



Instruction Manual
ExTox Integral Measuring Concepts
IMC-8 and IMC-4

Foreword

We thank you very much for your confidence in our products and us, the ExTox Gasmess-Systeme GmbH.

The Integral Measuring Concepts of the IMC Series as well as all other ExTox-Products and services stand for our high quality targets. Our business is the health protection of mankind, protection of the environment and installations. We are glad to take this responsibility. Our Quality Management System therefore follows ISO 9001 and our Production Monitoring is to keep the European Directives 94/9/EC ("ATEX"). You profit of the high reliability due to modern sensor techniques and consequent interpretation acc. to the requirements of the regulations and standards valid for industrial application.

The Integral Measuring Concepts serve for monitoring gas concentrations in sealed off processes or not accessible areas. The IMC Series combines all necessary components in one compact wall mounted housing – from sampling and preparation of measured gas, sensor technique and evaluation. The modular construction leads to a high adaptation to the different applications, such as for example land fill gas measurement or bio gas facilities.

Reliable and permanent application as well as easy maintenance has been important development targets.

The IMC Series can be equipped with all ExTox-Transmitters ExSens(-I) and Sens(-I).

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1 Introduction


This Instruction Manual generally describes operation, installation and maintenance of the following ExTox-Products:

Continuous Measurement	Article ¹
IMC-8D (k) ²	420106
IMC-8DA (k)	420107
IMC-4D (k)/(m)/(g)	420108 (k), 420114 (m), 420110 (g)
IMC-4DA (k)/(m)/(g)	420109 (k), 420115 (m), 420111 (g)

Biogas-Application	Article
IMC-8D-Biogas2 (k)/(g)	430106 (k), 430114 (g)
IMC-8DA-Biogas2 (k)/(g)	430107 (k), 430115 (g)
IMC-4D-Biogas2 (k)/(g)	430108 (k), 430120 (g)
IMC-4DA-Biogas2 (k)/(g)	430109 (k), 430121 (g)
With exchangeable transmitter module:	
IMC-4M-Biogas2 (m)	430116
IMC-4MA-Biogas2 (m)	430117

Biogas-KAT-Application	Article
IMC-8D-KAT (g)	430112
IMC-8DA-KAT (g)	430113
IMC-4D-KAT (m)	430110
IMC-4DA-KAT (m)	430111
With exchangeable transmitter module:	
IMC-4M-KAT (m)	430118
IMC-4MA-KAT (m)	430119

All herein described installations or options may not consequently form part of your type of Integral Measuring Concept IMC. Type specific data of your IMC should be taken from the drawings "Gas flow", "Connection Scheme", "Terminal Assignment" and "Mounting plate". The set of drawings forms part of the written documentation and is on delivery also attached to each system.

Type specific data for each device should be taken from a corresponding separate and specific Data Sheet. This Data Sheet forms consequently part of this Instruction Manual. References on the Data Sheet within this text are marked with  DB.


IMC types use control units of the Series ET-8D and ET-4D2. Configuration, operation and maintenance are described in the enclosed Instruction Manual of the Series ET-8D and ET-4D2.

You will find details regarding every transmitter being installed in your IMC in a separate documentation which has also been prepared individually for your IMC.

Please read this Instruction Manual carefully before installation and initial operation. We kindly ask you to pay attention to all details and cross-references.

We kindly ask you not to repair the IMC or to perform any changes which go beyond the measures described herein. Otherwise you endanger your own safety and your warranty claims of merchantability. In such cases please contact ExTox or authorised ExTox Service Partner.

¹ All mentioned article numbers are valid for standard IMC. Due to reasons concerning production we do often use special article numbers 700xxx. The corresponding standard article can be taken from the name of the article or the attached test certificate.

² (k), (m), (g): to differ between types with small (k), medium (m) or bigger (g) housing ( DB). The housing types vary regarding number of transmitters to be integrated and selectable options, i.e. measured gas cooler.

Third parties take the responsibility for correct performance of work when maintenance and repairs are done by them.

On receipt of goods please take care that packing and consignment are not damaged and the goods supplied correspond to the articles described in the delivery note. Please do also compare with your order. In case of any damage please inform your forwarding agent and your supplier. Please keep the damaged packing.

Please keep in mind that our IMCs are sensitive measuring devices and take special care when unpacking and installing them.

2 Features of the Integral Measuring Concepts (IMC)

We are often faced with the task to monitor gas concentrations even in sealed off processes or not accessible areas. Typical applications are for example monitoring of silos and tanks, measurement on dumpsites or biogas plants. Due to the adverse operation conditions direct measurement within these processes is often impossible. Instead of that sampling from process gas and external measurement are necessary.

With the Integral Measuring Concepts of the Series IMC ExTox offers efficient solutions even for these measuring tasks. This Series combines all necessary components from sampling of measured gas, preparation, sensor techniques and evaluation in one compact wall mounting housing.


The IMC includes the control unit ET-8D or ET-4D2 which takes over evaluation of measured signals and triggering of switching commands. Software expansions in the control unit integrate controlling and monitoring of the components for sampling and preparation of measured gas. The measuring channels which are not used for analysis can easily be taken for external transmitters, for continuous monitoring of ambient air for example.

The modular construction and the use of the approved ExTox-Transmitters and control units assure a cost effective acquirement and maintenance. ExTox is glad to offer customer specific types on demand.

The IMC Series can be equipped with all ExTox-Transmitters ExSens(-I) and Sens(-I).

The control units in combination with ExTox-Transmitters comply with EN 60079-29-1 and EN 45544 for Gas Detection Systems. Furthermore they are in conformity with the European Directives 94/9/EC (ATEX), 2004/108/EEC (EMC) and 2006/95/EEC (LVD).

