6 Relays R1 Mode Menu

Relay 1 can be operated in different modes described below. Selecting “Relay 1” and pressing <ENTER> gives access to the different modes.

1) “R 1Mode L/H” signalling from low to high
   When the measured concentration increases and reaches the threshold,

the alarm is triggered. When the measured concentration decreases again below the threshold, the alarm is only reset if the value decreases below the threshold minus the hysteresis given in “R1 Hysteresis”. The hysteresis is specified in percent of threshold.

2) “R 1Mode H/L” signalling from high to low
   When the measured concentration decreases and reaches the threshold, the alarm is triggered. When the measured concentration increases again above the threshold, the alarm is only reset if the value increases above the threshold plus the hysteresis given in “R1 Hysteresis”. The hysteresis is specified in percent of threshold
3) “R 1Mode OFF”
   Relay 1 is not used.

8.2.2 Relay 1 Threshold

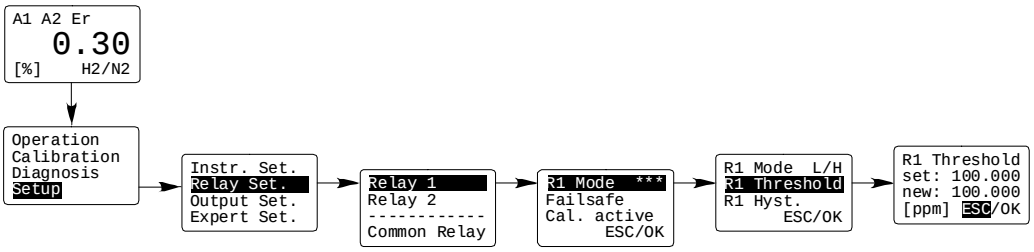


Figure 8.7 Relay 1 Threshold

In the “R1 Threshold” menu the threshold value is set. The value is denotes in the currently used measuring unit (ppm in this case). Confirm with “OK”.

The threshold is independent from the measuring range.

8.2.3 Relay 1 Hysteresis

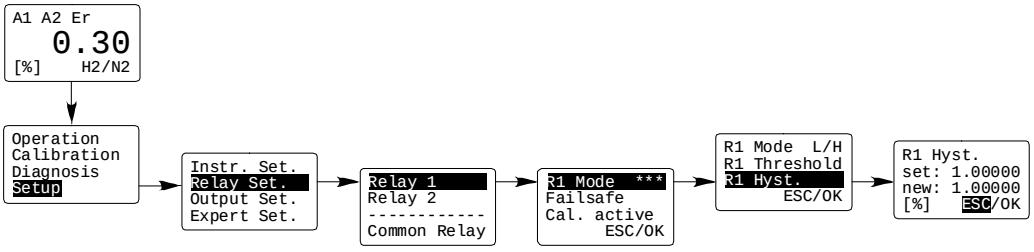


Figure 8.8 Relay 1 Hysteresis Menu

In the “R1 Hysteresis” menu the hysteresis value is set. The value is given in percent of the threshold value. Confirm with “OK”.

8.2.4 Relay 1 Failsafe / Not failsafe

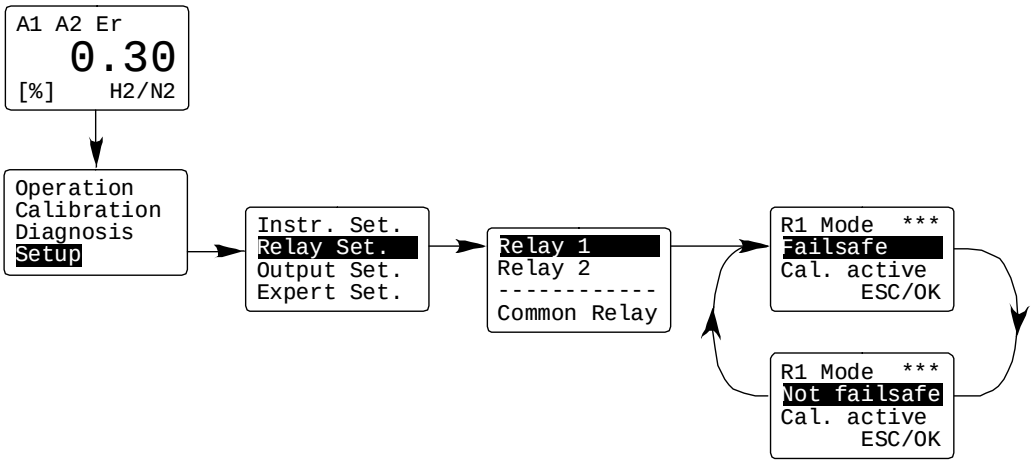


Figure 8.9 Process Alarm Failsafe / Not failsafe

The threshold alarms can be configured as “Failsafe” or “Not Failsafe”. “Failsafe” means that the relay is live with no error pending. Hence, the alarm is indicated if the threshold is reached or if the closed-circuit contact is interrupted.
“Not Failsafe” means that the relay is open with no error pending and closes when an error appears.
Press <ENTER> to switch between “Failsafe” and “Not Failsafe”. The change is made effective by pressing <RIGHT> three times to mark “OK” and confirm with <ENTER>.

8.2.5 Relay 1 active/frozen during Calibration

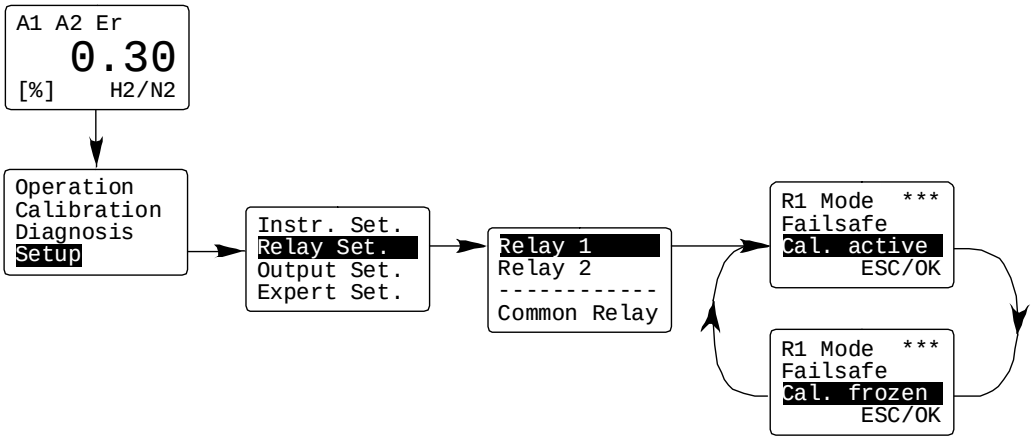


Figure 8.10 Relay 1 active/frozen during calibration

The relay can be configured as “Calibration active” or “Calibration frozen”. With “Calibration frozen” the relay does not respond to any changes of the measured concentration during the calibration procedure and stays in the state it was in when the calibration began. With “Calibration active” the

relay acts according to its current settings during calibration.
Press <ENTER> to switch between “Calibration frozen” and “Calibration active”. The change is made effective by pressing <RIGHT> two times to mark “OK” and confirm with <ENTER>.

