

**QUALITY ASSURANCE/QUALITY
CONTROL (QA/QC) PLAN
FOR
WALKER FARMS LLC
BIOLOGICAL SCRUBBER SYSTEM
Agreement # 108295**

October 18th, 2017

Submitted to:

New York State Energy Research and Development Authority
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Submitted by:

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Wendel Project No. 4338-17

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Introduction

Walker Farms, LLC, is a 2,800-acre family owned dairy farm, located in Fort Ann, NY in Washington County. The farm maintains a herd of 1,085 milking cows as well as 920 dairy heifers and 6 bulls. The animals produce approximately 36,500 gallons of manure per day. In 2017, the farm installed a biological scrubber system to help lower the levels of H₂S in the biogas produced from the cow manure.

This plan describes the approach to monitor the performance of the biological scrubber system that has been installed by Walker Farms LLC to lower the level of H₂S in the biogas, to reduce downtime and maintenance, and increase the engine-generator power output. A monitoring system is installed to measure and collect pre and post biological scrubber H₂S levels to quantify the H₂S removal by the biological scrubber. The data collected will serve as the basis for payment of a capacity incentive to help offset the capital expenses associated with the procurement of the new biological scrubber equipment and will also be used to determine ten (10) years of performance incentive payments, which Walker Farms LLC has applied for under a Standard Performance Contract with NYSERDA.

Biological Scrubber System Description

The biological scrubber system at the farm was designed by Martin Energy Group. The scrubber is designed for a biogas flow rate of 150 standard cubic feet per minute (scfm). The sulfur loading has been designed for biogas with 4,500 parts per million by volume (ppm) of H₂S.

Figure 1, includes photographs of the biological scrubber system. Figure 2, schematically shows the biological scrubber system.

The biological scrubber system consists of a cylindrical bioreactor, an air blower, recirculation pump, dosing pump for nutrient solution, and pre and post H₂S gas analyzer. Within the cylindrical bioreactor is packed media to allow for the growth of the microorganism, thiobacillus bacteria. The recirculation pump runs all the time at the lower speed of 17 HZ to keep the liquid within the bioreactor stirred and heated to keep the microorganisms at a temperature of approximately 100°F. Once an hour for seven (7) minutes the recirculation pump goes to a high speed of 55 HZ which allows the pump to spray the microorganisms from the spray system at the top of the bioreactor. Twice an hour water is added into to bioreactor for 5 minutes to allow for the nutrients to be fed to the microorganisms. One (1) tote, approximately 300 gallons, of nutrients is used a year to feed the microorganisms. Biogas airflow into the bioreactor is tied to the kW the engine is producing.

The bioreactor typically runs at a pressure of one (1) inch of water column during normal operation. When the pressure reaches four (4) psi the bioreactor needs to be cleaned. The clean the bioreactor, the packed media is covered with water and air is added for mixing. The process takes approximately an hour and the water is drained to the lagoon. This process is repeated until the bioreactor media is cleaned, typically a half day procedure.

Table 1. Biological Scrubber Systems at Walker Farms LLC

Biological Scrubber	Martin Energy Group Cylindrical Tower w/ randomly packed media and a specific strain of thiobacillus bacteria
Biogas Flow Rate	Inlet : design 150 scfm
Gas Temperature	100°F
Gas Pressure	1 inch of water column
Gas Composition	
CH ₄	55%
O ₂	2 – 2.5 %
H ₂ S	Varies depending on digester output (max inlet = 4,500 ppm)



Bioreactor Tower



Control Panel



Gas Analyzer (1)



Gas Analyzer (2)

Figure 1a. Photos of System Components

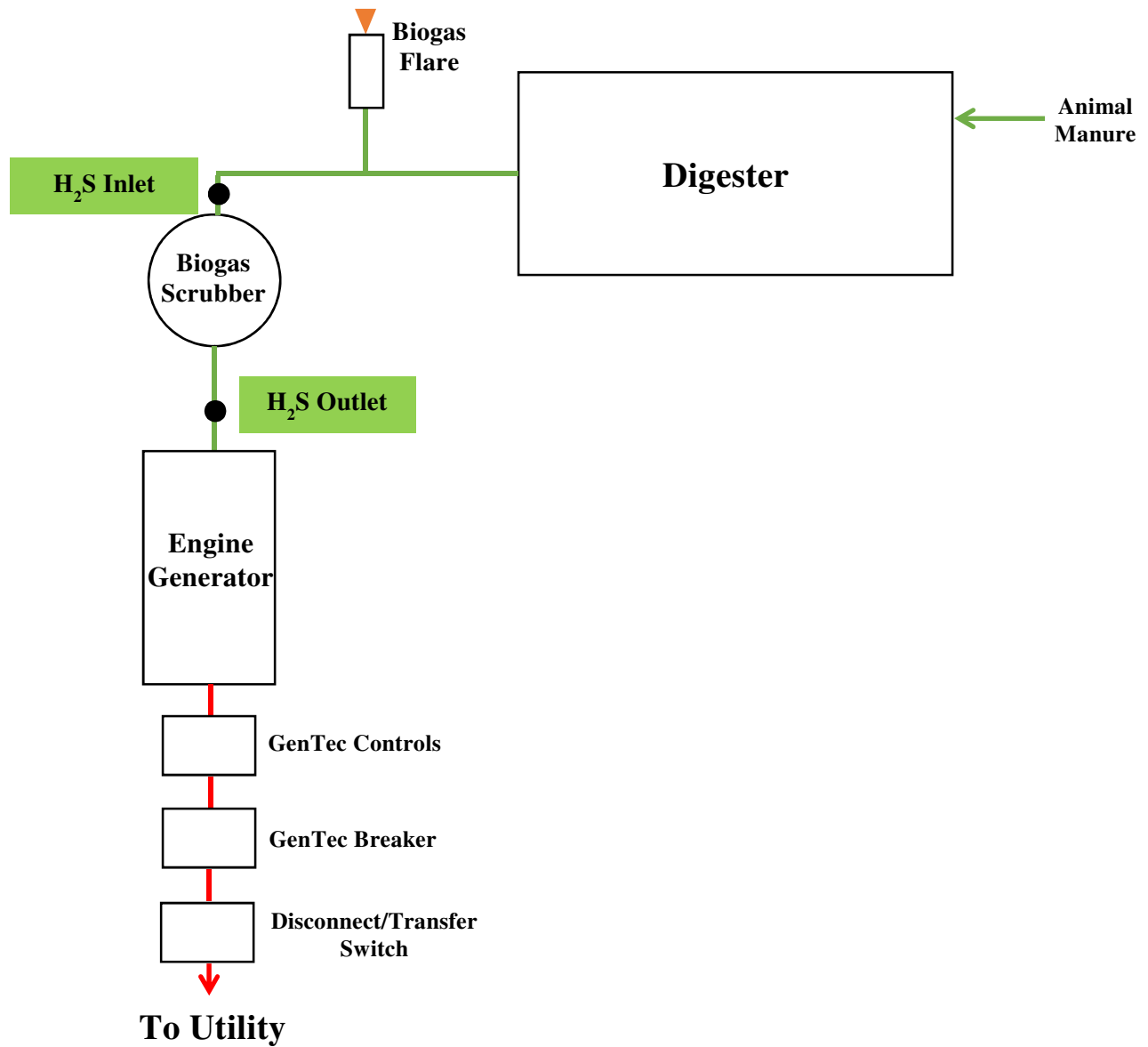


Air Blower & Recirculation Pump



HMI

Figure 1b. Photos of System Components



KEY:

● - Sensor

Figure 2. Schematic of System

Biological Scrubber System Capacity Payment Descriptions

This Section describes the Capacity Incentive Payments included in the Agreement, the payment milestones to be achieved in order to receive payment, and the deliverables to be provided in achieving these milestones. For a biological scrubber system, the available Capacity Payments are Capacity Payments 1, 4, 5, and 6, which are presented below.

Capacity Payment #1: Up to 15% of Total Capacity Incentive is payable for reimbursement of project costs once the Contractor provides evidence sufficient to demonstrate payments for major equipment (e.g. power generation system, anaerobic digester system, biogas clean-up and handling systems etc.) and/or engineering design.

Capacity Payment #4: Up to 45% of the Project Enhancement Component of the Total Capacity Incentive is payable once NYSERDA's designated technical consultant has verified that construction/installation of the Project Enhancement has been completed or the required documentation for the Project Enhancement, according to applicable sections of *Using the Incentive Calculation Tool* of Exhibit D has been submitted to NYSERDA. The Contractor may request payment at this time for any Project Enhancements that have been completed and verified. Payment for Project Enhancements completed and verified after the request for Capacity Payment #4 had been made may be requested with the Capacity Payment #6.

Capacity Payment #5: 20% of Total Capacity Incentive is payable once documentation has been provided to NYSERDA that sufficiently verifies successful operation of the newly installed system and completion of interconnection, if applicable (e.g. interconnection acceptance test documentation from the utility.).

Capacity Payment #6: Up to 100% of the Total Capacity Incentive is payable once the newly installed system is successfully commissioned. Commissioning includes operating the ADG-fueled energy generation system at a minimum of 75% average capacity factor over seven (7) consecutive days, and demonstrating the ability to upload data generated by the system to NYSERDA's CHP website, if applicable. A project Commissioning Report must also be completed detailing the installation and commissioning activities and include design updates and as-built diagrams. Any project Enhancements payments that were not made with the Capacity Payment #4 may be requested with this payment.

Monitoring System Equipment, Installation, Operation, and Maintenance

Payment for this incentive shall ultimately be based on adequate measurements of the ability of the biological scrubber to reduce H₂S levels to less than 400 ppm. Measurements will be made with continuous automatic gas sampling and analysis, or by other methods found acceptable to NYSERDA. For this project Union Instruments GmbH INCA4003, a biogas analyzer, will be used to measure the H₂S concentrations. A link to the specification for the gas analyzer can be found in Appendix A. This system is in-line and can measure H₂S from 0 to 5,000 ppm. Readings of H₂S will be taken once every six hours and then averaged over each six hour period.

Figure 2 shows the locations of the two (2) new H₂S data monitoring points, which will be used to measure system performance. The gas analyzer measures H₂S levels prior to the biological scrubber (**H₂S Inlet**) and H₂S levels after the biological scrubber (**H₂S Outlet**). Information on these data points is shown in Table 2.

Table 2. Monitored Points for Biological Scrubber System

Point Type	Point Name	Description	Instrument	Engineering Units	Expected Range
Pulse	H ₂ S Inlet	H ₂ S Level	Union Instruments GmbH INCA4003	ppm	0-5000 ppm (±150 ppm)
Pulse	H ₂ S Outlet	H ₂ S Level	Union Instruments GmbH INCA4003	ppm	0-5000 ppm (±150 ppm)

The H₂S levels in both the inlet (**H₂S Inlet**) and outlet (**H₂S Outlet**) of the biological scrubber are measured using the Union Instruments GmbH INCA4003 biogas analyzer. This system includes an LCD display and is installed in the electrical room of the generator building. The system has the capability to measure ppm data for H₂S in 15-minute intervals. The data logger is programmed to average or totalize data for each monitoring point for each 15-minute interval as appropriate. Maintenance activities will be performed in accordance with the instructions in the O&M manual. A log of maintenance activities for the meter will be maintained at the site.

The existing data logger currently used for tracking electrical and biogas production from the digester may be used for transferring H₂S reduction data to NYSERDA's Integrated Data System website. The data logger is programmed to average or totalize data for each monitoring point for each 15-minute interval as appropriate. A record of all multipliers and data logger settings will be maintained. The data logger will be connected to an uninterruptible power supply (UPS) to ensure the data logger retains its settings and data in the event of a power outage. The UPS is capable of powering the data logger for at least one day. The farm will provide a dedicated phone line (or an Ethernet connection with fixed IP address) that will be used to communicate with the data logger. The NYSERDA CHP website contractor (CDH Energy Corp.) will communicate with the data logger nightly to extract monitored data from the data logger and transfer the data to the NYSERDA Integrated Data System website. If communications are lost, the data logger is capable of holding at least 15 days of 15-minute interval data.

