NORSK ANALYSE

User Manual

Fuel Gas Analyser

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User Manual

Fuel Gas Analyser

The purpose of this user manual is to provide the descriptions and procedures required to operate and maintain the Fuel Gas Analyser in a safe and efficient manner. This system is designed for analysis of fuel calorific values, methane number and gas composition.

FGA-D21-04

Revision status

Revision	Date	Prepared	Checked	Approved
Rev. 01	17.02.2022	ALI	JCV/HOH	MBA
Rev. 02	28.02.2022	ALI	CRA	TAK
Rev. 03	25.03.2022	ALI	CRA	MBA
Rev. 04	12.04.2022	ALI	CRA	MBA

Document history

Revision	Reason for issue
Rev. 01	First issue. Document renamed from NA-E-USM-120-03.
Rev. 02	Updated Ex information (labels and connections).
Rev. 03	Section 2.5 and 3.7 added, Section 3.2 and 10 updated.
Rev. 04	More documents added to section 10.

Important

Before using the equipment, read all instructions thoroughly and follow all precautions and warnings contained within this document. Improper use may cause personal injury and/or damage to the equipment and may void the warranty. Norsk Analyse disclaims any responsibility for damage or injury caused by improper installation, use or maintenance of the equipment.

Table of contents

Acronyms and abbreviations

CO_2	Carbon dioxide
DWG	Drawing
FGA	Fuel Gas Analyser
GA	General Arrangement (Drawing)
N_2	Nitrogen
PFA	Perfluoroalkoxy alkane (plastic tube material)
PLC	Programmable Logic Controller
PTFE	Polytetrafluoroethylene (plastic tube material)

Admonitions

Note	*Text set off in this manner presents clarifying information or specific instructions relevant to the immediate instruction.*
Caution	***Text set off in this manner provides a warning notice that failure to follow the directions in this caution can result in damage to equipment.***
Warning	***Text set off in this manner provides a warning notice that failure to follow the directions in this warning can result in bodily harm or loss of life and/or extensive damage to equipment.***
DANGER	***TEXT SET OFF IN THIS MANNER PROVIDES A WARNING NOTICE THAT FAILURE TO FOLLOW THE DIRECTIONS IN THIS WARNING WILL RESULT IN BODILY HARM OR LOSS OF LIFE AND/OR EXTENSIVE DAMAGE TO EQUIPMENT.***

1 Introduction

1.1 Purpose

The purpose of this user manual is to provide the descriptions and procedures required to operate and maintain the Fuel Gas Analyser, FGA, in a safe and efficient manner.

A thorough understanding of system functions and controls is necessary to optimise overall performance. Careful study of the information in this manual is highly recommended, preferably while exploring the system's various functions.