8.2.6 Relay 2 Mode

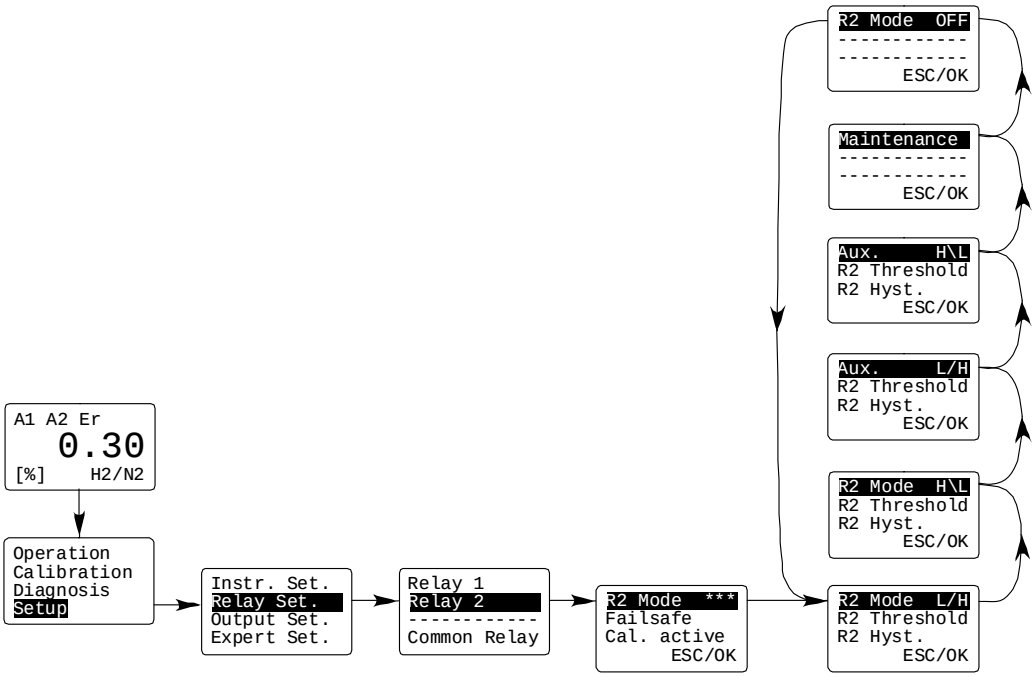


Figure 8.11 Relay 2 Mode Menu

“Relay 2” provides all functionalities of“Relay 1”, see description above. In addition Relay 2 permits the external signaling of the “Maintenance” alarm or monitoring the external auxiliary signal with the menu “Aux.”.

8.2.7 Common Relay

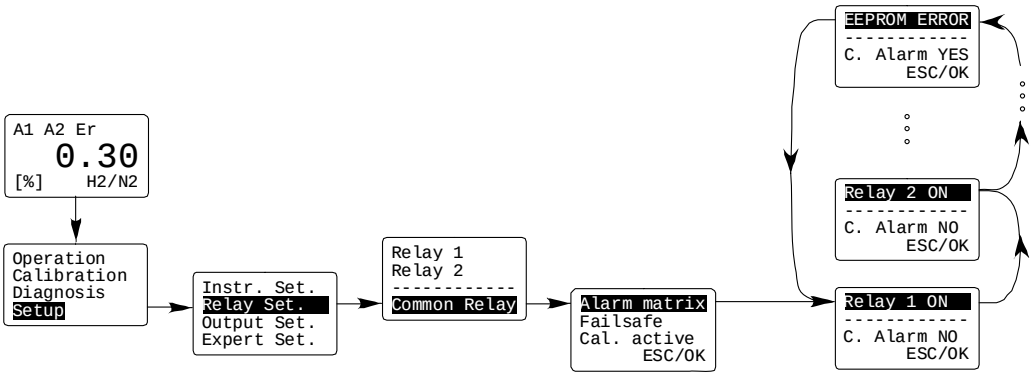


Figure 8.12 Common Relays Menu

In the “Common Relay” menu based on the following errors is defined:

- threshold alarms from relay 1 und 2
- external error
- internal errors (see Appendix A for a detailed description)

The menu “Alarm matrix” opens the list of errors that can be included in the common relay. Scroll forward through the list with <ENTER> and backwards with <UP>. The third display line indicates whether this error is included in the common (“C. Alarm YES”) relay or not (“C. Alarm NO”). Press <RIGHT> to proceed to the third display line press <ENTER> to switch between“C. Alarm YES” and “C. Alarm NO”. Confirm with “OK”.
If one or more of errors included in the Alarm matrix by “C. Alarm YES” are pending, the common relay triggers.

In the factory settings all internal errors described in Appendix A are included in the common relay.