IMC for continuous measurement

- compact wall mounted housing in maintenance friendly construction
- up to 8 or 4 transmitters (Indications for the different types:  DB)
- allocation of transmitter inputs to analysis including sampling and preparation of measured gas as well as monitoring of ambient air freely selectable
- evaluation and indication of measured values and status messages as well as control of sampling and preparation of measured gas by control units of the series ET-8D or ET-4D2
- gas suction pump (distance of suction ≥ 50 m length of hose)
- pressure at sampling point: -100 to +100 hPa (in comparison with environment)
- electronic flow rate monitoring
- condensate trap with automatic manual removal of condensate by means of a hose pump
- hosing: PE/PP
- magnetic valve to change from measured gas to test gas
- 2 housing fans, rotary speed monitored
- 4..20 mA-outputs (only Types IMC-xDA)

Extension for Type "Biogas"

- software extension Biogas: discontinuous measurement in batch mode with configurable intervals for measuring / flushing / air; indication of the latest measured value during flushing and air phases; control of overload protection for H₂S-Measurement
- magnetic valves to change from measured gas to flushing air and to control the batch measurement
- pressure compensation
- Flame arrestor (Measured gas inlet)

Extension for Type "KAT"

- Extension for type "Biogas"
- Biogas-Application with integrated monitoring of activated carbon filters by means of switching between measuring ranges for H₂S-Measurement. Assignment of the H₂S-Measuring range configurable to the corresponding measuring point
- Switching between the measuring ranges minimum 2-times (before / after activated carbon filter)

Extension for Type "M(odule)"

- Extension for Type "Biogas" or "KAT"
- Exchangeable Transmitter Module
 - all transmitter for CH₄, H₂S and O₂ integrated
 - Easily exchangeable (complete module)
 - preadjusted ("Plug and Play")

Options

- Monitoring of Ambient Air:
A continuous monitoring of ambient air, such as for example for Methane (CH₄) and Hydrogen Sulphide (H₂S), can also be realised via external ExTox-Transmitters.
- Switching between Measuring Points (Types Biogas2 and KAT):
Determination of gas composition at different measuring points temporally one after another. Supplementation of switching between measuring points forms a cost saving alternative to using several IMC. One single IMC performs the analysis one after another for the different measuring points. Switching can be done cyclically or externally controlled. The IMC-4D can cover up to four, the IMC-8D even up to six measuring points (special types: twelve).
- Flame Arrestor ☒ IIG IIB3 (Standard) or ☒ IIG IIC:
When sampling in hazardous areas the gas flow inside the IMC is decoupled of the monitored process as far as the danger of explosion is concerned. The flame arrestor is connected previous to the measured gas inlet. When returning the measured gas into the process another flame arrestor at the measured gas outlet is necessary.
- Measured gas cooler incl. Automatic Removal of Condensate:
Gas dehumidification by means of a Peltier cooler, temperature of measured gas at outlet: +5 °C.
- Heating for Enclosure with thermostat control +5 to +30 °C:
Necessary for very low temperatures at the place of application. Formation of condensate inside the housing is avoided when installing the IMC outside.
- Preparation for Installation outside:
- Rain protection covers for housing fans, internal control unit and heating for enclosure. A rain protection roof can be offered as option.
- ProfiBus®-, ProfiNet®-, ModBus®- and Ethernet-Connection:

Measured values and messages can be transferred to a superior PLT-System via Interface. Further interfaces on demand.

- Data Logger:
Measured values and messages are stored on a SD memory card. All data can be read out and processed on every standard PC later on.
- Customer specific modifications – Ask us!
Different biogas concepts also require different monitoring concepts. The modular design of our IMC-Systems allows us to respond to your special wishes and requirements.

3 Indications and Facilities

The control unit covering the indication of measured values, alarms and messages as well as keys is installed in the door of the wall mounted housing.

For description of the indications and facilities please see the Instruction Manual of the control unit.

In the survey on measured values of ET-4D2 and ET-8D the volume stream of measured gas (Measured value, see 6.1.1, or Status, see 6.1.2) and state of housing fans are indicated instead of date and time on IMC. The active measuring point is also indicated on IMC with switching between measuring points.

4 Configuration

For description of configuration possibilities please see the Instruction Manual of the control unit.

The menu system parameter serves for factory sided activation of operating modes "IMC" or for the biogas and KAT types "BIO" instead of "ET-8" or "ET-4".

Attention: Changing of these settings should in no way be done by the user. Changed measuring functions may otherwise lead to loss of safety functions.

Software extensions and pre-settings of inputs and outputs depend on the different operation modes.

5 Description

The following indications are valid for the standard types mentioned in Paragraph 1. For special types, generally with Article Number 7xxxxx, further amendments can be necessary. These will then be part of an amendment to this Instruction Manual.

Documentation supplied with each IMC contains individually generated indications of the gas flow, connection scheme, terminal assignment and construction of mounting plate. These are also attached to the system and are located inside the housing.

5.1 Type IMC

5.1.1 Functions

- *Course of Measurement*

Measurement is done continuously even on the transmitters built in the IMC. The included channels are activated in the menu Channel Configuration by setting the Mode ON.

- *Monitoring of Ambient Air*

Channels not to be used for the IMC measurement can be used for continuous monitoring of ambient air. Behavior of these channels corresponds to the normal measuring operation of the gas detection control unit. The channels included in monitoring of ambient air are activated in the menu Channel Configuration by setting the Mode ON.

- *Status Monitoring*

The following status monitoring functions are integrated in this type:

- Rotary speed monitoring of both housing fans
- Flow rate monitoring: message for under-scale / over-scale of the nominal range
- Temperature monitoring of the measured gas cooler (if installed)

In the first two cases a message leads to system fault of the control unit.

As long as the measured gas cooler does not reach its operating temperature, for example during the warm-up phase after initial operation, the gas suction pump remains switched off.