The worksheet in Appendix B will be used as a template for documenting the capabilities of the biological scrubber system. Biogas flow and H₂S input to and output from the biological scrubber will be documented for each hour of the year that samples are taken.

- The percentage of cumulative outlet H₂S samples (up to a maximum of 90% of the hours in a year) with 399 ppm H₂S and below will be submitted to document adequate compliance with the requirement for payment.
- The summary of samples will show the percentage of cumulative samples with 399 ppm H₂S and below as well as the percentage of cumulative samples with 400 ppm H₂S and above.
- To satisfy requirements for the 6th Capacity Incentive payment, a minimum of 75% of the samples taken in a 7 day period must be below 400 ppm. The H₂S reduction component of the annual Performance Incentive payment is determined by multiplying the Contract Capacity (300kW), times the factor 75%/90%, times the verified hourly samples below the minimum H₂S threshold, times the H₂S Performance Incentive variable for a biological scrubber (\$0.0023/kWh).

NYSERDA will consider other formulations for calculating the Performance Incentive, in the event that the biological scrubber is unable to operate due to reasons outside of the operation of the scrubber itself. NYSERDA may direct its technical contractors to sample the biogas, determine H₂S removal efficiency, and compare the results to the data originally provided by the operator.

Management of Monitoring System Data (Farm Responsibilities)

The Walker Farms LLC staff will perform the following quality assurance and quality control (QA/QC) measures to ensure the data produced from the monitoring system accurately describes system performance.

On a daily basis, the Walker Farms LLC equipment manager (or other specified employee) will perform inspections of the biological scrubber equipment and record findings into the project log.

On a weekly basis, the Walker Farms LLC equipment manager (or other specified employee) will perform QA/QC inspections of the biogas analyzer installations and complete the routine maintenance on the analyzer, noting any abnormalities or unexpected readings.

On a weekly basis, the Walker Farms LLC staff will review the data stored on the NYSERDA Integrated Data System website (<http://dg.nyserderda.ny.gov/home/index.cfm?>) to ensure it is consistent with their observed performance of the biological scrubber system and logged readings. Walker Farms LLC will review the data using the reporting features at the website, including:

- Monitored Data – Plots and Graphs
- RPS: Customer-Sited Tier Anaerobic Digester Gas-to-Electricity Program NYSERDA Incentive Program Reports

In addition, the Walker Farms LLC staff will also setup and use the email reports that are available at the Integrated Data System website to help track system performance, including:

- A periodic email report summarizing performance and the estimated incentive,
- An email report will be sent out if data are not received at the web site or do not pass the quality checks.

The website will automatically take the data collected from the data logger and evaluate the quality of the data for each interval using range and relational checks. The expected ranges for the sensors (see Table 2) will be used for the range checks. The relational check will compare the H₂S ppm data for each 15-minute interval to ensure both analyzers always provide non-zero readings at the same time (e.g., to detect if a meter has failed). Only data that passes the range and relational quality checks are used in the incentive reports listed above. However, all hourly data are available from the NYSERDA Integrated Data System website using the “Download (CSV file)” reporting option.

In the event of a communication or analyzer failure, Walker Farms LLC personnel will work with CDH to resolve the issue.

If unanticipated loss of data occurs when the biological scrubber is operational, Walker Farms LLC will follow the procedures outlined in Exhibit D of their contract, i.e. using data from similar periods – either just before or after the outage – to replace the lost data. Walker Farms LLC personnel understand that they can use this approach for up to two (2) 36-hour periods within each 12-month performance reporting period. If more than two (2) such data outages occur, Walker

Farms LLC personnel will provide information from other acceptable data sources (e.g., weekly recorded logs) to definitively determine the H₂S levels of the biogas during the period in question.

APPENDIX A

Cut Sheets and Manuals-

Union Instruments INCA4003 Gas Analyzer O&M and Data Sheet:

http://www.union-instruments.com/images/downloads/Handbuecher/inca/englisch/OI_INCA4003_EN.pdf

http://www.union-instruments.com/images/downloads/Datenblaetter/inca/INCA4003_DEU.pdf

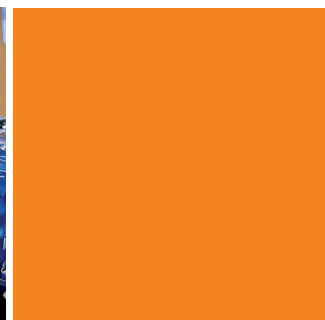
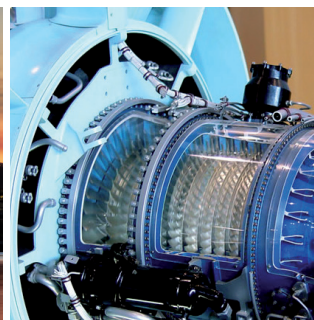


Messparameter:

- Methan
- Kohlendioxid
- Schwefelwasserstoff
- Sauerstoff
- Wasserstoff
- Höhere Kohlenwasserstoffe (C₂₊)

Anwendungen:

- Biogas
- Klärgasanlagen
- Deponien
- Glas/Keramik
- Energieversorgung
- Energieerzeugung
- Umwelt



INCA4003

Multigasanalysator



Die Multigasanalytoren der Geräteserie INCA4003 dienen zur Bestimmung der Gaszusammensetzung

- Methan
- Kohlendioxid
- Schwefelwasserstoff
- Sauerstoff
- Wasserstoff
- Höhere Kohlenwasserstoffe (C₂₊)

Die Multigasanalytoren der Geräteserie **INCA4003** Serie sind für Innenraumaufstellung konstruiert. Vermessen werden können kondensathaltige Gase mit und ohne Vordruck. Das Gerät ist max. mit vier Messgaseingängen und einem Kalibriergaseingang ausgestattet. Bedingt durch den Einsatz einer Schlauchpumpe ist ein online Betrieb möglich einer Messstelle möglich.



Typische Messbereiche INCA4003

Messkomponente	Messverfahren	Messbereiche	Messgenauigkeit
CH ₄	NDIR	0–100 Vol.-%	+/- 1 % MBE ¹⁾
CH ₄	NDIR	0–5 Vol.-%	+/- 3 % MBE ¹⁾
CH ₄	NDIR	80–100 Vol.-%	+/- 1 % MBE ¹⁾
C ₂₊	NDIR	0–20 Vol.-%	+/- 2,5 % MBE ¹⁾
CO ₂	NDIR	0–100 Vol.-%	+/- 1 % MBE ¹⁾
CO ₂	NDIR	0–0,5 Vol.-%	+/- 2 % MBE ¹⁾
CO ₂	NDIR	0–10 Vol.-%	+/- 1,5 % MBE ¹⁾
O ₂	EC	0–25 Vol.-%	+/- 3 % MW ²⁾
O ₂	paramagnetisch	0–25 Vol.-%	+/- 1 % MW ²⁾
H ₂ S	EC	0–50 ppm	+/- 3 % MBE ¹⁾
H ₂ S	EC	0–100 ppm	+/- 3 % MBE ¹⁾
H ₂ S	EC	0–2.000 ppm	+/- 30 ppm (≤ 1000 ppm) +/- 3 % MW ²⁾ (> 1000 ppm)
H ₂ S	EC-µPulse	0–10.000 ppm	+/- 3 ppm (≤ 25 ppm) +/- 15 % MW ²⁾ (> 25 ppm)
H ₂ S	EC	0–10.000 ppm	+/- 3 % MBE ¹⁾
H ₂ S	EC-µPulse	0–50.000 ppm	+/- 30 ppm (≤ 500 ppm) +/- 15 % MW ²⁾ (> 500 ppm)
Heizwert H _i ³⁾	berechnet	8–11,5 kWh/m ³	+/- 1,5 % MBE ¹⁾
Wobbeindex W _i ³⁾	berechnet	10–14,3 kWh/m ³	+/- 2 % MBE ¹⁾
relative Dichte (SG)	akustisch	0,5–0,8	+/- 3 % MBE ¹⁾

¹⁾ Linearitätsfehler bezogen auf den Messbereichsendwert
²⁾ Linearitätsfehler bezogen auf den Messwert

Tabelle 1: Typische Messbereiche INCA4003

Option (T-Modele) INCA4003

T-Modelle	kon./diskont.	CH ₄ [Vol%]	CO ₂ [Vol%]	H ₂ S [ppm]	O ₂ [Vol%]	H ₂ [ppm]	C ₂₊ [Vol%]
T030	diskont.	0 - 100 disk.	-	0 - 2000 disk.	0 - 25 disk.	-	-
T045	kont.	-	-	-	0 - 5 kont. ¹⁾ (Par)	-	-
T055	kont.	0 - 100 kont.	0 - 100 kont.	-	-	-	-
T074	diskont.	-	-	0 - 10.000 disk. ³⁾	0 - 25 disk.	-	-
T087	kont.	0 - 5 kont.	0 - 100 kont.	-	-	-	-
T095	kont.	0 - 100 kont.	0 - 100 kont.	-	0 - 25 kont.	-	-
T096	diskont.	-	-	0 - 10.000 disk. ³⁾	-	-	-
T098	diskont.	0 - 100 disk.	-	0 - 10.000 disk. ³⁾	0 - 25 disk.	-	-
T099	kont.	0 - 100 kont.	-	0 - 10.000 disk. ³⁾	0 - 25 disk.	-	-
T100	diskont.	0 - 100 disk.	0 - 100 disk.	0 - 10.000 disk. ³⁾	0 - 25 disk.	-	-
T101	kont.	0 - 100 kont.	0 - 100 kont.	0 - 10.000 disk. ³⁾	0 - 25 kont.	-	-
T107	kont.	0 - 100 kont.	-	-	-	-	-
T109	kont.	0 - 100 kont.	0 - 10 kont.	-	-	-	-
T111	kont.	0 - 100 kont.	0 - 100 kont.	0 - 2000 disk.	0 - 25 disk.	0 - 4000 disk.	-
T131	kont.	0 - 100 kont.	0 - 10 kont.	0 - 100 disk.	0 - 25 disk.	-	-
T133	kont.	0 - 100 kont.	0 - 100 kont.	0 - 100 disk.	0 - 25 kont.	-	-
T137	kont.	0 - 100 kont.	0 - 10 kont.	0 - 100 disk.	0 - 25 disk.	0 - 4000 disk.	-
T140	diskont.	0 - 100 disk.	0 - 100 disk.	0 - 10.000 disk. ³⁾	0 - 25 disk.	0 - 4000 disk.	-
T141	kont.	0 - 100 kont.	0 - 100 kont.	0 - 10.000 disk. ³⁾	0 - 25 kont.	0 - 4000 disk.	-
T145	kont.	0 - 100 kont.	0 - 10 kont.	0 - 100 disk.	0 - 25 kont.	-	-
T160	diskont.	0 - 100 disk.	0 - 100 disk.	0 - 50.000 disk. ³⁾	0 - 25 disk.	-	-
T161	kont.	0 - 100 kont.	0 - 100 kont.	0 - 50.000 disk. ³⁾	0 - 25 kont.	-	-
T301	kont.	80 - 100 kont. ²⁾ (7µm)	-	-	-	-	0-20 kont.
T303	kont.	0 - 100 kont. ²⁾ (7µm)	-	-	-	-	0-20 kont.