8.3 Analog Output Setup

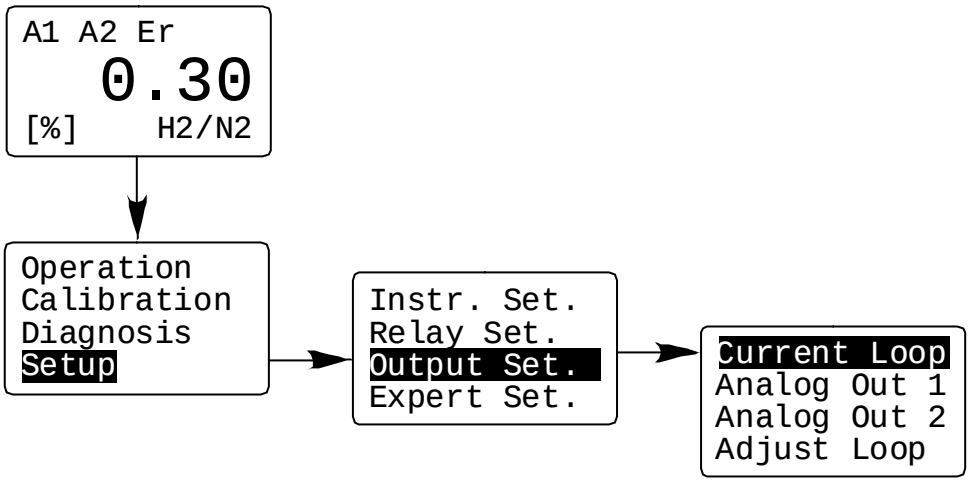


Figure 8.13 Output Setup

The FTC300 is equipped with three analog outputs. “Current Loop” is an isolated current output. “Analog Out 1” and “Analog Out 2” are not DC-isolated outputs with an output range from 0 to 10 V.

8.3.1 Current Loop

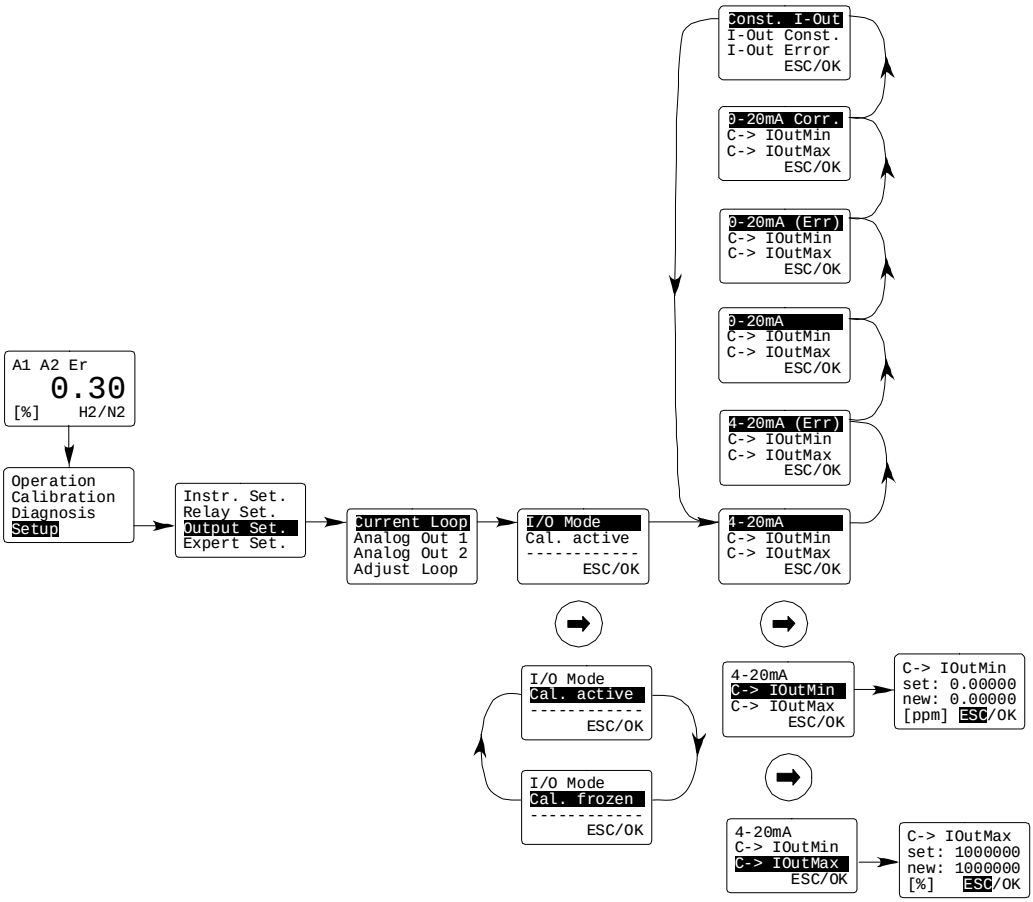


Figure 8.14 Current Loop Set Up

In the “Current Loop” menu the range of the current output and the behavior of the current loop during calibration and in case of an error are defined.
Press <RIGHT> to scroll through the list of the different modes. Select “OK” and confirm with <ENTER> to confirm the selection of the mode.

Current loop output modes:

“I/O Mode” “4-20mA”
The loop current ranges from 4mA to 20mA. 4mA correspond to the starting point of the measuring range as defined in “IoutMin”, 20mA correspond to the starting point of the measuring range as defined in “IoutMax”.

“I/O Mode” “4-20mA (Err)”
This mode works in the analogous manner as the previously described mode. In case of an error the current output is set to the value specified in the submenu “I-Out Error”.

“I/O Mode” “0-20mA”
The loop current ranges from 0mA to 20mA. 0mA correspond to the starting point of the measuring range as defined in “IoutMin”, 20mA correspond to the starting point of the measuring range as defined in “IoutMax”.

“I/O Mode” “0-20mA (Err)”
This mode works in the analogous manner as the previously described mode. In case of an error the current output is set to the value specified in the submenu “I-Out Error”.

“I/O Mode” “0-20mA (Corr.)”
The current output of this mode creates a voltage drop from 0V to 10V at a 510 Ohm resistor. (Correction factor: Parameter 73)

“Const. I-Out”
The output of the current loop is constant current specified in the submenu “I-Out Const”. Set the value to 0.0mA if the current loop is not used.

The current specified for signalling errors should be outside the measuring range. By default the error current is set to 3.0mA, values up to 22.0mA can be set.

When choosing the “Cal. active” option the currently measured value is shown at the current output during the calibration. When choosing the “Cal. frozen” the last measured value before the calibration began is shown at the current output.