- *Functional Extensions*

For maintenance purposes the gas inlet of the IMC can be switched to the inlet test gas / flushing air by means of the magnetic valve. For that purpose you have to select the menu Maintenance. By means of the keys SHIFT + F4 it can be switched between both gas inlets.

5.1.2 Parameter Settings

- *System Parameter*

In the menu System Parameter the operation mode „IMC“ instead of "ET-8" and "ET-4" is factory-sided activated.

Attention: Changing of these settings should in no way be done by the user. Changed measuring functions may otherwise lead to loss of safety functions.

The menu point OPTIONS comprises now also the possibilities of setting for flow rate monitoring (see 6.1.2) and change-over of measuring points.

Access level to perform changes within this menu: 3

Menu Text	Selection	Function
FLOW-MIN	0 to 300 l/h	<i>Only activated in Systems with DDL-Module (see 6.1.1)</i> Lower limit of flow rate monitoring in l/h. Under-scale leads to system fault Unterer Grenzwert für die Durchflussüberwachung in l/h. Bei Unterschreiten wird eine Gerätestörung ausgelöst. (Standard setting: 15 l/h)
FLOW-MAX	0 to 300 l/h	<i>Only activated in Systems with DDL-Module (see 6.1.1)</i> Upper limit for flow rate monitoring in l/h. Over-scale leads to system fault. (Standard setting: 60 l/h)

▪ Channel Configuration

The IMC channels are activated in the same manner as channels for external transmitters in the menu Channel Configuration by setting the Mode ON.

5.1.3 Pre-configured Relays and Digital Inputs

The following relays cannot be configured freely.

IMC-8D (IMC-4D)	Application
Relay K21 (K9)	Internally allocated
Relay K22 (K10)	Internally allocated
Relay K23 (K11)	Control of measured gas pump
Relay K24 (K12)	Control of magnetic valve (MV1) for switching between measured gas and test gas
Digital input E2	Status signal flow rate (<i>only allocated in systems with Flow-Meter, see 6.1.2</i>)
Digital input E3	Status signal housing fans (<i>only allocated in systems with Flow-Meter, see 6.1.2</i>)
Digital input E4	External activation of maintenance mode <u>is not</u> provided

5.1.4 Calibration and Adjustment

Calibration and adjustment is done by application of test gases at the inlet of test gas. From the inlet of measured gas the gas inlet can be changed-over to the inlet test gas/flushing air via magnetic valve. For that purpose you have to select the menu maintenance. You can switch between both gas inlets by pressing the keys SHIFT + F4.

Application of test gas should be done pressure less. It has always to be ensured that an adequate test gas volume stream is provided, that means an application of test gas has to be set which corresponds to the one in measuring operation³. This is to avoid that air is additionally sucked in and dilution of the test gas resulting from this falsifies calibration / adjustment.

When adjusting please follow the hints in the Instruction Manuals of transmitter and control unit.

³ Depending on type the necessary test gas volume stream may be considerably above the indicated volume stream.

5.2 Type Biogas

5.2.1 Functions

▪ *Course of Biogas-Measurement*

During operation mode "BIO" discontinuous measurement takes place. All channels for biogas measurement are selected in the menu Channel Configuration by setting the mode TIMER. Three phases are run through cyclically:

1. Air: the gas flow is flushed with air that means the magnetic valve has switched to the inlet test gas / flushing air.
2. Flushing: the system switches to the measured gas inlet. The gas concentration is not measured during this time. This phase is needed to transport the sampled gas from the process to the IMC using the gas flow. The gas suction pump is switched off two minutes before end and the gas flow is closed. Measurement in batch mode is prepared.
3. Measuring: the system measures the actual values when changing over to phase measurement. During this phase the gas suction pump remains switched off.

You can manually interfere in this process. Measurement can be started by pressing simultaneously the keys F8+F3 (IMC-8D) or F6+F3 (IMC-4D). The IMC-Biogas first changes to the phase flushing and starts the measurement later on.

For measuring points in TIMER Mode all measured values, alarms and outputs remain frozen on the latest value of the previous measuring phase during the phases "air" and "flushing". Latching alarms can only be reset during measuring phase. *Attention:* This means that reset will be possible in the next phase. If necessary measurement can be started manually (see above) to reduce the waiting time on longer cycle times.

The times for the individual phases can be adjusted in the menu Timer which can be reached via the menu System Parameter and selection of the menu setting Mode BIO.

▪ *Monitoring of ambient air*

Channels which are not needed for the IMC measurement can easily be used for a continuous monitoring of ambient air. Performance of these channels corresponds to the normal measuring operation of the control unit. Channels for monitoring of ambient air are also activated in the menu Channel Configuration by setting the Mode ON.

▪ *Status Monitoring*

The following status monitoring functions are integrated in this type:

- Rotary speed monitoring of both housing fans
- Flow rate monitoring: message for over- and under-scale of nominal range
- Temperature monitoring of the measured gas cooler (if installed)

In the first two cases a message leads to system fault of the control unit.

As long as the measured gas cooler does not reach its operating temperature, for example during the warm-up phase after initial operation, the gas suction pump remains switched off.

5.2.2 Parameter Settings

▪ *System Parameter*

In the menu System Parameter the operation mode „BIO“ instead of „ET-8“ and „ET-4“ is factory-sided activated.

Attention: Changing of these settings should in no way be done by the user. Changed measuring functions may otherwise lead to loss of safety functions.

In the submenu BIO the following changes can be performed.