Kont. = Online Messung; diskont. = min 15 min; ¹⁾ paramagnetic; ²⁾ 7,9µm; ³⁾ µPulse; ⁴⁾ without µPulse; ⁵⁾ in N₂; ⁶⁾ Ergas in Luft; ⁷⁾ berechnet

Technische Daten



Technische Daten INCA4003

Gewicht	bis zu 30 kg
Abmessung B x H x T [mm]	745 x 630 x 220
Schutzklasse	IP20
Stromversorgung	100–240 V, 50/60 H
Leistungsaufnahme	250 VA
Gaseingänge	
Messgaseingänge	2–4 elektr. Kugelhahnventile
Kalibriergaseingänge	1
Spülgaseingänge	1
Gasanschlüsse	Klemmringverschraubung 6 mm
max. Gaseingangsdruck	20 mbar rel.
min. Gaseingangsdruck	- 100 mbar rel.
Flammensperre	ATEX-Zulassung G IIC
Rel. Gasfeuchte	≤ 100% (Kondensat möglich)
Kondensatfalle	ja
Messgaskühler	ja
Kühlprinzip	thermoelektrisch
Taupunkt	3–30 °C einstellbar
Kondensatableitung	Schlauchpumpe
Umgebungsbedingungen	
Betriebstemperatur	5–45 °C
Feuchtigkeit	0–95 % relative Luftfeuchtigkeit
Umgebungsdruck	900–1250 hPa (0,9–1,2 bar)
Lagertemperatur	-20–60 °C
Schnittstellen	
Relais	3
dig. Schnittstelle	RS232
4-20 mA	optional
Feldbus	optional
Fernwartungsmodul (IP/TCP)	optional

Tabelle 2: Technische Daten INCA4003



Über Union Instruments

Die 1919 gegründete UNION Instruments GmbH ist ein Spezialanbieter messtechnischer Geräte in den Bereichen Kalorimetrie und Gaszusammensetzung. Sowohl Biogaserzeuger, die chemische Industrie sowie Energie- und Wasserversorger gehören zum Anwender- und Kundenkreis. Das Unternehmen mit Hauptsitz in Karlsruhe hat eine Niederlassung in Lübeck.

Mit 30 internationalen Distributoren operiert UNION Instruments weltweit. Zum Kerngeschäft gehören einerseits Entwicklung und Fertigung sowie andererseits Wartung, Service und Support.

Unsere Serviceleistungen



Support

Die **UNION-Hotline** hilft schnell und unkompliziert dringende Fragen zu lösen. Durch die Kommunikation über TEAM-VIEWER lassen sich Probleme weltweit in Minuten beheben.



Original-Ersatzteile

Ersatzteile der Originalgeräte sind bei den meisten Produkten werkseitig verfügbar und innerhalb weniger Stunden zum Versand bereit.



Software

Zum Auslesen von Mess- und Kalibrierdaten steht unseren Kunden eine gerätespezifische Software zur Verfügung. Neben der grafischen Darstellung der Messdaten ist ihr Export in verschiedenen Formaten möglich.



Schulung

UNION bietet INHOUSE- oder VOR-ORT-Schulungen zur Installation, Benutzung und Wartung von Geräten an. Die Schulungen werden individuell auf die Kundenbedürfnisse abgestimmt.



Reparaturservice

UNION bietet direkt und über Distributoren einen weltweiten Reparatur-Service an, der die Überprüfung, Wartung und Instandsetzung von Geräten und Systemen umfasst.



Zertifizierungen

UNION hat seit 20 Jahren ein ISO900-System; die Produkte sind ATEX und UL/CSA zertifiziert. Der Arbeitsschutz mit „**Sicher mit System**“ gehört zu den Leitfäden der Firmenpolitik.



Engineering

Den Stand der Technik, den UNION in den letzten Jahrzehnten erarbeitet hat, erstreckt sich über viele Marktsegmente. Daher kann auf ein großes Spektrum von Lösungsansätzen zurückgegriffen werden.



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UNION bietet im Rahmen von Wartung und Service die Validierung und Re-Kalibrierung von Messgeräten gegen eichamtliche und/oder rückführbare Normale an.

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Translation of the original
operating instructions

Process gas analyser INCA4003



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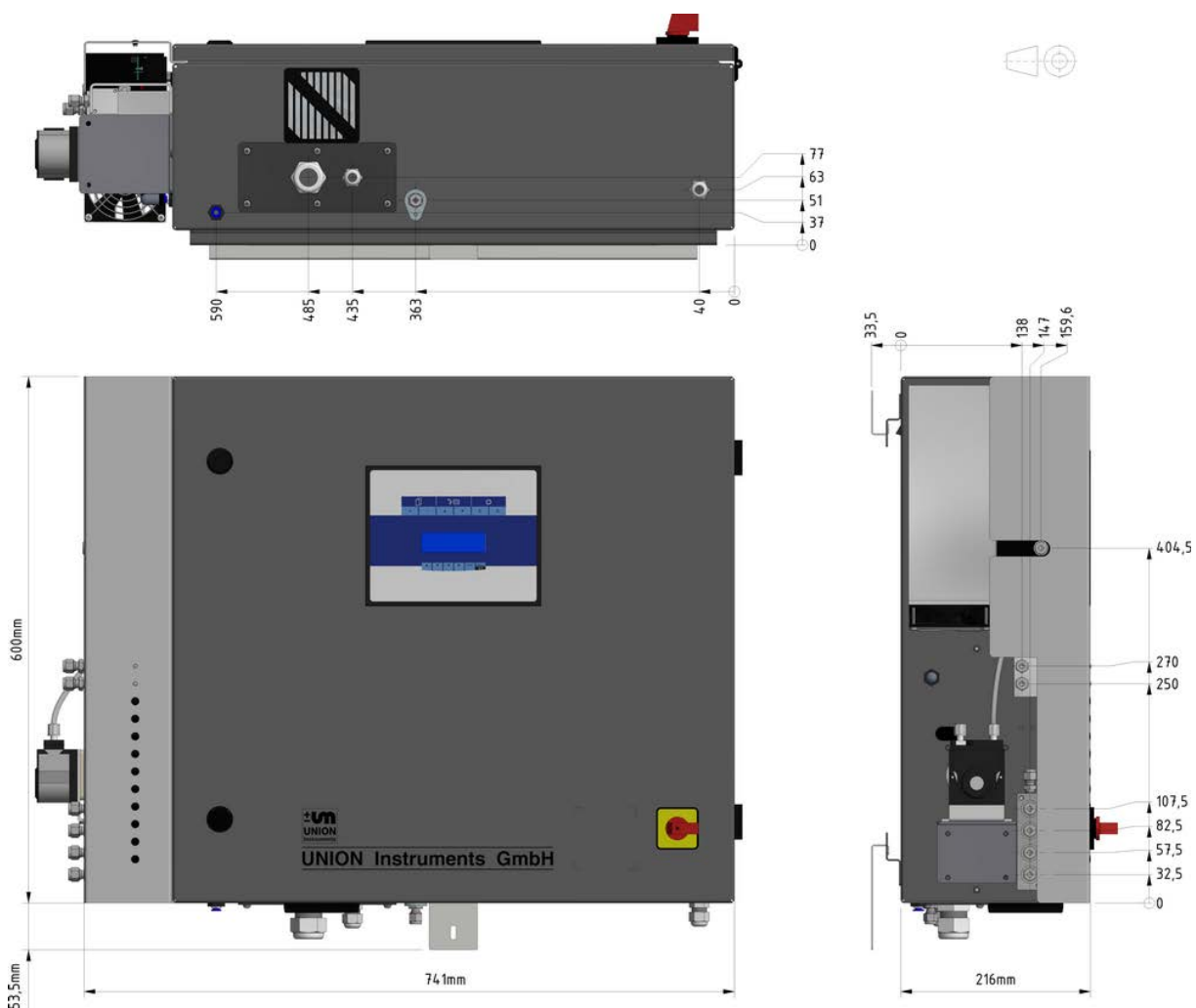
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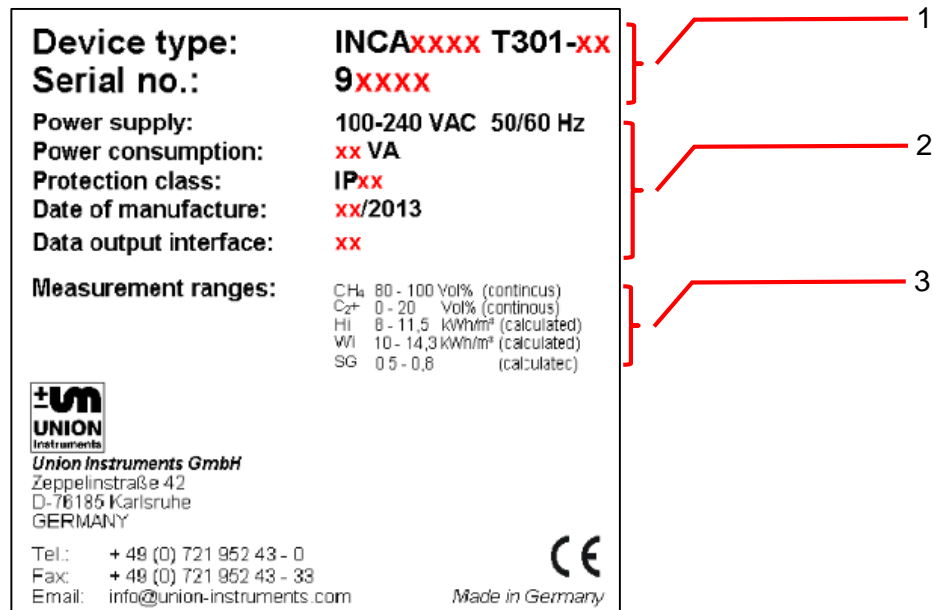
Dimensions



Measuring ranges and measuring accuracy

Refer to type plate on device also attached data and information.

Example of Measuring ranges on type plate:



The type plate contains the following information:

Device type:	INCAxxxx T301-xx
Serial no.:	9xxxx
Power supply:	100-240 VAC 50/60 Hz
Power consumption:	xx VA
Protection class:	IPxx
Date of manufacture:	xx/2013
Data output interface:	xx
Measurement ranges:	CH ₄ 80 - 100 Vol% (continuous) C ₂ H ₂ 0 - 20 Vol% (continuous) HI 8 - 11,5 kWh/m ³ (calculated) WI 10 - 14,3 kWh/m ³ (calculated) SG 0,5 - 0,8 (calculated)

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CE Made in Germany

Red brackets and numbers 1, 2, and 3 point to the following sections:

- 1: Device type and Serial no.
- 2: Power supply, Power consumption, Protection class, Date of manufacture, and Data output interface.
- 3: Measurement ranges.

Fig. 1.1: Type plate (exemplary)

1. Device description
2. Technical Information
3. Measurement ranges

Technical data

Gas inlets

Number of measuring points:	1 – 4 electrical ball valves
Calibration inlets:	1
Purge gas inlets:	1
Gas connections:	Clamp ring connection 6 mm
Max. distance between measuring point and analyser:	10 m
Max. gas inlet pressure:	20 mbar relative (optional 300 mbar)
Min. gas inlet pressure:	-100 mbar relative
Flame arrester:	ATEX certification G IIC
Relative gas humidity:	≤ 100% (condensate possible)
Condensate trap:	yes

Calibration gas

Calibration interval:	manual or automatic (configurable between one hour and up to several weeks)
Duration of calibration:	10 minutes (recommended by the manufacturer)
Gas consumption:	5 l/calibration

Power supply

Voltage:	100 - 240 V 50/60 Hz
Power consumption:	250 VA max.
Protection class:	I
Degree of protection	IP20

Interfaces

Relay:	3
Dig. interface:	RS232
Field bus:	optional
Optional relay:	optional
Remote Control Unit:	optional

Sample gas cooler

Cooling principle:	thermoelectric
Dew point:	3 - 30 °C adjustable
Condensate drain:	Hose pump

Ambient conditions

Operating temperature:	5 - 45°C
Humidity:	0 - 95 % relative humidity
Ambient pressure:	900 - 1250 hPa (0.9 - 1.2 bar)
Storage temperature:	-20 - 60°C

Weight

Weight:	up to 30 kg
---------	-------------



ATTENTION

When using the process gas analyser in other ambient conditions, consult UNION Instruments GmbH for additional measures.