8.3.2 Analog Output 1

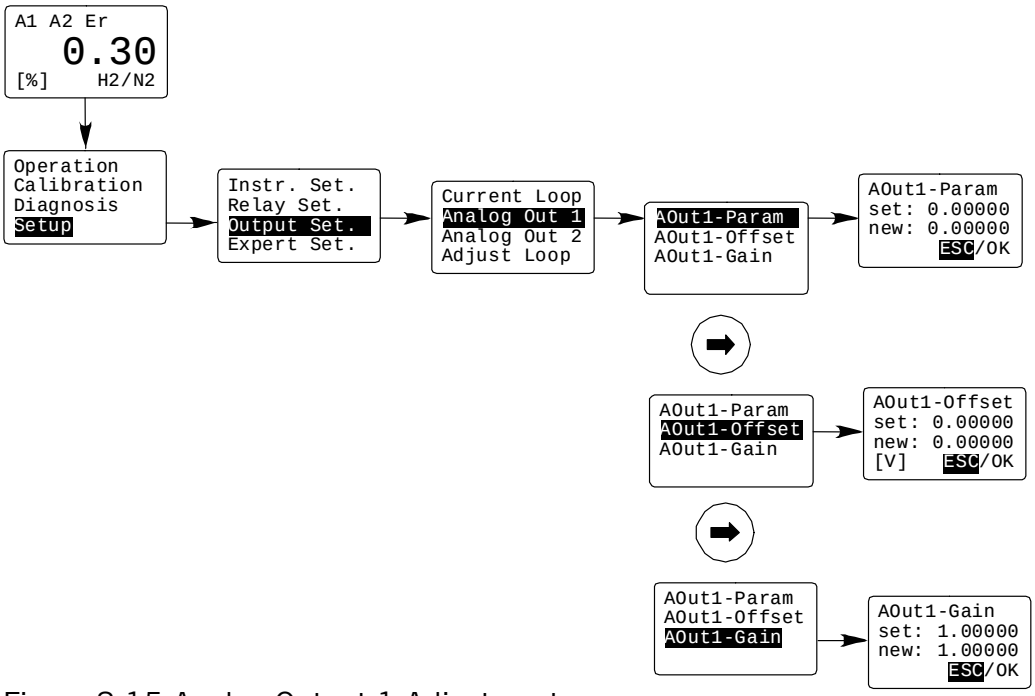


Figure 8.15 Analog Output 1 Adjustment

“Analog Out 1” is a non DC-isolated 0 to 10V output. The maximum load is 1kOhm.
The following parameters can be routed to “AOut-Parameter “:

Value	Param. No.	Param. Name	Description
0	-	-	No output
1	P0	Compound ppm	Measuring signal in ppm
2	P1	Compound raw	Linearized raw signal in ppm
3	P2	Norm. signal	Normalized measuring signal
4	P3	TC average	Thermal Conductivity in mV
5	P53	Block Temp	Block Temperature
6	P133	Aux ppm	Linearized and calibrated signal in ppm of the raw signal applied to analog input 1
7	P134	Aux norm.	Normalized signal applied to analog input 1
8	P67	IOut	Current Loop

“AOut1-Offset” and “AOut-Gain” allow to scale the analog output according to a linear equation (Output= AOut1-Gain*signal+AOut1_Offset).

8.3.3 Analog Output 2

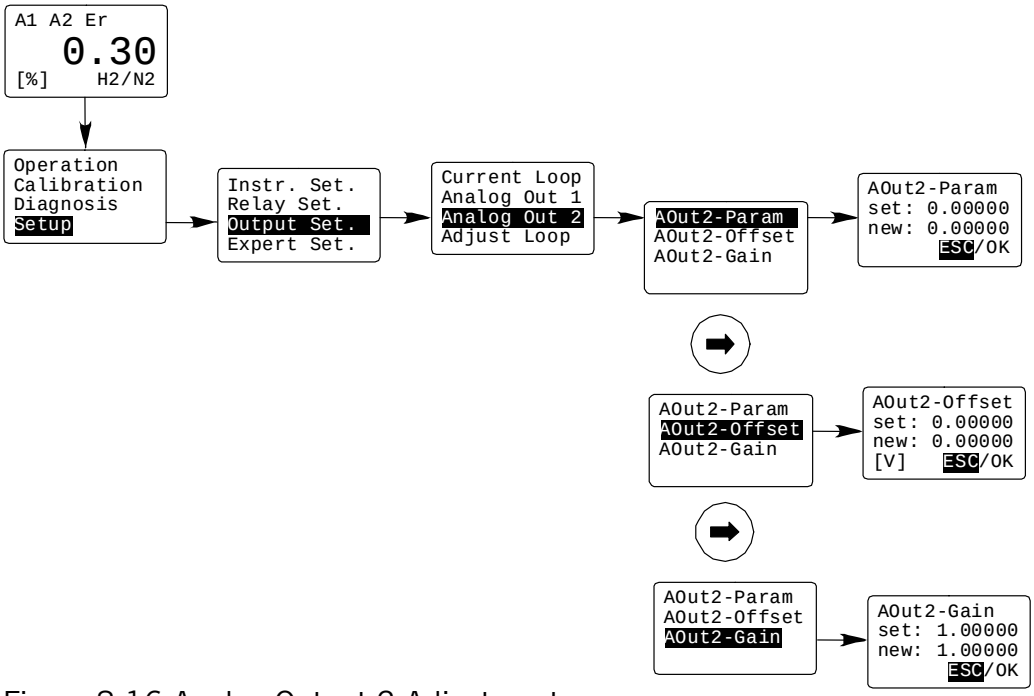


Figure 8.16 Analog Output 2 Adjustment

All “Analog Out 2” settings are made as described for “Analog Out 1”.

8.3.4 Adjust Loop

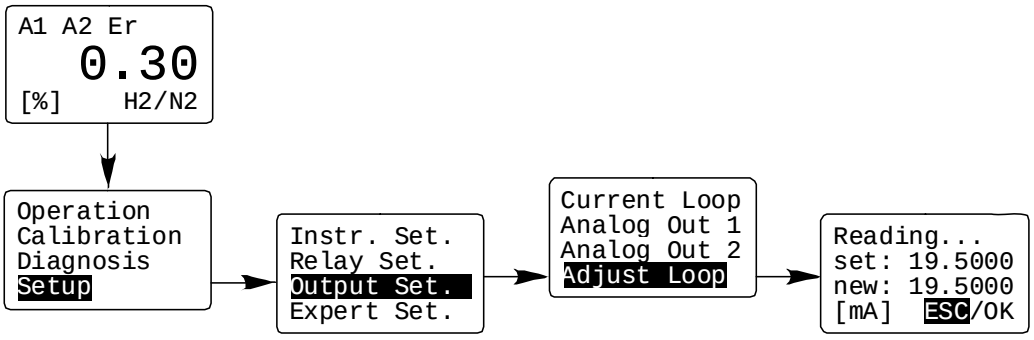


Figure 8.17 Adjust Loop

In the menu “Adjust Loop“ the current loop can be calibrated. Opening the menu “Adjust Loop” set the current loop output to 19.500mA. Measure the resulting current at the output (e.g. with a multimeter) and enter the measured value in the third display line, then confirm with “OK” and <ENTER>. After successful adjustment the multimeter shows the value of 19.5mV.