Access Level to perform changes within the Menu Timer: 3

Menu Text	Selection	Function
T1	to 1439	Duration of the phase Air in minutes
T2	to 1439	Duration of the phase Flushing in minutes
T3	to 1439	Duration of the phase Measuring in minutes
Flow	ON, OFF	For IMC-Biogas2 the setting has to be OFF. <i>Attention:</i> Changing of these settings should in no way be done by the user. Changed measuring functions may otherwise lead to loss of safety functions.
Measured gas - right co- lumn -	Concentration	Concentrations of test gases for the measuring channels of the Biogas-Measurement have to be indicated. Only the TIMER controlled channels are processed. On the left side the measured gas and on the right side the corresponding concentration is indicated.

The menu point OPTIONS now comprises the possibilities of setting for flow rate monitoring (see 6.1).

Access Level to perform changes in the Menu: 3

Menu Text	Selection	Function
FLOW-MIN	0 to 300 l/h	<i>Only activated in systems with DDL-Module (see 6.1.1)</i> Lower limit of flow rate monitoring in l/h. Under-scale leads to system fault. (Standard setting: 15 l/h)
FLOW-MAX	0 to 300 l/h	<i>Only activated on systems with DDL-Module (see 6.1.1)</i> Upper limit for flow rate monitoring in l/h. Over-scale leads to system fault. (Standard setting: 60 l/h)
MAX-CHANNEL	1...4 (IMC-4D) and 1...6 (IMC-8D)	Number of measuring points (only for Option switching between measuring points, see 5.2.5)

▪ Channel Configuration

Besides the Mode settings ON and OFF the setting TIMER is accessible in Biogas Mode. All measuring points with this setting are integrated in the discontinuous course of biogas measurement.

Attention: Please note that oxygen measurement – if available – always has to be on Channel 2 due to system internal reasons.

5.2.3 Pre-configured Relays and Digital Inputs

The following relays cannot be configured freely.

IMC-8D (IMC-4D)	Application
Relay K21 (K9)	Internally allocated
Relay K22 (K10)	Control of magnetic valve (MV2) for closing the gas flow during batch measurement
Relay K23 (K11)	Control of measured gas pump
Relay K24 (K12)	Control of magnetic valve (MV1) for switching between measured gas and test gas

IMC-8D (IMC-4D)	Application
Digital Input E2	Status signal flow rate (<i>only allocated in systems with Flow-Meter, see 6.1.2</i>)
Digital Input E3	Status signal housing fans (<i>only allocated in systems with Flow-Meter, see 6.1.2</i>)
Digital input E4	External activation of maintenance mode <u>is not</u> provided

5.2.4 Calibration and Adjustment

Calibration and adjustment of the biogas-types is only done via automatic control.

▪ Preparation

You have to enter the concentrations of the used calibration gases in the menu "System Parameter/Mode/Bio/Timer". On the right side of the display you could enter the concentrations for CH₄, O₂, CO₂ and H₂S. These values are necessary for automatic calibration. You will normally find this information on the test gas bottle. In case the test gases are filled in different pressure gas bottles, you have to follow the instructions following below for all used test gases. For calibration of the O₂-Measuring Channel you have to apply a test gas which does not contain any oxygen.

▪ Course

You have to select the menu point "Calibration" in the menu "Setup". For that purpose you have to activate minimum Access Level 2 before. The calibration menu appears and the internal magnetic valve switches to flushing air. In case the system should not be calibrated you could leave the menu via "Esc". By means of "Start" the automatic calibration is started. The analogue outputs keep the measured values of the last measurement.

Calibration is done in five phases:

Phase	Indication on Display ET-8D-(ET-4D2-)	Course
1	RINSING AIR (RINS AIR)	The system is flushed with air for three minutes
2	READING ZERO (READ ZERO)	The gas suction pump is switched off. The system waits one minute until stabilisation of measured values. Then the measured values are stored (zero point values for CH ₄ , CO ₂ , H ₂ S or 20.9 Vol.-% for O ₂).
3	RINSING GAS (RINS GAS)	The gas suction pump is switched on again and the system is flushed with connected test gas for four minutes. <i>Attention:</i> Only during this phase the test gas bottle has to be connected and the test gas has to be applied to the IMC. The test gas has to be applied pressure less. It has always to be ensured that an adequate test gas volume stream is provided, that means on application of test gas has to be set which corresponds to the one in measuring operation ⁴ . This is to avoid that air is additionally sucked in and dilution of the test gas resulting from this falsifies calibration / adjustment.
4	READING SENSITIVITY (READ SENS)	The measured gas pump is switched off and batch measurement is done within two minutes.

⁴ Depending on type the necessary test gas volume stream may be considerably above the indicated volume stream.

Phase	Indication on Display ET-8D-(ET-4D2-)	Course
5	READY (READY)	<p>Calibration is completed and a plausibility check of the new values for zero point and sensitivity takes place. Offset for the zero point may not exceed ± 2 mA. The gain factor for sensitivity has to be between 0.5 and 2 (see comments on adjustment of the control units). Calibration values outside these limits are rejected, in the calibration menu the message "ERROR" is issued after completed calibration and the previous settings are kept.</p> <p><i>Attention:</i> The message "ERROR" for channels with measuring components which are <u>not</u> part of the test gas does not indicate a malfunction of the measuring channel. These measuring channels will be calibrated and adjusted later on or have already been calibrated and adjusted on application of other test gases.</p>

When using several test gases please change now the bottle and start another calibration cycle by pressing "Start".

Calibration is definitely completed with "Esc".

5.2.5 Switching between Measuring Points (Option)

This option allows use of one IMC for several measuring points. Measurement is done one after another on specified scheme. To do this all magnetic valves which access the corresponding measuring line for measurement inside the IMC are driven by the control unit. Via relay outputs the control unit signals the measuring point for which the measured values are actually indicated.

Attention: The standard type is described below. As in many cases customer specific adaptations take place you have to pay attention to system specific deviations in the documentation.