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1 EU Declaration of Conformity



Der Hersteller / The manufacturer

Union Instruments GmbH
Zeppelinstrasse 42
76185 Karlsruhe

erklärt hiermit, dass folgend bezeichnete Produkte / hereby declares, that following named products:

Produktbezeichnung:	Gasanalysator	Gerätegruppe:	INCA4000
Product name	Gas Analyzer	device group	INCA4000

konform sind mit den Anforderungen, die in der EU – Richtlinie festgelegt sind / are compliant with the requirements as defined in the EU directive:

2014/30/EU	Elektromagnetische Verträglichkeit
2014/30/EU	Electromagnetic compatibility
2014/35/EU	Elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen
2014/35/EU	Electrical equipment designed for use with certain voltage limits

Angewandte harmonisierte Normen / Used harmonized standards:

EN 61010-1:2010	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte - Teil 1: Allgemeine Anforderungen; Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements
EN 61326-1:2013	Elektrische Mess-, Steuer-, Regel- und Laborgeräte - EMV-Anforderungen - Teil 1: Allgemeine Anforderungen Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

Name des Dokumentationsbevollmächtigten:	Schlichter
Name delegate of documentation	

Adresse des Dokumentationsbevollmächtigten:	siehe Adresse des Herstellers
address delegate of documentation	see address of manufacturer

Bei einer nicht autorisierten Änderung des Gerätes verliert diese Erklärung ihre Gültigkeit. / Any unauthorized modification of the device results in invalidity of this declaration.



2 Safety notes


2.1 Warnings and symbols

In the operating instructions, the following names and symbols are used to denote particularly important information:

	 DANGER
	Immediate danger that can lead to serious physical injury or death.

	 WARNING
	Potentially hazardous situations that can lead to serious injury or death.

	 ATTENTION
	Potentially hazardous situations that can lead to minor physical injury. This can also be used for property damage.

	NOTE
	Denotes information that can make it easier to handle the process gas analyser or help prevent property damage.

2.2 Fundamentals of proper use

The process gas analyser serves to identify gases and their quality in biogas, crude biogas, lean gas and biomethane.


Applications are biological process optimisation during motor control, controlling preparation systems, analysing biogas, landfill gas and gas from purification plants.

The gas analyser is not suitable for determining the workplace threshold or lower explosion limit.

In the case of toxic and explosive gases, observe the safety instructions at the setup site.

The process gas analyser is permanently installed and is intended for use inside closed rooms in a sufficient quantity of clean ambient air.

Any other use is considered improper. The manufacturer is not liable for the resulting damage; the associated risk is borne by the installer, fitter, operator or user. Only certified professionals may alter the process gas analyser (mechanical, electrical or pneumatic modifications).



	 WARNING
	<p>Proper use includes following these operating instructions. In addition to the following safety notes, always follow the safety instructions of the linked system components.</p> <p>Additional equipment or accessories that are not installed, delivered or manufactured by UNION Instruments GmbH require the approval of UNION Instruments GmbH as the manufacturer! Otherwise the guarantee expires.</p>

2.3 Personnel and qualifications




Gas connections and work on the electrical equipment of the process gas analyser may only be performed by a professional while observing safety regulations.

2.4 Safety notes

2.4.1 General notes on safety

	 <h2 style="margin: 0;">WARNING</h2>
	<p>The process gas analyser may only be operated when all of the protective equipment is available and operable.</p> <p>Additional safety notes:</p> <p>☞ <i>before the corresponding chapters!</i></p>

2.4.2 Notes regarding special hazards

 	 <h2 style="margin: 0;">WARNING</h2>
	<ul style="list-style-type: none"> • After installation, all gas conducting parts must be checked for leaks according to national regulations. • All repairs that require the protective covering to be opened may only be performed by trained personnel. • Sensors can contain sulphuric acid. This may leak in case of improper use. Protect from contact with skin and eyes.

2.5 Regular operator training

	<h2 style="margin: 0;">NOTE</h2>
<p>Country-specific regulations about regular user training by the operator must be observed, in particular training on handling gases and electrical equipment.</p>	

2.6 Workplace hazard analysis

	NOTE
	Depending on the national regulations, the operator must perform a workplace hazard analysis, if applicable independent of the CE mark for this process gas analyser.




Technical developments can give rise to deviations from these operating instructions. If you require additional information or if particular problems arise that are not fully addressed in this manual, please contact the following address:

Union Instruments GmbH

Zeppelinstrasse 42

76185 Karlsruhe

Germany

	+49 (0)721-680381-0
	+49 (0)721-680381-33
	support@union-instruments.com
	http://www.union-instruments.com

3 Safety equipment

3.1 Main switch

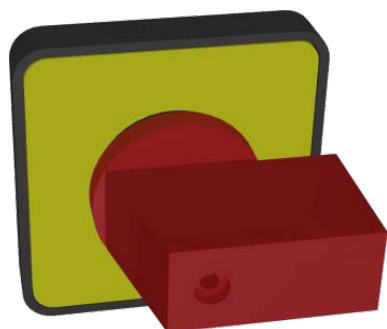


Fig. 3.1: Main switch (exemplarisch)

3.2 Safety equipment

3.2.1 Door - not electronically queried

- Door of the process gas analyser.

3.2.2 Ventilator monitoring

If the housing fan fails, the process gas analyser is de-energized. The power supply unit and fan monitor control still have power.

3.3 Markings and warnings

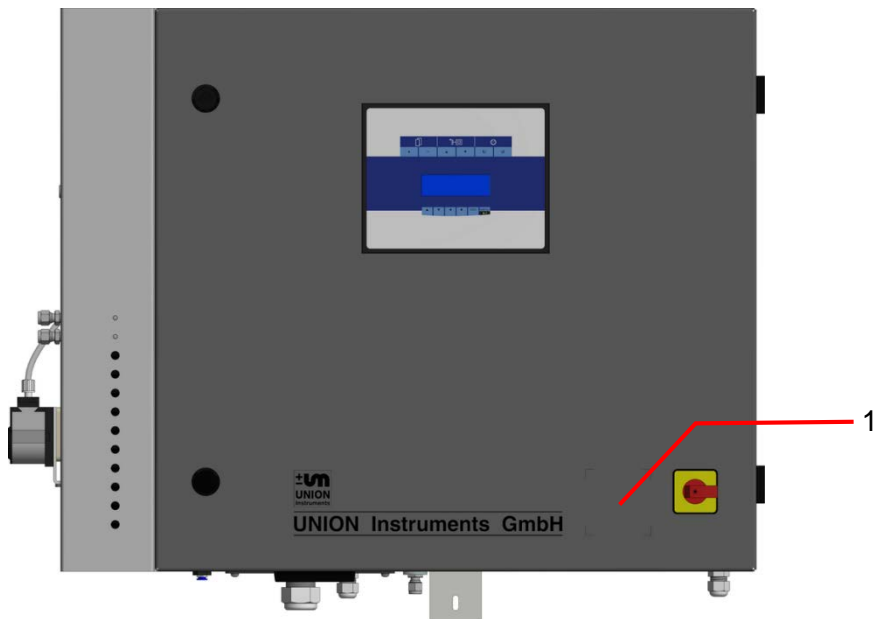


Fig. 3.2: Markings and warnings

1. Type plate

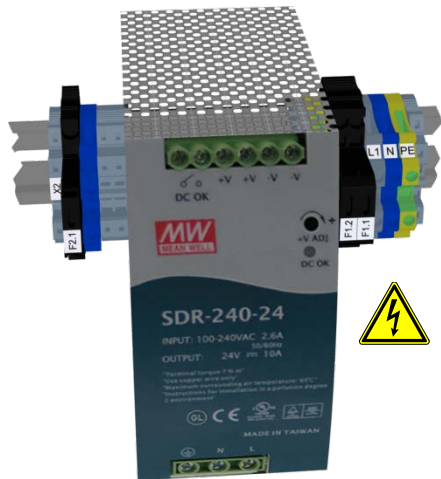


Fig. 3.3: Warning in housing

4 Connections

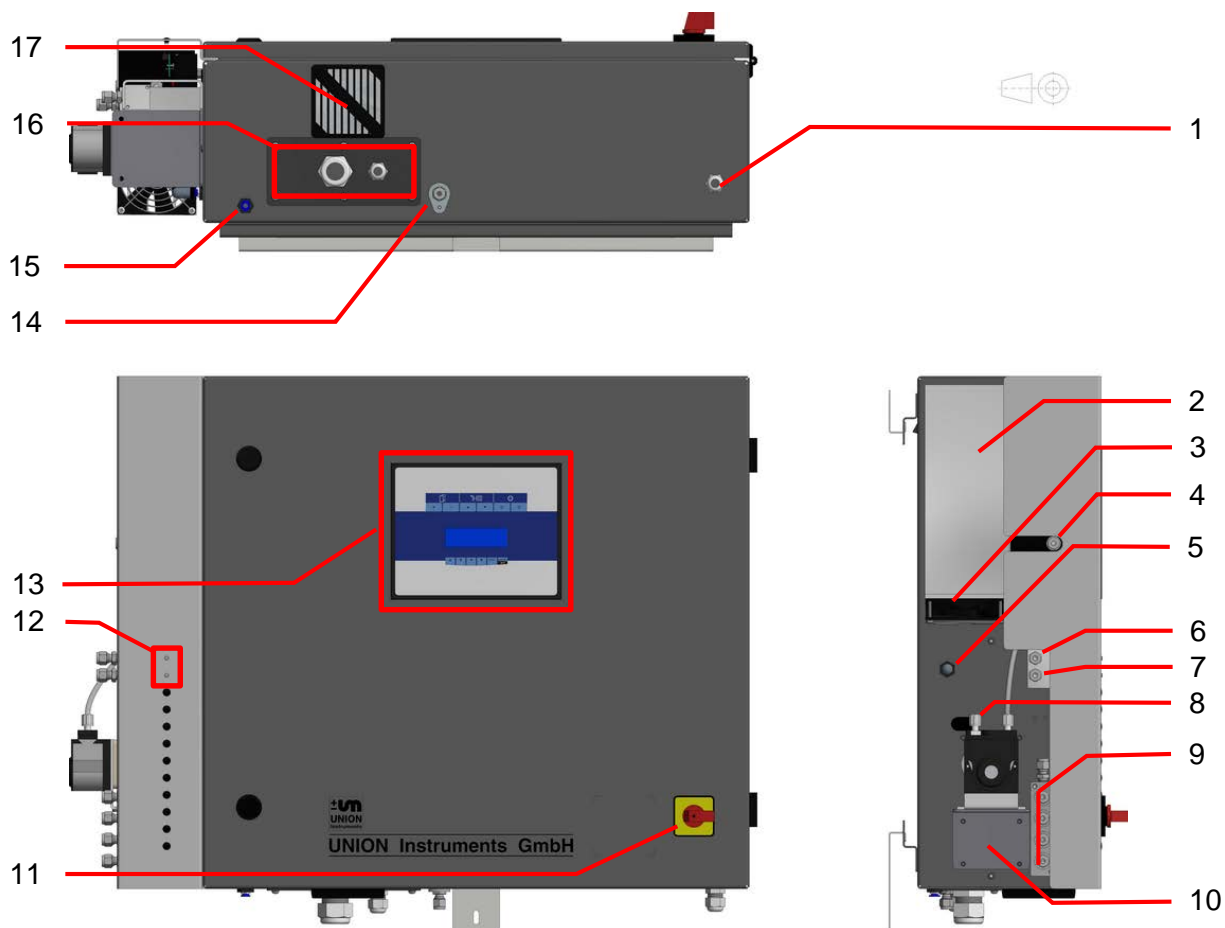


Fig. 4.1: Product description

- | | |
|-------------------------------|--|
| 1. Power supply cable bushing | 10. Hose pump |
| 2. Gas cooler | 11. Main Switch |
| 3. Gas cooler fan | 12. Solenoid valve display, inlet on/off |
| 4. Input gas cooler | 13. Operating element |
| 5. Intake air filter | 14. Output process gas |
| 6. Input calibration gas | 15. Output pressure regulator leakage |
| 7. Input purge gas | 16. Cable bushings |
| 8. Condensate pump connection | 17. Fan |
| 9. Input process gas | |



NOTE

Up to 4 process gas lines can be connected.