8.4 Expert Setup

The Expert Setup provides a couple of functionalities that should only be used by an advanced user or expert.

- set parameters
- reset of the FTC300 to factory settings
- changing “Operator Code” and “Expert Code”
- swap between “Normal Mode” and “Safety Mode”
- Simulation of alarm and voltage outputs

This level is for advanced users or experts and should not be entered by normal operators. It is in the expert’s responsibility to set the parameters properly. The default expert code is “222.000”.

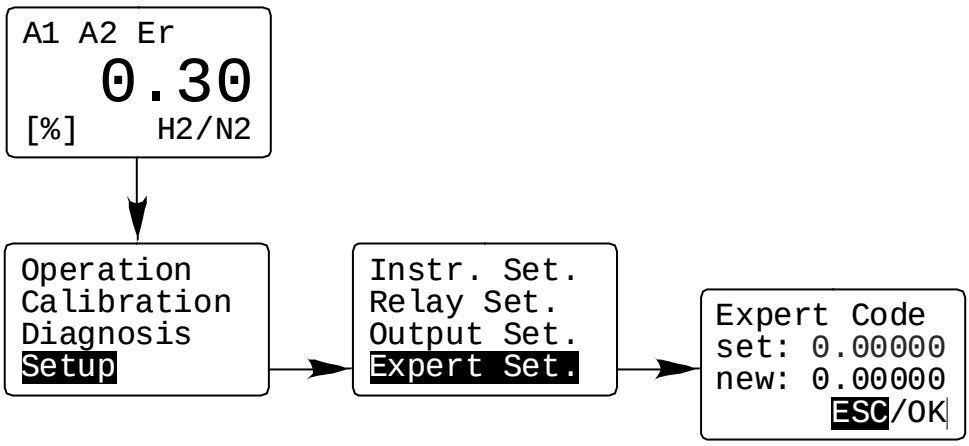


Figure 8.18 Expert Level Entry

8.4.1 Parameter

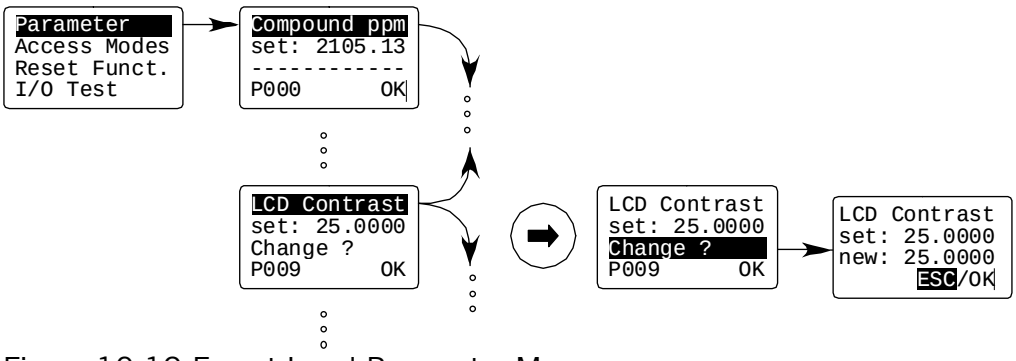


Figure 10.19 Expert Level Parameter Menu

The configuration of the FTC300 is represented by a set of about 170 parameters. These parameters govern all settings and functions of the device. Press <ENTER> to scroll forward through the list and backwards by pressing <UP>.
Some parameters cannot be changed (e.g. “Compound ppm”, see Figure

above) other can be changed (e.g. “LED Contrast”, see Figure above). All changeable parameters are indicated by “Change?” in the third line.
Enter the new number in the numerical submenu, mark “OK” and confirm with <ENTER>.

Note!
Setting the parameter to improper values cause a failure of the entire device.

8.4.2 Access Modes

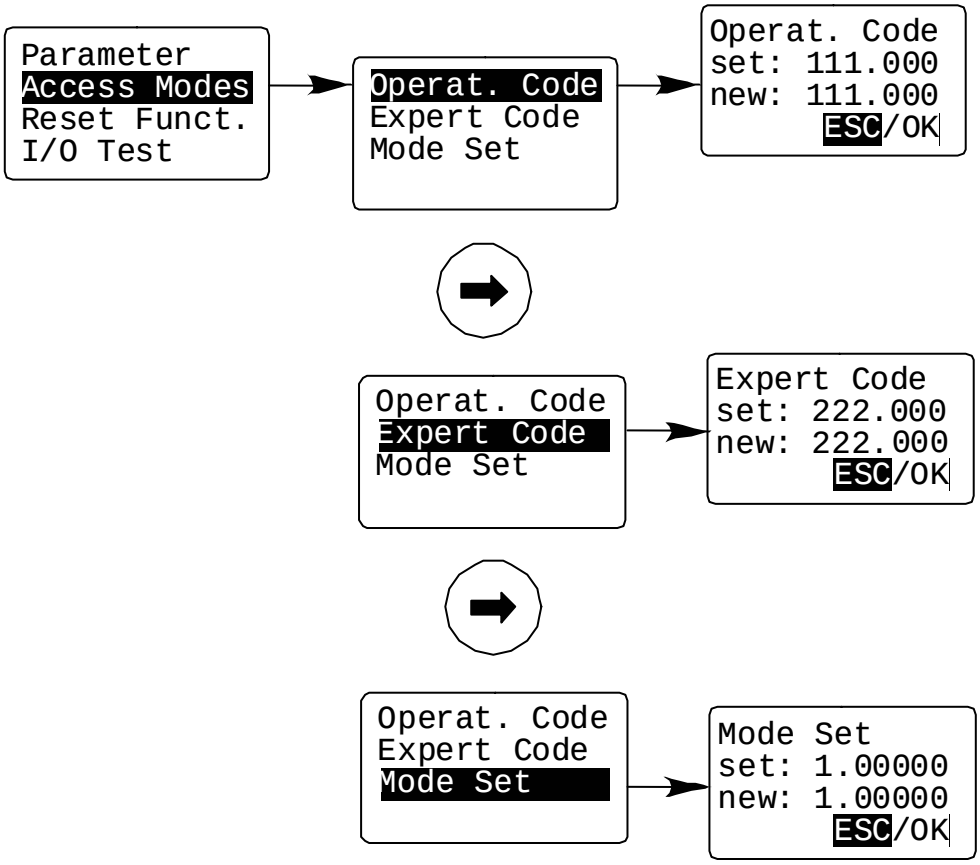


Figure 8.20 Expert Level Access Modes Menus

This menu allows to change codes for the “Operator Code” and the “Expert Code”.
Further, the device can be switched between “Safety Mode” and “Operation Mode”. The operation mode is used with the setting “1.00000” in the menu “Mode Set” and “3.00000” for the safe mode. Each change in this mode requires the manual input of the actual Operator Code.