Switching between measuring points is configured in the menu SET-UP>SYSTEMPARAMETER>OPTIONS. The drawing shows an example for a system with switching between 4 measuring points.

OPTIONEN			M1: ON	1	H
RS232	:	1	M2: ON	1	H
FLOW-MIN	:	15 l/h	M3: ON	1	H
FLOW-MAX	:	60 l/h	M4: ON	2	L
MAX-CH	:	4			
<	^	v	>	ESC	SAVE

MAX-CHANNEL indicates the number of measuring points (here: 4).

Function of these measuring points is displayed on the right side: the first column shows the ON/OFF-Status of the measuring point. This parameter can be set without entering a password. By this the user has the possibility to deactivate measuring points easily in case it is needed (maintenance on the fermenter for example). The second column indicates how often the measuring point is processed (possible settings: 1, 2, 4, 8). The above mentioned example shows that at measuring points M1, M2 and M3 it is measured in every cycle, at measuring point M4 only every second cycle. It results M1-M2-M3-M4-M1-M2-M3-M1-M2-M3-M4.... The fourth column is only important for type KAT (see 5.3).

The following relays cannot be configured freely.

IMC-8D (IMC-4D)	Application
Relays K1, K2, K3, K4, K9, K11 (K1, K2, K3, K4)	Control of magnetic valves for switching between measuring points: Relay 1 closed: Magnetic valve for measuring point 1 activated Relay 2 closed: Magnetic valve for measuring point 2 activated Relay 3 closed: Magnetic valve for measuring point 3 activated Relay 4 closed: Magnetic valve for measuring point 4 activated Relay 9 closed: Magnetic valve for measuring point 5 activated (IMC-8) Relay 11 closed: Magnetic valve for measuring point 6 activated (IMC-8)
Relays K12, K18, K19 (K6, K7, K8)	BCD-coded indication of measuring point, for which the measured value is actually indicated as 4...20 mA-Signal: <div style="display: flex; align-items: center;"> <div style="margin-right: 20px;"> K19 K18 K12 (K8 K7 K6) </div> <div> Measuring point 0 0 0 no valid 4...20 mA-Signals 0 0 1 valid 4...20 mA-Signals Measuring point 1 0 1 0 valid 4...20 mA-Signals Measuring point 2 0 1 1 valid 4...20 mA-Signals Measuring point 3 1 0 0 valid 4...20 mA-Signals Measuring point 4 1 0 1 valid 4...20 mA-Signals Measuring point 5 (IMC-8) 1 1 0 valid 4...20 mA-Signals Measuring point 6 (IMC-8) </div> </div>

5.3 Type KAT

5.3.1 Functions

Type KAT completes Type Biogas by the possibility to monitor with activated carbon filter (AKF). This type is always coupled with switching between measuring points (see 5.2.5). The measuring points can be configured that way that the gas composition is determined alternately before and after the AKF. Depending on the configuration the H₂S-Transmitter with corresponding measuring range is activated automatically.

The following relays cannot be configured freely.

IMC-8D (IMC-4D)	Application
Relay K21 (K9)	Switching of magnetic valves for high (before AKF) and low H ₂ S-Measuring Range (after AKF) closed = low measuring range (100 ppm) open = high measuring range (≥ 1000 ppm)

The measuring range of the H₂S-measuring points is configured in the menu SYSTEMPARAMETER>OPTIONS. The drawing shows an example for a system with switching between 4 measuring points.

OPTIONS			M1:	ON	1	H
RS232	:	1	M2:	ON	1	H
FLOW-MIN	:	15 l/h	M3:	ON	1	H
FLOW-MAX	:	300 l/h	M4:	ON	2	L
MAX-CH	:	4				
<	^	v	>	ESC	SAVE	

MAX-CHANNEL indicates the number of measuring points (here: 4).

Function of these measuring points is displayed on the right side: the first column shows the ON/OFF-Status of the measuring point. This parameter can be set without entering a password. By this the user has the possibility to deactivate measuring points easily in case it is needed (maintenance on the fermenter for example). The second column indicates how often the measuring point is processed (possible settings: 1, 2, 4, 8). The above mentioned example shows that at measuring points M1, M2 and M3 it is measured in every cycle, at measuring point M4 only every second cycle. It results M1-M2-M3-M4-M1-M2-M3-M1-M2-M3-M4....

In the fourth column the measuring range of the H₂S-Channel can be configured:

H (High) = Measurement before AKF (Raw gas, Measuring range ≥ 1000 ppm)

L (Low) = Measurement after AKF (Measuring range ≤ 200 ppm)

ATTENTION: on wrong definition of measuring range (H/L) the H₂S-Sensor can be damaged due to overload.

5.3.2 Calibration and Adjustment

Calibration shows the following specific features: In case there is no H₂S-Transmitter for measurement after AKF configured calibration is done as usual. Configuration of a H₂S-Transmitter with low measuring range is recognized by the software and calibration menu is automatically extended:

CALIBRATION			FLOW= 31 l/h		
F1:CAL. H2S 0-3000 ppm					
F2:CAL. H2S 0- 100 ppm					
H2S-HI	H2S-LO				ESC

In case calibration is started with F1 (H2S-HI) the IMC expects a H₂S-test gas concentration for high measuring range, the gas flow is switched correspondingly. When starting with F2 (H2S-LOW) a test gas concentration for calibration of the low H₂S-measuring range is expected. To calibrate both transmitters you have to perform the calibration process for both measuring ranges.

5.4 Type M

5.4.1 Description

In Type M all transmitters are combined in one exchangeable TransmitterModule. This module can in case of maintenance easily be taken out of the IMC and replaced by a new pre-adjusted module. All functions correspond to the IMC-Types BIOGAS and KAT.