Connection of process gas and electric ball valve

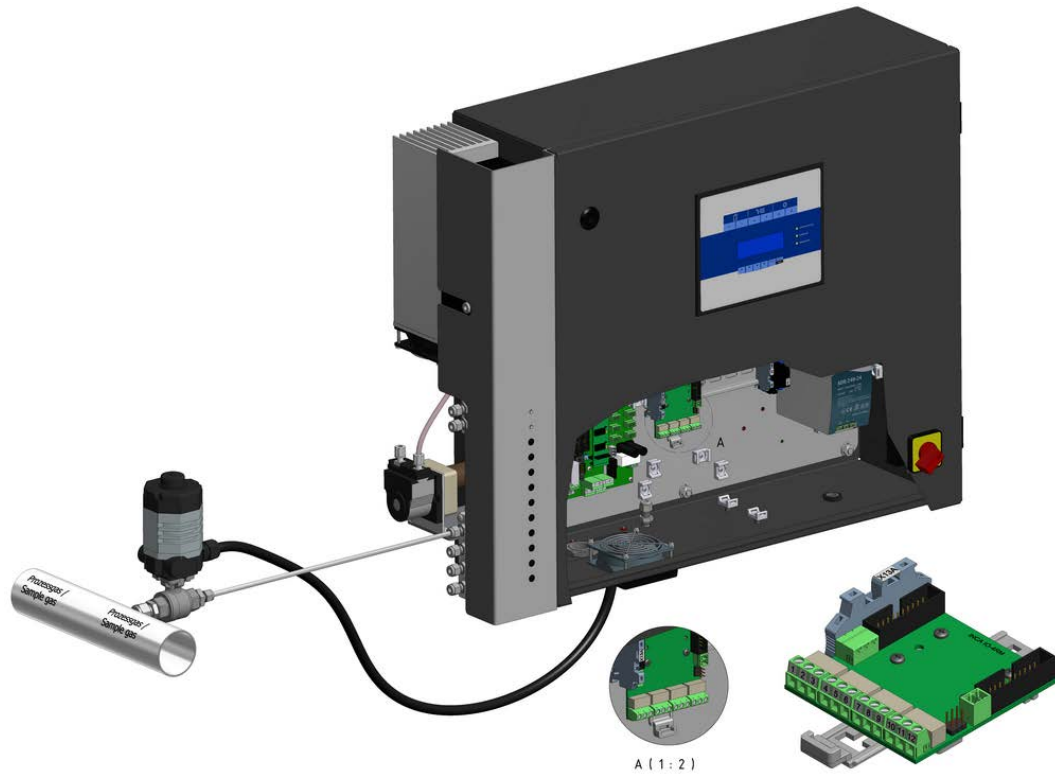




Fig. 4.2: Connection of process gas and electric ball valve

Observe the following during installation:


- Mount ball valves directly at withdrawal point.
- Diameter of outgoing line at ball valve 6 mm.
- The process gas line must not overcome larger height differences.
- Install the lines to the process gas analyser frost-free.

	! WARNING
	<p>Closing ball valves! If the process gas analyser is switched off or after a failure of the power supply, ball valves are without power supply. Valves must be closed manually! Observe the operating instructions of the ball valves.</p>



4.1 Accessories

	<p> WARNING</p> <p>Risk of injury/defective!</p> <p>Use of non-approved accessories can cause defects and be hazardous. This will render the warranty null and void. The operator is then liable for any damage that may occur.</p> <p>Only use original accessories or accessories that have been approved by Union Instruments GmbH.</p>
---	---

5 Transport, setup and acceptance



	NOTE
	<p>Generally, the process gas analyser is started up by Union Instruments GmbH or service technicians.</p> <p>If it is not transported, set up and started up by Union Instruments GmbH (for example in-house transportation and resale), coordinate the appropriate procedure with Union Instruments GmbH (☞ <i>Chapter 12 Service</i>).</p>

5.1 Transport

 	WARNING
	<p>Possible injury from the process gas analyser tipping over or falling from pallets and load carrying equipment.</p> <ul style="list-style-type: none"> • At least two persons are required to unpack and transport the analyser (for weight see technical data)! • Check the load bearing capacity and condition of the slinging equipment and carefully attach it. • Never stand under suspended loads.

	NOTE
	<p>In case of damage during transport from improper handling, the carrier should perform a damage report within seven days (railway, post office, freight forwarder).</p>

5.2 Ambient conditions

	 ATTENTION
	<p>Ambient conditions during storage and set up.</p> <p>Observe the stipulated ambient conditions. Contact Union Instruments GmbH if the process gas analyser has been stored for more than three months or needs to be operated or stored under ambient conditions other than those specified.</p>

5.2.1 Storage conditions

If condensation water freezes in the process gas analyser, this can cause defects. Protect the process gas analyser against frost when putting it into storage.

Ambient temperature:	-20 - 60°C
Humidity:	0 - 95% relative humidity
Ambient pressure:	700 - 1400 hPa (0.7 - 1.4 bar)

5.3 Set up and connection

5.4 Setup site

The setup site for the process gas analyser must satisfy the following conditions:

- Clean dry room (with the exception of INCA5000/INCA6000)
- No direct exposure to sun
- Protect from climate influences with a heater or air conditioning if necessary
- Insure a clean, sufficient amount of ambient air for undistorted measurements
- Ensure that the loadbearing capacity of the wall is sufficient

	 WARNING
	<p>Leaking process gas can pose a hazard and needs to be discharged by the operator into a safe environment.</p>

5.4.1 Wall attachment


The process gas analyzer is intended for wall installation. The wall brackets are permanently attached to the housing.


The wall on which the process gas analyser is to be installed needs to be sufficiently stable to bear its weight.
Attach process gas analyser to brackets.





Fig. 5.1: Wall attachment

5.4.2 Process gas



	NOTE
	<ul style="list-style-type: none">• The connecting parts need to be clean and free of residue. Impurities can enter the process gas analyser and cause incorrect measurements and/or damage.• The inlet pressure for the gas connections must not exceed the pressure specified on the instruction sticker on the process gas analyser.• Each connection needs to be carefully checked for leaks. If there are any leaks, the system will draw air, and the measurements will be incorrect.• Do not use sealing compound to seal the gas connections as this can lead to inaccurate measurements. Use PTFE sealing tape.• Only use suitable pipes.• Use a separate line to drain off the condensate.


	ATTENTION
	The process gas must be free of condensate and dust if the process gas analyser has no gas preparation system (or gas cooler).

5.4.3 Electrical connection

	 DANGER
	<p>Danger from electrical shock!</p> <p>Only a trained electrician may modify the electrical equipment of the process gas analyser in accordance with the relevant guidelines.</p> <p>When the process gas analyser has been opened, the parts identified by the adjacent symbol may still be live even when the master switch has been turned off. If necessary, disconnect the process gas analyser from the power supply.</p>

5.4.4 Electrical interfaces

	 WARNING
	<p>Untrained personnel starting the process gas analyser may endanger people and equipment.</p> <p>Only trained service technicians may start up the analyser.</p>

	NOTE
	<p>Only operate relay with functional extra low voltage.</p> <p>Do not connect to the power supply.</p>

Power Supply Connections



Fig. 5.2: Power Supply X2 with fuses

1. Power supply connections

Connect the process gas analyser to the power supply in accordance with national regulations via L1, N and PE.

Electrical Interfaces

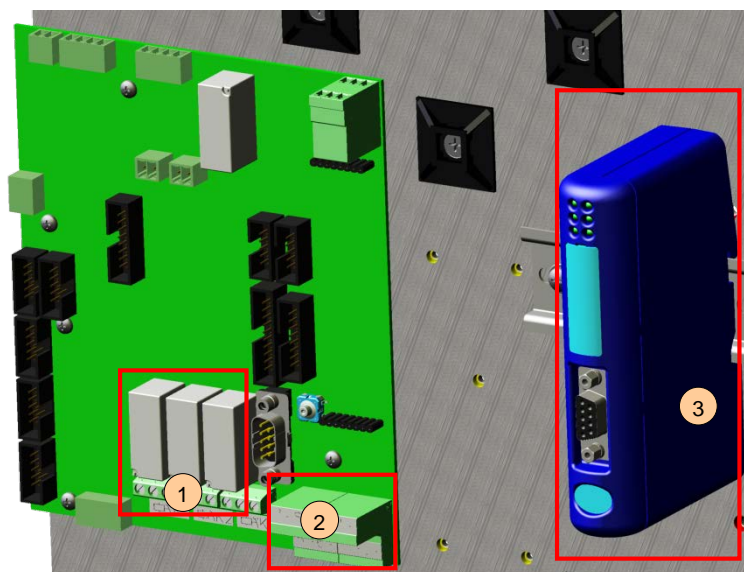


Fig. 5.3: Electrical interfaces

Item No.	Designation
1	Relay X10A <i>☞ Fig. 5.4 and 5.5!</i>
2	Analogue outputs X11A (optional) <i>☞ 5.6</i>
3	Profibus module X12 (optional)

Relay

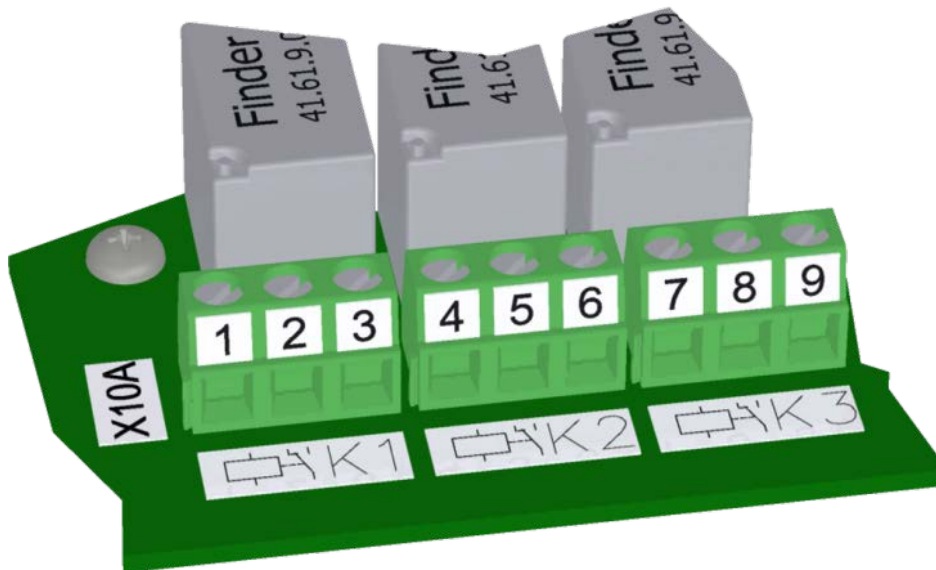


Fig. 5.4: Relay X10A, outputs K1 – K3

Item No.	Designation	Function
1	Relay K1	Operation
2	Relay K2	Failure (inverted)
3	Relay K3	OFF

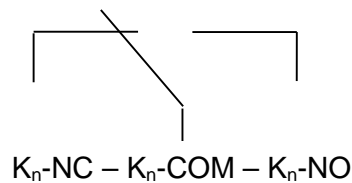



Fig. 5.5: Relay X10A terminal assignment

left - middle: normally closed
right - middle: normally open



NOTE

Only operate relay with functional extra low voltage.