8.4.3 Reset Functions

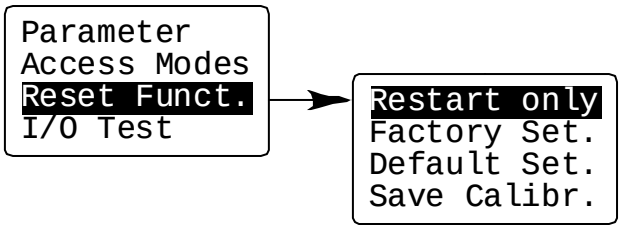


Figure 8.21 Expert Level Reset Functions Menus

This menu provides three reset functions and the possibility to save the current calibration parameters to the Factory Settings.

Restart only:	Restart of the software
Factory Set.:	Resets all parameters to the factory set values
Default Set.:	Resets all parameters to the default set values. CAREFUL: These values are not suited for a properly working device.
Save Calibration:	Saves the parameters relevant to calibration. They can be retrieved by “Factory Set.”

If a rest to Factory Settings was performing without saving the calibration parameters beforehand a new calibration might be necessary.

When the device is reset to “Default Setting” the parameters relevant for the proper operation are overwritten by default values. With these values the device will not work. The correct parameters (contact Messkonzept) have to be written to the device again, see chapter 8.4.1 or the manual of SetApp under www.messkonzept.de

8.4 .4 Test of Relays, Analog Outputs and Connections

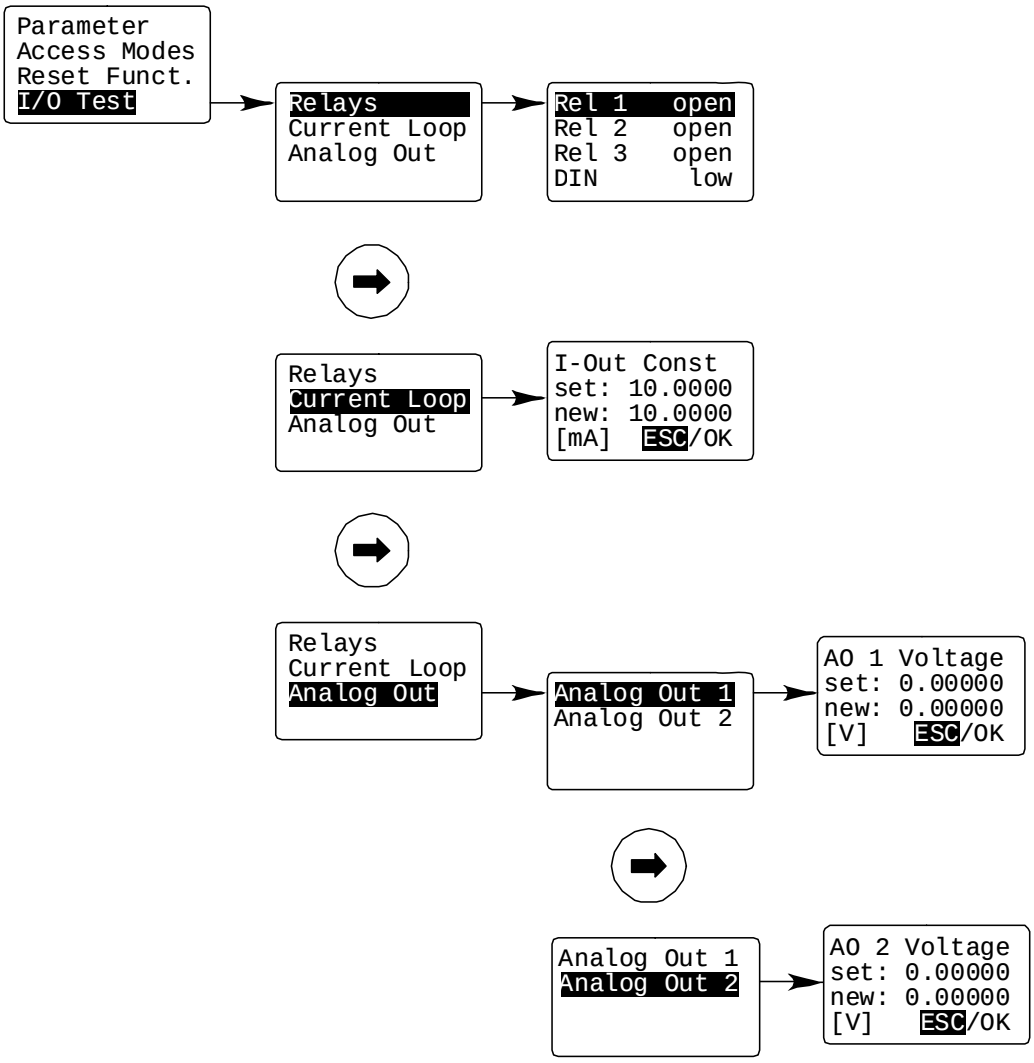


Figure 8.22 Analog I/O Test

The “I/O Test” menu provides the opportunity to set the following properties to a defined status in order to test subsequent connected equipment:

- Relay 1 (Rel 1) (open/closed)
- Relay 2 (Rel 2) (open/closed)
- Common Relay (Rel 3) (open/closed)
- Current of current loop
- Voltage for Analog Out 1
- Voltage for Analog Out 2

The digital input “DIN” is “low” for voltages below 4.6V and “high” above 11.4 V. The output “Current Loop” can be set to currents between 0 and 22mA. The analog outputs 1 and 2 can be set to supply a voltage between 0V and 10V.

Note!
All test signals are permanently on until leaving the “I/O Test” menu. It is the responsibility of the expert to assure that the I/O test does not interfere with the subsequent connected systems and processes in an unintended way.