There are three types of transmitter modules available:

IMC-Transmitter Module	Article (new/replacement)	In combination with:
KAT-CH ₄ , O ₂ , H ₂ S100, H ₂ S3000 Standard-Measuring ranges: 0-100 % (v/v) Methane 0-25 % (v/v) Oxygen 0-100 ppm Hydrogen Sulphide 0-3000 ppm Hydrogen Sulphide	290006/ 295006	IMC-4M(A)-KAT
CH ₄ , O ₂ , H ₂ S3000 Standard-Measuring ranges: 0-100 % (v/v) Methane 0-25 % (v/v) Oxygen 0-3000 ppm Hydrogen Sulphide	290007/ 295007	IMC-4M(A)-Biogas2
CH ₄ , O ₂ , H ₂ S100 Standard-Measuring ranges: 0-100 % (v/v) Methane 0-25 % (v/v) Oxygen 0-100 ppm Hydrogen Sulphide	290008/ 295008	IMC-4M(A)-Biogas2

5.4.2 Replacement of a Transmitter Module

On delivery of the IMC a new transmitter module is installed (Art. 290xxx). In case you need a new one you will get a Replacement Transmitter Module (Art. 295xxx), on which all wear parts have been replaced. The module has been checked completely and adjusted. It has the same warranty as for a new module. In case you return the defective module you will get a credit note for the defective one.

Replacement is done in few steps:

1. Release access level 3 on the control unit (see Instruction Manual).
2. Press the keys "F1+F5+F6". On the display "CHANGE MODULE" is indicated.
3. Select "Change". The latest actual measuring value is frozen and is constantly sent to the connected periphery for the duration of the module exchange.
4. Replace Module:
 - a. Untighten glands at measured gas inlet and outlet and remove hoses.
 - b. Remove cable(s) from transmitter module.
 - c. Loosen the four fixing screws and remove transmitter module.
 - d. Install new module in reverse order.
5. Select "Ready". Measurement is started again.
6. Select "End". The IMC returns to the standard indication.

The transmitter module is pre-adjusted. After exchange it is necessary to let it run for ca. 1 to 3 hours till the final measuring accuracy is reached. During this time you should not perform any adjustment. Afterwards the IMC with exchangeable transmitter modules can be calibrated and adjusted as Types Biogas2 and/or KAT (see 5.2.4 or 5.3.2).

6 Operation of the IMC

The operation of the control unit is described in the Instruction Manual of the Series ET-8D and ET-4D2.

Furthermore the following remarks are valid for the additional functions and options.

Remark: Please note that some options or their combination is not available for all IMC-Types. ExTox is at your disposal for planning your IMC-System.

Furthermore customer specific designed IMC-Types can dispose of deviating functions, which are described separately in the corresponding documentation of your device.

6.1 Flow rate monitoring

The IMC are in general equipped with the System DDL-Module 3.0 (Art. 940285). Special types can also be equipped with other types of flow rate monitoring. The installed type is specified in the corresponding documentation of your device.

6.1.1 Types with DDL-Module 3.0 (Art. 940285) and 2.0 (Art. 940178)

Flow rate monitoring bases on measurement of pressure difference. The measurement of pressure difference is built in the assembly group DDL-Module together with the monitoring of housing fans. The normal flow through is ca. 30 l/h. In case the gas flow is constraint the lower alarm level is over-run. Leakages or loosening of a hose connection leads to the entering of leak air. The upper alarm is triggered due to the higher volume stream.

The DDL-Module transfers the measured value serially to the control unit. It is detailed indicated on the display ("FLOW"). In case the alarm levels are reached the indication on the display switches between measured value and the message "ERROR" every second. In case the serial data link between control unit and DDL-Module is interrupted for more than 15 s, the message "COMERROR" is issued. A fault of control unit is indicated at the control unit.

Remark: in the Biogas-Types the gas suction pump is switched off during some operation phases, so that no gas flow takes place. During these planned phases the DDL-Module does not show any flow through, but a system fault is correctly not triggered.

The setting of the alarm levels is done at the control unit in the extended submenu OPTIONS of the menu System Parameter.

6.1.2 Types with Flow-Meter (Art. 940025)

The flow rate monitoring is built in a common housing together with a dust filter. At the front side there is a text display and three keys (M, +, -). In the text display the measured gas volume stream is indicated in litre per hour (l/h) during normal measuring mode. The flow rate monitoring is equipped with an upper (MAX) and lower (MIN) alarm level; the nominal range which should be kept is in between.⁵

In case the gas flow is constraint the lower alarm level is over-run. Leakages or loosening of a hose connection leads to the entering of leak air. The upper alarm is triggered due to the higher volume stream.

Alarm Levels

For setting the alarm levels press key M until the required alarm level is indicated. By means of the keys + and - the alarm level can newly be set. The displayed value is immediately effective.

Adjustment

When setting the zero point there should definitely be no measured gas. Then you have to press first key + and then additionally key M to store the zero value.

Then the volume stream is set to the nominal value 30 l/h. For storing you first have to press Key - and then additionally Key M.

⁵ On this type the indication of volume stream on the display of the control unit is not applied.

Dust Filter

The dust filter is integrated in the housing of flow rate monitoring. The condition of the filter can easily be checked in the inspection glass. This test should be done regularly in intervals which depend on the dust load of the measured gas. For exchange of the used filter inlet the inspection glass can be removed. When closing you have to ensure correct installation of the sealing and the inspection glass. Please also check tightness.

6.2 Housing Fans

The housing fans are equipped with a dust protection mat which should be cleaned regularly from dust. Therefore remove plug cover and clean mat.

The redundant ventilation of housing including monitoring of fans avoids safely the formation of potentially explosive mixtures in case of leakages in the IMC. The state of the fans is detailed indicated on the display of the control unit ("FAN"). In case even one of the fan fails the status indication changes from "OK" to "FAULT" and a fault of control unit is indicated at the control unit.