Do not connect to the power supply.

Maximum load of the relay connections 30VDC / 1A.

Analogue outputs

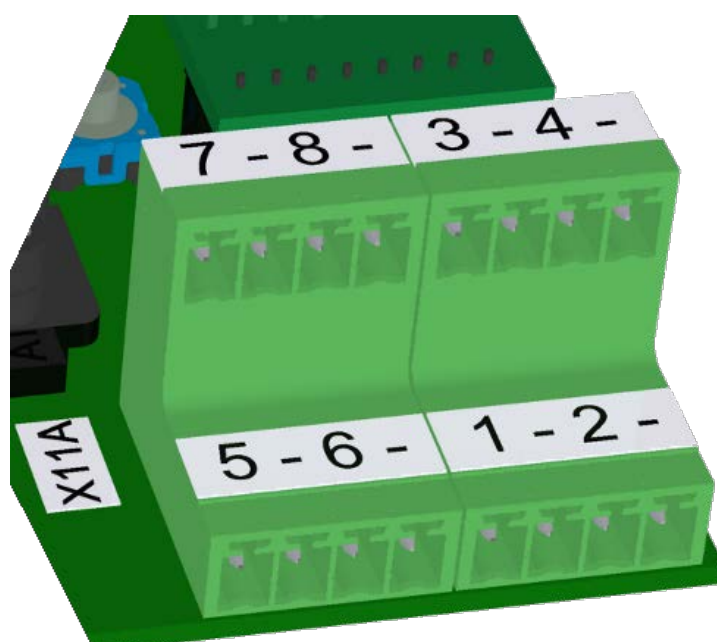


Fig. 5.6: Analogue outputs X11A, connections

Item No.	Function	Item No.	Function (2-channel device)
1	Output 1 – signal/signal 4-20 mA	5	Output 5 – signal/signal 4-20 mA
-	1 GND	-	5 GND
2	Output 2 – signal/signal 4-20 mA	6	Output 6 – signal/signal 4-20 mA
-	2 GND	-	6 GND
3	Output 3 – signal/signal 4-20 mA	7	Output 7 – signal/signal 4-20 mA
-	3 GND	-	7 GND
4	Output 4 – signal/signal 4-20 mA	8	Output 8 – signal/signal 4-20 mA
-	4 GND	-	8 GND

Assignment of analog interface configurable with Software INCACtrl.

The load resistor is 500 ohm.

Remote Control Unit RCM

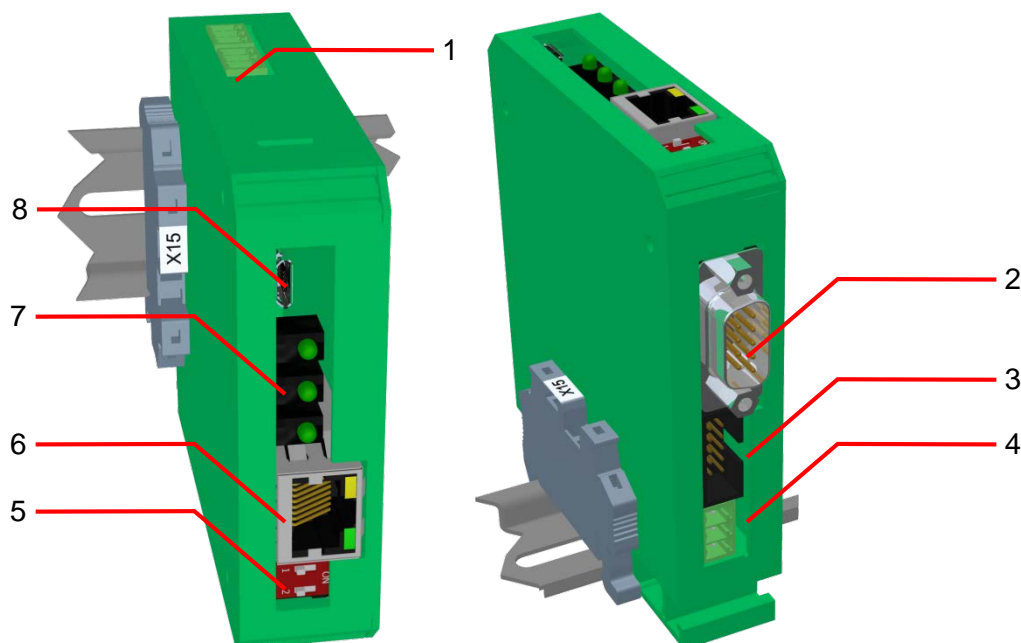


Fig. 5.7: Remote Control Unit RCM X15

Pos.-No.	Description
1	bus, connecting internal power supply
2	internal, RS232 connection for PCB-AddOn (Display) via null modem cable
3	connection Fieldbus coupler
4	bus, connecting internal power supply
5	DIP switches
6	Ethernet
7	status LED, LED 1- USB active, LED 2- Fieldbus active, LED 3 - Ethernet active (from top to bottom)
8	Micro-USB, local connection to PC, if used no connection via Ethernet/Fieldbus

Communication module for integration into Ethernet networks to communicate and operate the process gas analyser.

DHCP is enabled as factory setting, RCM received IP - address automatically from a DHCP server. Manual assignment of IP address with separate software (example: "DeviceInstaller", Lantronix).

Default Settings:

IP over DHCP	On
Port	10001
Protocol	TCP/IP
RS232	115200 bit/s, 8 data bit, 1 stop bit, no parity bit
MAC address	refer to label on RCM.

Electric Ball Valves

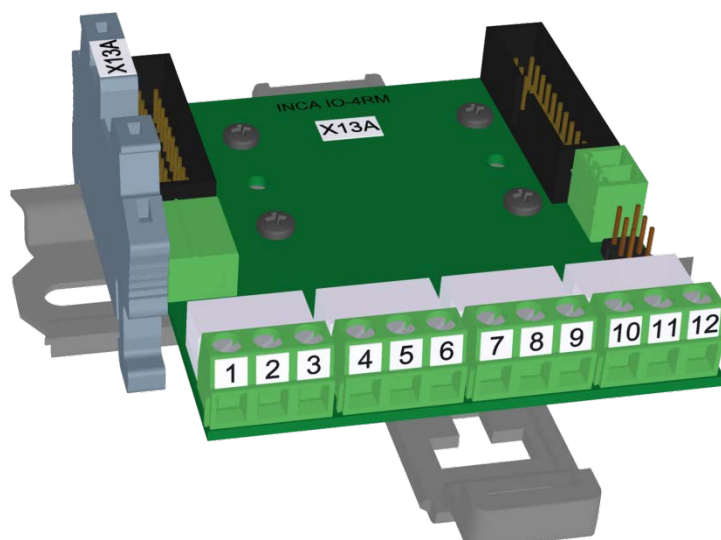





Fig. 5.8: Relay X13A, Connections ball valves

The electrical connections for the ball valves are established from the left with the first relay - channel 1 – to the right (channel 2 to channel 4). The first two terminals of each relay are assigned in each case.

Pos.-No. X13A	Channel	cable of ball valve
.1	1	red
.2		black
.3		--
.4	2	red
.5		black
.6		--
.7	3	red
.8		black
.9		--
.10	4	red
.11		black
.12		--



Maximum load of the relay connections 30VDC / 1A.

5.4.5 Operator safety precautions


 	 WARNING
	<ul style="list-style-type: none">• The operator needs to provide suitable safety equipment for the process gas analyser to reliably prevent individuals from being injured from gas leaks.• Any leaking process gas needs to be diverted into a safe environment.• Identify the exit point of the diverted gas with a warning.• Danger of tripping due to improperly installed supply lines.

Install the supply lines in a suitable manner.



5.5 Startup after setup


	 WARNING
	<p>Untrained personnel starting the process gas analyser may endanger people and equipment.</p> <p>Only trained service technicians may start up the analyser.</p>


5.6 Documentation

	NOTE
	<p>Union Instruments GmbH recommends keeping a maintenance manual and documenting all jobs and tests.</p>


6 Startup /switching on

	 ATTENTION
	<p>To establish operational readiness, including of the linked system components, according to the corresponding operating instructions.</p>

	NOTE
	<p>The following table contains highly abbreviated steps for starting up after a long downtime.</p> <p>To turn on the process gas analyser after a short downtime, a few steps can be omitted: <i>☞ right column!</i></p>

Steps	Startup	Turning on
Check whether the ambient conditions (<i>☞ Technical Data chapter on page 5!</i>) meet the requirements.	X	X
Check that the process gas analyser has been fastened securely.	X	
Check that the device is suitable for the process gas.	X	
Check that the process gas is correct.	X	
Check that the gas connections are correct and tight.	X	X
Check the integrated filters (water/fine filter) for condensate, if necessary.	X	X
Check, if necessary, that the calibration gas is correct.	X	X
Establish/switch on the operator energy and media supply.	X	X
Check the voltage.	X	
Open shut-off valves.	X	X
Turn on the master switch.	X	X
Make sure the linked system components are ready to start.	X	X
 If the process gas analyser was only switched off temporarily, production can be resumed.		

7 Description of the workplaces/operating elements

	NOTE
	<p>This chapter only discusses the elements used by normal operators to operate the process gas analyser.</p>

7.1 Workplaces

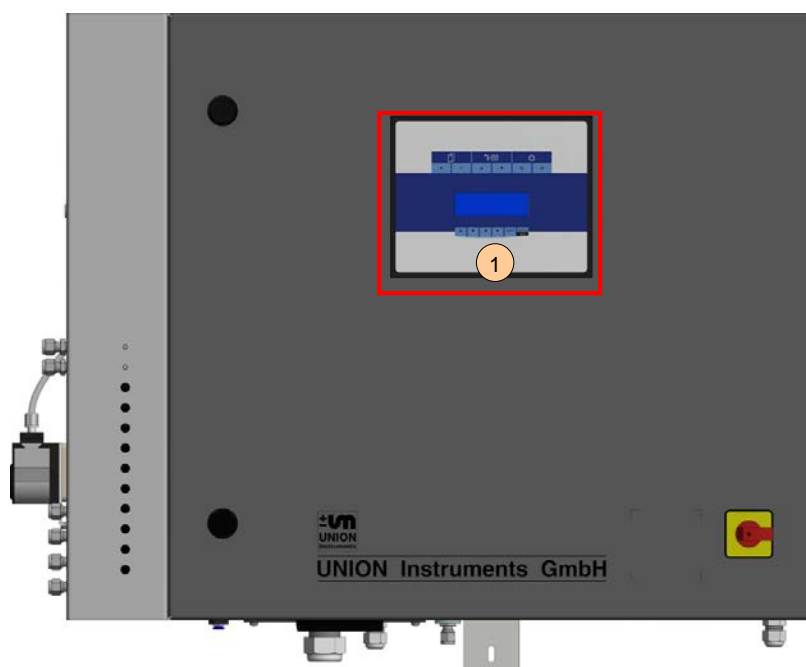


Fig. 7.1: Workplaces

Item No.	Designation	Function/Activity
1	Display with status LED	Display status.