Appendix A System Errors

Displayed label	*Cause*	*Default range*	*corrective measure*
EEPROM ERROR	Error reading or writing data to or from internal FLASH-EEPROM	-	Repeat procedure. If the error persists, send the device to Messkonzept with description of error.
CAL GAIN ER	Calibration gain exceeding max. allowed range	0.5-1.5	Check if the used test gas concentration accords with the set concentration. Repeat procedure. If the error persists, send the device to Messkonzept with description of error.
CAL OFFS ER	Calibration offset exceeding max. allowed range	100 mV	Check if the used test gas concentration accords with the set concentration. Repeat procedure. If the error persists, send the device to Messkonzept with description of error.
CAL DEV ER	Calibration deviation exceeding max. allowed range	50000 ppm	Check if the used test gas concentration accords with the set concentration. Repeat procedure. If the error persists, send the device to Messkonzept with description of error.
CAL VAR ER	Calibration variation exceeding max. allowed range	1000ppm	Check if the used test gas concentration accords with the set concentration. Repeat procedure. If the error persists, send the device to Messkonzept with description of error.
BT MIN ER	Block temperature below specified range	SetTemp–0.3°C	The device still warms up or a sudden change of ambient temperature, gas flow disturbed the temperature control loop. Wait for a couple of minutes.

			The device is used outside the specified ambient temperature or gas temperature range. Consider the specifications. If the error persists, send the device to Messkonzept with description of error.
BT MAX ER	Block temperature above specified range	SetTemp +0.3°C	The device still warms up or a sudden change of ambient temperature, gas flow disturbed the temperature control loop. Wait for a couple of minutes. The device is used outside the specified ambient temperature or gas temperature range. Consider the specifications. If the error persists, send the device to Messkonzept with description of error.
BU MIN ER	Bridge voltage below specified range	1V	Send the device to Messkonzept with description of error.
BU MAX ER	Bridge voltage above specified range	11V	Send the device to Messkonzept with description of error.
TC MIN ER	WLD-signal below specified range	500mV	Send the device to Messkonzept with description of error.
TC MAX ER	WLD-signal above specified range	7000mV	Send the device to Messkonzept with description of error.
EXT. ERROR	Error routed from input “DIN” (0V=no error, +24V=error)	Signal >14V	Check the external unit surveyed by the external error.

Appendix B Specifications

B.1 Performance

Linearity	< 1% of range
Warm up time	Approx. 20min; up to 1h for small ranges
Flow rate	10l/h-150l/h, recommended 60l/h to 80l/h
T90-time	<1sec at flow rate higher 60l/h (or user selected)
Noise	< 1% of smallest range
Drift at zero point	< 2% of smallest range per week
Repeatability	< 1% of range
Error due to change of ambient temperature	< 1% of smallest range per 10°C
Error due to change of flow at 80l/h	< 1% of smallest range per 10l/h
Gas pressure	Max. 2000kPa (20 bar)
Error due to change of pressure (>800hPa)	< 1% of smallest range per 10hPa

B.2 Electrical

Display:	128 x 64 dot graphic LCD display	
Keypad:	3x membrane covered push-buttons	
Analog Input :	Non isolated	
	Voltage range:	0 to 10V
	Input resistance:	Approx. 50 kOhm
	Resolution:	24 bit
Current Loop:	Linearized 0/4 to 20 mA	User selectable
	Fully floating:	±500V to ground (max.)
	Load:	800 Ohm (max.)
	Resolution:	16 bit
Analog Output 1/2:	Non isolated	
	Voltage range:	0 to 10V
	Load:	1000 Ohm (min.)
	Resolution:	16 bit
Relay 1/2/3:	Isolated contact	
	Maximum Voltage:	36V
	Maximum Power:	10W
	Typ. Number of Switches:	10^7
Power Supply:	Voltage range:	18V to 36V DC
	Max. Current:	700mA
	Typical Current:	300mA
Interface:	RS-232	
	Baud rate:	19.2 kbaud
	Data:	8 bit
	Parity:	None
	Stop:	1
	Flow control:	None

B.3 Environmental conditions

Operating temp.:	-20°C to 50°C (-4 to 122°F) or -5°C to 50°C (23 to 122°F) glass balls filled version
Storage temp.:	-25°C to 70°C (-15 to 160°F) (not-condensing)
Vibration:	10 to 150Hz (2g peak)
Protection class:	IP 65

B.4 Dimensions

Dimensions:	Depth:	85mm
	Width:	145mm
	Height:	80mm without connectors
	Weight:	Max. 1800g
Mounting:	Wall mounting	

Appendix C EG-Konformitätserklärung

Anhang C

Der Produkt FTC 300 ist eine Weiterentwicklung des FTC 200. Mit Ausnahme des neuen Bedienpanels ist der FTC300 in allen die elektromagnetische Verträglichkeit betreffenden Bauteilen, Leitungsführungen und Abschirmungen baugleich mit dem FTC200.
Das neue Bedienpanel wurde einer eine Prüfung nach EN 61000-4-2 mit elektrostatischer Entladung unterzogen. Dabei wurde ein Static Discharge Simulator NSG 430 der Firma Schaffner mit Entladungen bis zu 8kV eingesetzt.
Es zeigte sich kein Einfluss auf das Gerät. Damit ist die Prüfung bestanden.
Die EG-Konformitätserklärung bezieht sich auf die EMV-Prüfung des Produkts FTC 200, sowie auf die Nachprüfung des Bedienpanels.

Der elektrostatische Entladungstest wurde durchgeführt von I. Kaufman.

Frankfurt, den 10.06.2014 Prüfingenieur:

EG-Konformitätserklärung

Firma: Messkonzept GmbH

Niedwiesenstr. 33
D-60431 Frankfurt

erklärt hiermit, dass das Produkt:

Analysator FTC 300

mit den Anforderungen folgender EG-Richtlinien:

2004/108/EG, EMV-Richtlinie

übereinstimmt.