6.3 Condensate Trap incl. Hose Pump

The condensate removal is automatically done via the hose pump (standard for Biogas and KAT-Types). Nevertheless we recommend checking the condensate trap and hose line regularly on possible blockages. Condensate traps and hose lines should be cleaned on demand. It has to be ensured that the measured gas flow is not interfered. For this purpose it might be necessary to disconnect hose lines. After connecting everything again please check tightness of sample line.

Please make sure that the condensate can drain off failure free and depending on composition of condensate even safe from the connection at the bottom of the housing.

6.4 Measured Gas Cooler incl. Automatic Removal of Condensate

Gas dehumidification is done by means of a Peltier cooler. The temperature of measured gas is factory sided adjusted to +5 °C and monitored. During the warm-up phase a fault message is issued until the cooler reaches operation temperature.

The measured gas cooler meets the high requirements of the industrial process analysis. The responsiveness of the temperature monitoring is a sign for the fact that the measured gas composes of very high temperatures or of a very high condensate load. It is the same with clearly higher measured gas volume streams.

The cooler is nearly maintenance free.

The condensate removal is automatically done via the hose pump. We recommend checking the hose line regularly on possible blockages. Condensate traps and hose lines should be cleaned on demand. It has to be ensured that the measured gas flow is not interfered. For this purpose it might be necessary to disconnect hose lines. After connecting everything again please check tightness of sample line.

Please make sure that the condensate can drain off failure free and safe from the connection at the bottom of the housing.

6.5 Flame Arrestor

It has to be ensured that the flame arrestors are not clogged with dust or condensate. In other aspects they are maintenance free.

Please note that the measured gas for standard construction of the flame arrestor should only contain flammable gases of ignition protection up to IIB3, such as for example methane. Please ask ExTox who assists you anytime for special gas mixtures.

As an option we could offer a flame arrestor for ignition protection IIC, such as for mixtures with significant contents of hydrogen.

6.6 Enclosures Heating with Thermostat Control

The nominal temperature can be adjusted in a range of +5°C to +30 °C by means of a

regulator. The temperature should be that high that no formation of condensate inside the housing will occur.

6.7 Switching between Measuring Points, Data Logger, Data Interfaces, Customer Specific Modifications

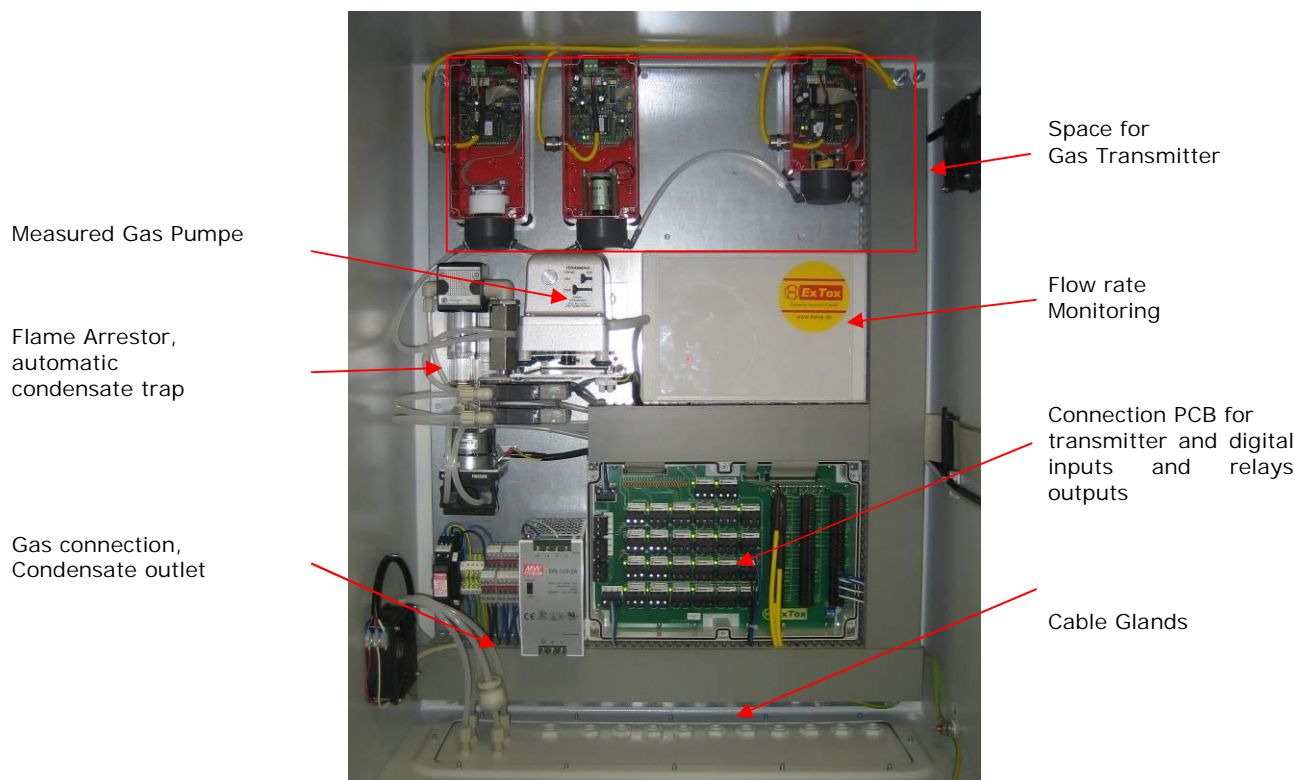
You will find detailed information to these topics in the separate documentation.

7 Application Hints

Here the application remarks in the Instruction Manual of the Control Units Series ET-8D and ET-4D2 are valid.