Display status LED

The following states are displayed through those LEDs:




LED Operation	
Output state	Description
 flashing	Device functionality OK (even Service might be pending)
 flashing	Device functionality is affected by errors, Service message pending
 flashing	Device stopped by fatal error, Error pending

Fig. 7.2: Status LED

8 Operation

	 WARNING
	<p>Danger of injury! Only use the process gas analyser when all lines have been installed and checked for leaks according to national regulations.</p>

8.1 Description of display

8.1.1 Using the membrane keypad

The software controls are operated using a membrane keypad. The displayed buttons can be selected by pressing the key. The menu structures are intentionally flat to enable quick access to functions.

ATTENTION

Damage to the membrane keypad!

The membrane keypad may be damaged if you use other objects to operate it apart from your fingers.

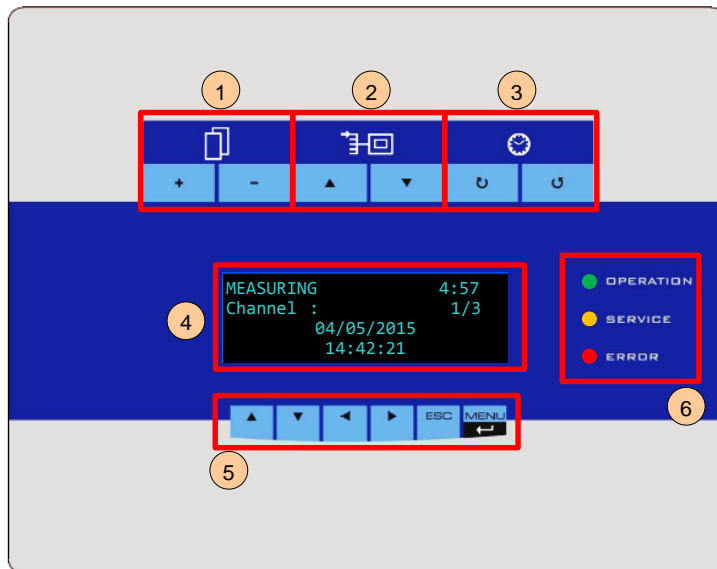


Fig. 8.1: Operating elements

Item No.	Designation	Function
1	Measurement display	Display the current sensor measurements.
2	Measuring channel display	Display the current channel measurements.
3	Saved measured values	Switch between the last 10 saved measured values.
4	Display	Display values, times and measurement results
5	Menu keys	Navigating the menu structure
6	Status LED	Display state of device

8.1.2 Displayarea

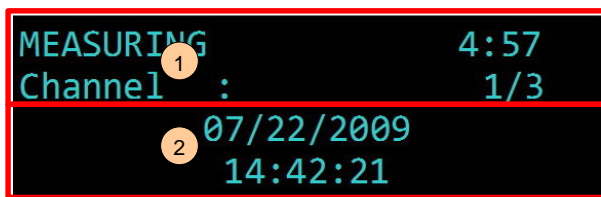



Fig. 8.2: Display area

Item No.	Designation	Function
1	Top display area	Display the status and channel information
2	Bottom display area	Switch between various measured values with the arrow keys (▼▲▶◀).

8.2 Available displays

	NOTE
	<p>The available displays and corresponding functions are described below. The navigation path to the displays is indicated by the menu and function keys in the chapter headings.</p> <p>The control system is based on the structure shown below.</p>

8.2.1 Menu structure



NOTE

If some of the menu items (framed in red) are changed, this can subsequently influence the measurement results.

Main menu

Settings

- Language
- Password

- Output data
- Screen change

Parameter

- ABC built-in
- EC meas. Cycle¹⁾
- Purge time¹⁾

Commands

- Start measurement
- Stop measurement
- Restart System
- Clear messages
- Calib. purge gas
- Calib. gas 1
- Calib. gas 2¹⁾
- Reset cal.-data
- Test (gas 1)
- Abort calib.
- Check OK

System info

- Version firmware

System messages

The menu structure refers to firmware version V1.08.

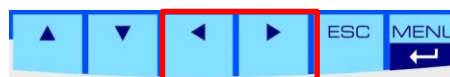
¹⁾ only available for certain device configurations

8.2.2 Navigate with the arrow keys left ◀ and right ▶

```
MEASURING 4:57
Channel : 1/3
07/22/2009
14:42:21
```

- The display indicates that the measuring status is active.

```
MEASURING 4:55
Channel : 1/3
CO2 : 20.8 vol%
CH4 : 30.8 vol%
```




- Switch between the measurements by pressing the left ◀ and right ▶ keys.

```
MEASURING 4:53
Channel : 1/3
H2S :* 23 ppm
O2 :* 20.8 vol%
```

The asterisk (*) indicates that a saved value is being displayed. The values are updated in the display depending on the measuring status.

With continuous measurement, an asterisk is not displayed since the value is measured and updated continuously.

8.2.3 Navigation with arrow keys up ▲ and down ▼



NOTE

To navigate with the arrow keys up ▲ or down ▼, use the left ◀ and right ▶ arrow keys to select the display in which the date and time are shown.

```
MEASURING          4:57
Channel  :         1/3
              07/22/2009
              14:42:21
```



```
MEASURING          4:53
Channel  :         1/3
Err      :          0 Errors
MSGs     :          7 Messages
```

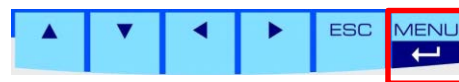
```
MEASURING          4:50
Channel  :         1/3
pAir     :          1.8 mbars
pGas     :          0.3 mbars
```

```
MEASURING          4:45
Channel  :         1/3
T_IR     :          49.2 °C
TCool    :          5.3 °C
```

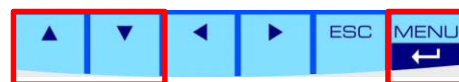
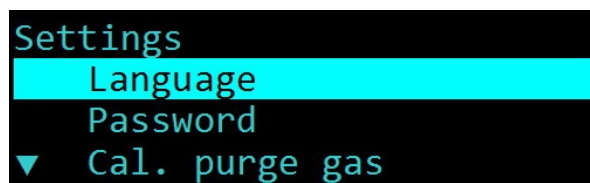
```
MEASURING          4:45
Channel  :         1/3
TCase    :          49.2 °C
Tout     :          5.3 °C
```

- Press the up ▲ and down ▼ keys to display other data.
- "Err" displays the number of saved errors.
- "MSGs" shows the number of saved messages.
- "pLuft" and "pGas" are the differential pressures measured for the individual gas pathways (air and process gas) in the process gas analyser.
- "T_IR" is the current temperature of the infrared measuring unit.
- "TCool" is the current temperature of the gas cooler.
- "TCase" is the current temperature in the housing.
- "Tout" is the current ambient temperature.

8.2.4 Navigation with ESC and MENU



- With the MENU key to the main menu.



- Select the submenu with the up ▲ and down ▼ keys.
- Confirm the selection by pressing the MENU key.



- Press the ESC key in the menu to go one level higher.

8.2.5 Measurement display

```
MEASURING          4:32
Channel  :         1/3
              07/22/2009
              14:42:21
```



- Select the individual measurements with the plus + or minus - keys.

```
O2 (Channel 1)
* 10.0 vol%
```

```
H2S (Channel 1)
* 31 ppm
```

The asterisk (*) indicates that a saved value is being displayed. The values are updated in the display depending on the measuring status.

With continuous measurement, an asterisk is not displayed since the value is measured and updated continuously.

8.2.6 Measuring channel display

```
MEASURING          4:12
Channel  :         1/3
              07/22/2009
              14:42:21
```



- Use the up ▲ or down ▼ keys to select the individual channels.

```
O2 (Channel 1)
* 10.0 vol%
```

```
O2 (Channel 2)
* 14.0 vol%
```

8.2.7 Saved measured values

```
MEASURING 4:12
Channel : 1/3
07/22/2009
14:42:21
```



- Press the forward ↶ or back ↷ key to step through the last saved measured values.
- The measured values are identified by the count/date/time.

```
O2 (Channel 1)
* 10.0 vol%
01 08/03/2009-12:21
```

```
O2 (Channel 1)
* 12.0 vol%
02 08/03/2009-11:21
```

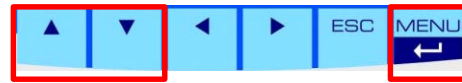
8.2.8 Display in the warmup phase

```
WARM-UP *
T(IR) : 49.2°C - OK
---
T(POX) : 0x0400 -
```

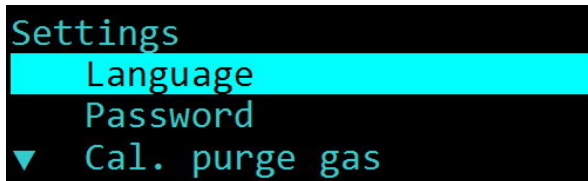
The figure shows the display during the warm-up phase. In the figure, the infrared electronics, T(IR), have reached operating temperature. Depending on the type of sensor, this is 49°C or 64°C. The Parox sensor, T(POX), is not ready. Once it reaches its operating temperature, the display shows T(POX)=0x0000 and OK.

Devices with sensors that do not require a specific operating temperature start without a warm-up phase and start measuring immediately when switched on.

8.2.9 Select language





- Select the language with the ▼▲ keys.
- Confirm the selection by pressing the MENU key.

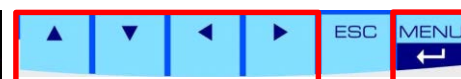


Available languages: German, English, Italian and Spanish

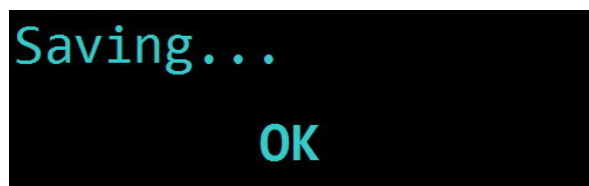


8.2.10 Password



	 ATTENTION
	<p>The password has a maximum of four characters. If you forget the password, you cannot change the configuration.</p>





- Enter the password using the ▼ ▲ ▶ ◀ keys.
- Confirm the entry by pressing the MENU key.



9 Decommissioning/switching off

	 <h1 style="margin: 0;">ATTENTION</h1>
	<p>To decommission the process gas analyser and the linked system components according to their operating instructions.</p>

	<h1 style="margin: 0;">NOTE</h1>
	<p>The following table contains the steps for decommissioning the analyser for a long period.</p> <p>If you only wish to switch off the process gas analyser temporarily, a few steps can be omitted: <i>☞ Switch off <u>column!</u></i></p>



Steps	Turn off	Decommissioning
Disconnect the device from the process, close the line professionally.	X	X
Rinse the process gas analyser with ambient air. (Start calibration with purge gas)		X
Shut down the linked system components.	X	X
Turn of the master switch.	X	X
 If you only wish to switch off the process gas analyser temporarily, follow the procedure here to the end!		
If required, disconnect / switch off the operator's energy and media supply and the signal transmission professionally.		X
If advantageous, pack process gas analyser.		X






10 Maintenance

The measuring quality of the process gas analyser can only be ensured if the service intervals are maintained.


10.1 Preparations

The feed lines to linked system components can be closed for servicing purposes. Once operation has been resumed, they need to be reopened.

	 DANGER
	<p>Serious risk of injury from electricity.</p> <ul style="list-style-type: none"> • Parts of the process gas analyser labelled with this symbol may still be live even when the main switch has been switched off. If necessary, disconnect the process gas analyser from the power supply. • Switch off the main fuse and if necessary, secure it to prevent it from switched back on. • Only a trained electrician may work on the electrical equipment of the process gas analyser.

   	 WARNING
	<p>Serious risk of injury from exiting gas.</p> <ul style="list-style-type: none"> • Switch off the process gas analyser, and also linked system components if required, before carrying out maintenance work. • The gas connections may only be established by trained personnel. Follow the applicable guidelines at the installation site.