Der Nachweis der Übereinstimmung mit den genannten Richtlinien erfolgt durch Anwendung folgender Europäischer Normen:

EN 61326-1:2006
(Einzelheiten sind dem Anhang zu dieser Erklärung zu entnehmen)

Frankfurt, den 10.06.2014

Prüfingenieur: _____

Geschäftsführer: _____

Diese Erklärung bescheinigt die Übereinstimmung mit den Anforderungen der genannten Richtlinien, beinhaltet jedoch keine Zusicherung von Eigenschaften im rechtlichen Sinne.
Die Sicherheits- und Einbauhinweise der Produktdokumentation sind zu beachten.

zur EG-Konformitätserklärung des Analysators FTC 300

Der Nachweis der Übereinstimmung mit den genannten Richtlinien erfolgt durch Anwendung folgender Europäischer Normen:

EN 61326-1:2006: Elektrische Betriebsmittel für Leittechnik und Laboreinsatz – EMV-Anforderungen:

Angewendet werden die Anforderungswerte aus folgender Tabelle:

Tabelle 2: Prüfanforderungen und Ergebnissen für Geräte für den Gebrauch in industriellen Bereichen.

Anschluss	Störphänomen	Referenznorm	Prüfwert	Prüfergebnis
Gehäuse	elektrostatische Entladung	EN 61000-4-2	4kV/8kV,Kontakt/Luft	kein Einfluss
	elektromagnetische Felder	EN 61000-4-3	10V/m,80-1000MHz, 80%AM	max. Einfluss $\leq$1% kleinste MBU*
DC-Versorgungs-anschluss	Schnelle Transienten	EN 61000-4-4	1kV	kein Einfluss
	Stossspannungen	EN 61000-4-5	0,5kV (L-L);1kV (L-G)	kein Einfluss
	leitungsgeführte HF-Signale	EN 61000-4-6	10V, 0,15-80MHz, 80%AM	max. Einfluss $\leq$0,5% kleinste MBU*
Eingang / Ausgang Signal/Steuerung	Schnelle Transienten	EN 61000-4-4	0,5kV	kein Einfluss
	Stossspannungen	EN 61000-4-5	1kV (L-G)	Leitungslänge begrenzt
	leitungsgeführte HF-Signale	EN 61000-4-6	10V	max. Einfluss $\leq$0,7% kleinste MBU*

* Kleinste Messbereichumfang (MBU) für die Messung von H2 in N2 von 0,5Vol% ist zugrunde gelegt.

Die Ermittlung der Störaussendungsgrenzwerte basiert auf folgende Norm:

EN 55011:2009: Industrielle, wissenschaftliche und medizinische Geräte – Funkstörungen – Grenzwerte und Messverfahren (IEC/CISPR 11:2009, modifiziert)

Tabelle 5: Grenzwerte für die elektromagnetische Störstrahlung von Geräten der Klasse B, Gruppe 1, die auf einem Messplatz gemessen werden
(schließt die Störaussendungsgrenzwerte für Betriebsmittel der Klasse A, Tabelle 3, ein)

Anschluss	Frequenzbereich [MHz]	Grenzwerte Quasispitzenwert	Referenznorm	Prüfergebnis
Gehäuse	30-230	30dB(μV/m)	EN 55022	Erfüllt**
	230-1000	37dB(μV/m)	EN 55022	Erfüllt**

** 20dB unter Grenzwerte Quasispitzenwert

Untersuchtes Prüfmuster:	FTC 200, Stand 12-2011
Prüfort/-zeit:	EMV-Prüflabor, BIS Prozesstechnik GmbH, Frankfurt-Höchst, KW 49-2011, KW04-2012
Prüfer:	Dipl.-Phys. H. Hahn, Quality-Engineering Hahn (Ingenieurbüro), Frankfurt

Appendix D Menu Tree

```
Operation
Calibration
        |_Calibrate
        |_Offset Gas
        |_Gain Gas

Diagnosis
        |_Parameter
        |_Errors

Setup
        |_Instr. Setup
        |       |_Unit ->Vol%/Unit->ppm
        |       |_Gas1 in Gas2
        |       |_T90 Response
        |       |_List for MGM
        |
        |_Relay Setup
        |       |_Relay 1
        |       |       |_R1 Mode
        |       |               |_R1 Mode Low/High; High/Low; OFF
        |       |               |_R1 Threshold
        |       |               |_R1 Hyst.
        |       |
        |       |_Relay 2
        |       |       |_R2 Mode
        |               |       |_R2 Mode/Aux; Low|High; High|Low; Maintnance;
OFF
        |       |       |       |_R2 Threshold
        |       |       |       |_R2 Hyst.
        |       |       |
        |       |       |_Failsafe/Not Failsafe
        |       |       |_Cal. active/frozen
        |       |
        |       |_Common Relay
        |               |_Alarm Matrix
        |               |_Failsafe/Not Failsafe
        |               |_Cal. active/frozen
        |
        |_Output Set.
        |       |_Current Loop
        |       |       |_I/O Mode
        |       |       |       |_4-20mA
        |       |       |       |       |_C->IoutMin
        |       |       |       |       |_C->IoutMax
        |       |       |       |
        |       |       |       |_4-20mA (Err)
        |       |       |       |       |_C->IoutMin
        |       |       |       |       |_C->IoutMax
        |       |       |       |
```

```
|       |       |       |_0-20mA
|       |       |       |       |_C->IoutMin
|       |       |       |       |_C->IoutMax
|       |       |       |
|       |       |       |_0-20mA (Err)
|       |       |       |       |_C->IoutMin
|       |       |       |       |_C->IoutMax
|       |       |       |
|       |       |       |_0-20mA Corr.
|       |       |       |       |_C->IoutMin
|       |       |       |       |_C->IoutMax
|       |       |       |
|       |       |       |_Const. I-Out
|       |       |               |_C->IoutMin
|       |       |               |_C->IoutMax
|       |       |
|       |       |_Cal. active/frozen
|       |
|       |_Analog Out 1
|       |       |_AOut1-Param
|       |       |_AOut1-Offset
|       |       |_AOut1-Gain
|       |
|       |_Analog Out 2
|       |       |_AOut2-Param
|       |       |_AOut2-Offset
|       |       |_AOut2-Gain
|       |
|       |_Adjust Loop
|
|_Expert Setup
        |_Parameter
        |_Access Modes
        |       |_Operat. Code
        |       |_Expert Code
        |       |_Mode Set
        |
        |_Reset Funct.
        |       |_Restart only
        |       |_Factory Set.
        |       |_Default Set.
        |       |_Save Calibr.
        |
        |_I/O Test
        |_Relays
                        |_Rel 1 open/closed
                        |_Rel 2 open/closed
                        |_Rel 3 open/closed
                        |_DIN low/high
```