8 Installation

The following figure shows the modular construction of the IMC with single transmitters.



8.1 Mechanical Installation

The wall mounted housing should be installed at an easily accessible place to enable the reading out of messages at every time and to ensure an easy maintenance.

Please pay attention to the indicated operation temperature for the IMC and build in transmitters (□DB). The IMC should be installed protected against weather conditions and bigger climatic fluctuations.

In general we do not recommend an installation outside, as in principle measuring accuracy and lifetime are influenced in a negative way. In case it is however necessary, please contact ExTox to design a suitable type. For this the following measures are necessary: control unit to be installed inside, enclosure heating and rain protection cover for housing fans. In addition to this a protection against driving rain and direct sun, for example in form of a housing, have to be installed.

The dimensions for assembly and further installation dimensions can be taken from the Technical Data Sheet (□DB). The wall mounted housing can be opened by means of a usual two cam lock key.

The IMC itself may not be installed in hazardous areas. The air change via ventilation of the housing is that designed that in case of a leakage in the internal hosing the measured gas is always that much diluted that a hazardous gas mixture cannot occur inside the housing. Due to the rotary speed monitoring of the two fans the function of the so called "inner explosion protection" is ensured.

8.2 Connection to the Process

The connections for the measured gas inlet, test gas / flushing air, gas outlet and if so condensate draining are marked at the bottom of the housing. The standard screw connections fit for usual 6/4 hoses (6mm outer / 4 mm inner diameter). Connections for external stainless steel piping are available on demand.

For usual laying of the line a distance of suction of up to 50 m length of hose can always be realised. Longer suction distances are generally possible, but it has to be checked before if the delivery rate of the pump is still sufficient.

At the measuring point the difference in pressure in comparison to the environment may not exceed ± 100 hPa. We recommend contacting ExTox in case the pressure differences are higher or the measured gas shall be returned to the process.

Please ensure that the line from sampling till measured gas inlet of IMC consists of suitable material and is protected against damage and leakages.

Condensation inside the line, for example possible when sampling hot process gases, should be avoided. The measured gas line should be placed with permanent incline to the sampling point to allow the condensate to get back into the process. Hose loops in which a higher quantity of condensate can be amassed should be avoided. Otherwise the condensate trap inside the IMC may overflow on sudden suction of the complete condensate mass. The measuring readiness of the IMC might then be temporarily impacted. In the worst case pump and transmitters are damaged. In case bigger condensate masses cannot be avoided an additional condensate trap (KSF1, Art. 700304) can be installed before the line gets into the IMC. If necessary please contact your partner at ExTox.

Operation in most of the compositions of measured gas is reliably possible due to the construction of the IMC. Only for some in practice rarely occurring gases incompatibilities with the used hose materials cannot be completely excluded. ExTox is on demand at your disposal for consultancy. The hose material is compatible to the biogas components.

It is essential to install a flame arrestor at the measured gas inlet in case the measured gas is sampled out of hazardous areas (already included for the Biogas-Types). If the measured gas should be lead back into the process, another flame arrestor is essential at the gas outlet. On principle flammable or toxic measured gases should be lead off safely, for example out-of doors via the roof.

On principle flammable or toxic measured gases should be lead off safely, for example out-of doors via the roof. For flammable gases there might be a classification as hazardous area of Zone 2 in the close-up range around the gas outlet (Radius < 30 cm). In this range there should not be any possible ignition source.

8.3 Electrical Installation

The electrical installation may only be done by electro specialists according to the installation regulations on the subject. Please ensure above all for an adequate protection against lightning and overvoltage. All connections are inside the wall mounted housing. This can be opened via a usual two cam lock key.

The cable glands are at the bottom of the housing. Connection to the external power supply is done via the designated clamp block.

Connection of transmitters and additional devices (gas suction pump, flow meter etc.) has already been done factory sided. The respective assignment should be taken from the connection scheme in your device specific documentation.

The IMC automatically starts operation with connection to the power supply.

9 Maintenance of Gas Detection Systems

Maintenance is described in the Instruction Manual of the Control Units of the Series ET-8D and ET-4D2.

Additionally the gas flow and the therein additional devices have to be checked for correct function. The gas flow has to be tight. It has to be ensured that the hoses are not clogged with dust or condensate which would block the flow through. The flow through has to be within the designated nominal range.

The dust filter has to be checked regularly depending on dust load and to be renewed on demand.

10 Spares, Expendables, Options

Article-No.	Denomination
295006	Replacement Transmitter Module KAT-CH ₄ , O ₂ , H ₂ S100, H ₂ S3000
295007	Replacement Transmitter Module CH ₄ , O ₂ , H ₂ S3000
295008	Replacement Transmitter Module CH ₄ , O ₂ , H ₂ S100
940006	Measured Gas Pump
940007	Condensate Trap
940010	Hose Pump 300 ml/h
940011	Replacement Hose for hose pump 300 ml/h
940021	Measured Gas Cooler
940024	Filter with grid for housing fans
940025	Flow-Meter
940026	Power Supply
940028	Flame Arrestor IIB3
940033	Filter inlet for Filter AGF-FE-1 (Flow-Meter)
940091	Flame Arrestor IIC
940119	Filter Type 2
940160	Measured Gas Pump, Replacement-
940178	DDL-Module 2.0
940193	Hose Pump 840 ml/h
940198	Replacement Hose for Hose Pump 840 ml/h
940285	DDL-Module 3.0
970048	KSF1 – Automatic Condensate Trap 840 ml/h

11 Technical Data, EC-Declaration of Conformity

The technical data should be taken from the Data Sheet of the IMC basis version (□DB) which forms part of the delivery. Please do also pay attention to possible customer specific deviations which are described in the system specific documentation.

The EC-Declaration of Conformity is added separately to the documentation.