10.2 Maintenance work/Inspection

	NOTE
	<p>The maintenance work must be carried out in accordance with the inspection and maintenance schedule! The type and extent of the wear depends on the individual application and operating conditions. All intervals specified are therefore for guidance only.</p>

Upon reaching the inspection intervals, this will be shown in the display. Conduct and document testing. Through menu confirm that validation was done: MENU→COMMANDS→Check OK→ [Enter]

Inspection	Interval (recommended)	
------------	------------------------	--

Weekly inspection

Purge gas inlet unobstructed (particularly in case of frost)	weekly	
Exhaust gas line unobstructed (particularly in case of frost)	weekly	

Quarterly inspection

Calibrate device according to manufacturer's specifications, message in display "Service [Typ] ZERO", "Service [Typ] SPAN", "Service [Typ] MID"	every 3 months, latest annually or when required	
---	--	--

Half-yearly inspection

Check integrated filter in the device	every 6 months	
Check compressed air supply ¹⁾ (negative pressure during "drainage")	every 6 months	
Check lines for condensate (including all integrated filters)	every 6 months	
Check gas inlets and clean professionally if necessary	every 6 months	
Check fan	every 6 months	
Check ejector pump ¹⁾	every 6 months	
Check inlet filter (inlet ambient air, filter mat, ventilator)	every 6 months	
Check Peltier cooler ¹⁾	every 6 months	
Check fan of Peltier cooler ¹⁾	every 6 months	

Yearly inspection


Check air and gas pump ¹⁾ (by performing a purge gas calibration)	yearly	
--	--------	--

¹⁾ if installed

Maintenance/Replacing components	Interval (recommended)	
Half-yearly service and after commissioning		
Check and, if necessary, update firmware version	every 6 months	
Save the current configuration with INCACtrl	every 6 months	
Annual service		
Replace integrated filters	every 12 months	
2-yearly service		
Replace pump hoses	every 24 months	
Replace flame arrester ¹⁾	every 24 months	
8-yearly service		
Replace integrated pressure reducer	every 8 years	
If necessary		
Replace gas-delivering pumps	if necessary	
Replace sensor, lifetime depends on sensor type, message in display "Service [Typ] age" or "Service [Typ] usage"	if necessary	


¹⁾ if installed

11 Troubleshooting

<h1>NOTE</h1>	
	<p>A distinction is made between the following categories:</p> <p>Possibility of the measured values: Measured values that deviate from the anticipated range</p> <ul style="list-style-type: none"> ☞ <i>last maintenance!</i> ☞ <i>maintenance manual!</i> <p>Faults: Faults during operating process For remedy: ☞ Section 11.2, p. 56</p>

11.1 Preparations

The feed lines to linked system components can be closed for servicing purposes. Once operation has been resumed, they need to be reopened.

<h1>WARNING</h1>	
	<p>Serious risk of injury from electricity and exiting gas.</p> <ul style="list-style-type: none"> • Switch off the process gas analyser, and also linked system components if required, before carrying out maintenance work. • Switch off the main fuse and if necessary, secure it to prevent it from switched back on. • Only a trained electrician may work on the electrical equipment of the process gas analyser. • Parts of the process gas analyser labelled with this symbol may still be live even when the main switch has been switched off. • If necessary, disconnect the process gas analyser from the power supply.

11.2 Changing/replacing fuses


Fuses may only be exchanged by an electrician or service professional. Choose the type approved by Union.

11.3 Messages/malfunctions on the display

11.3.1 Display of messages/malfunctions

If errors occur during operation, the control system automatically switches to overview to display priority messages.

11.3.2 Visualizing the error list

	NOTE
	<p>The following list contains errors and messages that are visually displayed.</p> <p>Troubleshooting measures: <i>☞ Troubleshooting list!</i></p> <p>Measures required are assigned via column [<i>☞ no.</i>].</p>


Error text	Error message	☞ No.
0x30D	Minimum pump pressure not reached, Sensor EC, Pressure Air	1
0x30E	Minimum pump pressure not reached, Sensor EC, Pressure Gas	2
Additional	All additional	3

11.3.3 Troubleshooting list

The following list contains causes of faults.

No.	Description
1	Inlet air filter for ambient air clogged (Fig. 4.1)
2	Process gas outlet blocked, for example frozen (Fig. 4.1) Process gas inlet closed (Fig. 4.1) - too much condensate in the line
3	Contact service ☞ <i>Chapter 12!</i>

12 Service

NOTE	
	<p>If you have any questions Union Instruments GmbH will be happy to assist. In case of orders or technical questions, please have the customer number, telephone number for return calls, the type and number of the process gas analyser (see the type plate) and the required spare parts and parts list numbers to hand.</p>

Union Instruments GmbH - Service

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Germany



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support@union-instruments.com



<http://www.union-instruments.com>

13 Associated documents

- Declaration of Conformity for flame arrester ¹⁾
- Operating and service log
- Service documentation, optional
- Operating Instructions Ball Valves

¹⁾ if installed



Associated documents

14 Disposal

Following decommissioning, the analyser can be returned to Union Instruments GmbH.

Suggestion, have Union Instruments GmbH dispose of the process gas analyser.



	 WARNING Serious risk of injury from electricity and exiting gas in the process gas analyser.
---	--

Before disassembly, disconnect the process gas analyser from the energy supply.

If necessary, purge the gases.

	NOTE Observe the national regulations on disposing of machines and operating materials! Grade the parts according to group and recycle properly.
---	---

15 Spare parts

	 WARNING
	<p>The use of non-approved spare parts (such as parts from other manufacturers, parts with different specifications, replicas of used and wear parts) can cause defects and be hazardous. This will render the warranty null and void. The operator is liable for any damage that occurs as a result.</p> <p>When replacing standard components, only use identical components by the original manufacturer. If components are discontinued or components by different manufacturers are used, request the manufacturer approval by Union Instruments GmbH.</p>

Spare parts can be ordered from Union Instruments GmbH:
☞ *Chapter 12 Service.*

Note the type and number (☞ *type plate*) of the process gas analyser.

If necessary, find and make a note of the order number (☞ *Applicable documents*).

Order part.

16 Annex

EU Declaration of Conformity Flame arrester



EU – Konformitätserklärung EU – declaration of conformity



Der Hersteller / The manufacturer

Union Instruments GmbH
Zeppelinstrasse 42
76185 Karlsruhe

erklärt hiermit, dass folgend bezeichnete Produkte / hereby declares, that following named products:

Produktbezeichnung: Product name	Flammensperre Flame arrester	Gerätetyp: Device type	Typ 21_01_25 Type 21_01_25
Explosionsgruppe: Explosion group:	 G IIC  G IIC	EG-Baumusterprüfbescheinigung: EC-type examination certificate:	IBExU07ATEX2107 X IBExU07ATEX2107 X

Benannte Stelle für Baumusterprüfung / notified body for type examination:
IBExU Institut für Sicherheitstechnik GmbH, Fuchsmühlenweg 7, 09599 Freiberg, Germany, Nr.: 0637

Benannte Stelle für QS – Überwachung / notified body for QA-Assesment:
TÜV Product Service GmbH, Ridlerstraße 65, 80339 München, Germany, Nr.: 0123

konform sind mit den Anforderungen, die in der EU – Richtlinie festgelegt sind / are compliant with the requirements as defined in the EU directive:

- 2014/34/EU Richtlinie für Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen**
- 2014/34/EU Directive on equipment and protective systems intended for use in potentially explosive atmospheres**

Angewandte harmonisierte Normen / Used harmonized standards:

- EN 1127-1:2011** Explosionsfähige Atmosphären - Explosionsschutz - Teil 1: Grundlagen und Methodik
Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology
- EN 16852:2010** Flammendurchschlagsicherungen - Leistungsanforderungen, Prüfverfahren und Einsatzgrenzen
Flame arresters - Performance requirements, test methods and limits for use

Bei einer nicht autorisierten Änderung des Gerätes verliert diese Erklärung ihre Gültigkeit. / Any unauthorized modification of the device results in invalidity of this declaration.

Die Erklärung gilt nur in Verbindung mit den zusätzlichen Bedingungen für die sichere Verwendung gemäß EG Baumusterprüfbescheinigung, Auszüge siehe Seite 2. / The declaration applies only in connection with the additional conditions for safe use subject to EC-type examination certificate, summary see page 2.

Karlsruhe, den 16.06.2016



Geschäftsführer / general manager

EU – Konformitätserklärung

EU – declaration of conformity



Auflagen zum Betrieb der Flammensperre

Die Flammensperre ist ausschließlich für die Anwendung in Verbindung mit den UNION Prozessgas-Analysegeräten INCA, Modelle INCA3000, INCA4000, INCA5000, INCA6000 für Biogas bestimmt. Sie dient zur Flammendurchschlagsicherheit des Prozessgaseingangs.

Montage

Es dürfen nur die von UNION mitgelieferten Rohrverschraubungen verwendet werden. Keine Rohrleitungen größer DN 10 (1/4") anschließen. Die Montage ist auf Dichtheit zu prüfen.

Wartung und Überwachung im Betrieb

Gemäß Wartungsplan der UNION Prozessgas-Analysegeräten INCA ist die Detonationssicherung alle 24 Monate auszuwechseln.

Werden die nachfolgenden Wasserfallen, Leitungen wegen Verschmutzung durch Kondensat gereinigt oder gewechselt, muss die Detonationssicherung ausgewechselt werden.

Operation of the flame arrester

The intended use of the flame arrester in conjunction with the UNION process gas analyser INCA, Type INCA3000, INCA4000, INCA5000, INCA6000 is the flame arresting of the process gas inlet.

Assembly

Only be connected with the included fittings, supplied by UNION. Not to be connected with pipes larger than a nominal diameter of 10 mm. The assembly is to be checked for leaks.

Maintenance and Monitoring

According to the maintenance plan of the UNION process gas analyser INCA the flame arrester is to be replaced every 24 months.

If the following water traps or pipelines are replaced or cleaned in case of contamination by condensate, the flame arrester must be replaced.

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APPENDIX B

Worksheet to Document Ability of Biological Scrubber to Produce Measured H ₂ S Concentrations Less than 400 ppmv									
Data to be Completed by Operator				Analysis which can be done by Technical Consultant					
A	B	C	D	E	F	G	H	I	
Hour	Date of Sample	H ₂ S in Biogas Before Cleanup (ppm)	H ₂ S in Biogas After Cleanup (ppm)	Sorted H ₂ S Data	Range of H ₂ S Concentrations (ppm)	Number of Samples in Each Range	Cumulative Number of Samples less than Range Maximum	Percentage of Cumulative Samples Less than Range Maximum	
12:00:00 AM	1	1,500	50		0 to 399	18	18	75%	
1:00:00 AM	1	1,600	50		400 or higher	6	24	100%	
2:00:00 AM	1	2,000	250			Total Samples: 24			
3:00:00 AM	1	1,600	250						
4:00:00 AM	1	1,400	400						
5:00:00 AM	1	1,250	150						
6:00:00 AM	1	1,300	150						
7:00:00 AM	1	1,500	150						
8:00:00 AM	1	2,000	200						
9:00:00 AM	1	1,500	250						
10:00:00 AM	1	1,500	250						
11:00:00 AM	1	1,600	150						
12:00:00 PM	1	800	250						
1:00:00 PM	1	800	350						
2:00:00 PM	1	1,200	350						
3:00:00 PM	1	1,100	450						
4:00:00 PM	1	1,300	350						
5:00:00 PM	1	1,400	350						
6:00:00 PM	1	1,500	350						
7:00:00 PM	1	1,400	550						
8:00:00 PM	1	1,300	550						
9:00:00 PM	1	1,500	350						
10:00:00 PM	1	2,000	950						
11:00:00 PM	1	800	550						

NOTE: This is an example for 1 days worth of data. This table will need to be extended to 7 days for the 6th Capacity Payment and 365 days for the Annual Performance Payments.