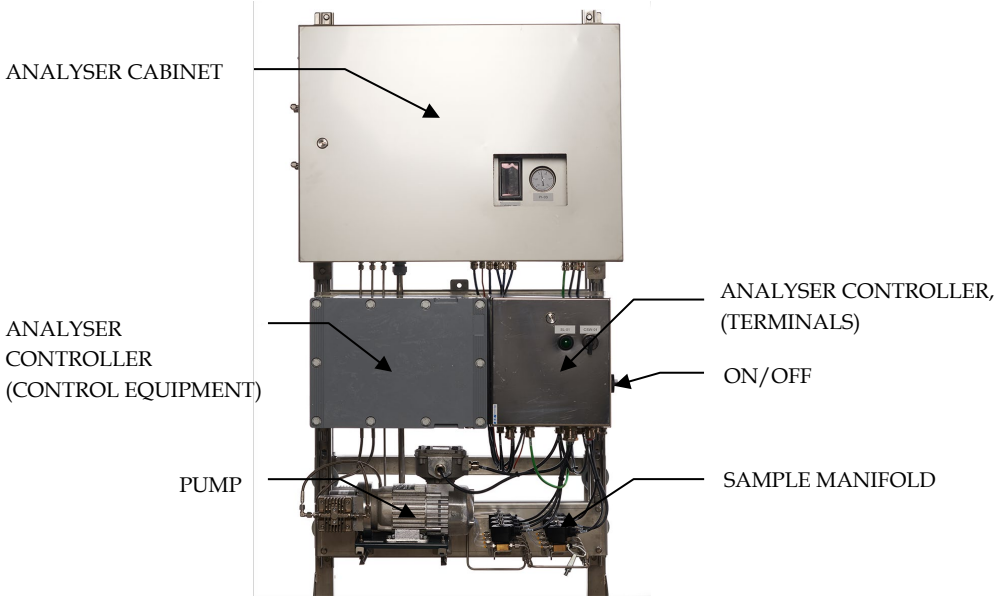


Figure 1 FGA main parts

1.2 Scope of supply

The FGA consists of the following main units:

- Analyser cabinet with analyser module
- Analyser controller
- Pump
- Manifolds with 8 solenoid valves

Note	*Equipment provided locally by the installation contractor or by local dealers is not described in this manual.*

1.3 Contact details

For enquiries related to sales, service, support, maintenance, and spare parts, please contact us at:

Norsk Analyse
P.O. Box 2313, 3103 Tønsberg, Norway
www.norskanalyse.com

Phone: +47 3337 5100
Fax: +47 3337 5149

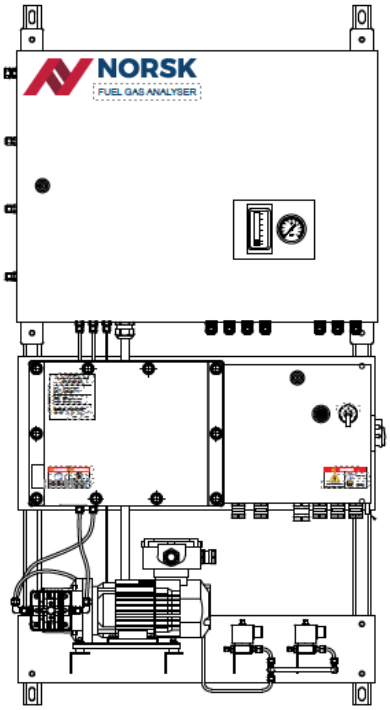
Support: support@norskanalyse.com
Service: service@norskanalyse.com
Spare parts: marine@norskanalyse.com

2 General safety rules

Safety precautions must always be followed during installation, operation, and maintenance of the system. Personnel shall be sufficiently qualified, and proper caution shall be taken to avoid injuries or damage to life, health, environment, equipment, and property.

2.1 Explosive atmosphere

The FGA is ATEX compliant and has been proved safe to use on vessels and in plants with explosive atmospheres. ATEX compliance is necessary wherever a potentially explosive atmosphere exists to keep workers safe.



DANGER ***FAILURE TO FOLLOW THE DIRECTIONS IN THESE WARNINGS CAN RESULT IN BODILY HARM OR LOSS OF LIFE AND/OR EXTENSIVE DAMAGE TO EQUIPMENT.***

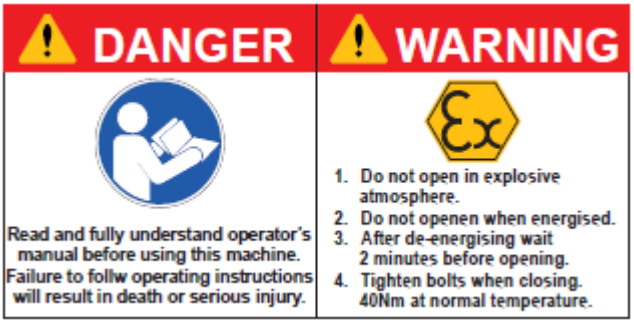


Figure 2 Analyser controller left side (control equipment)

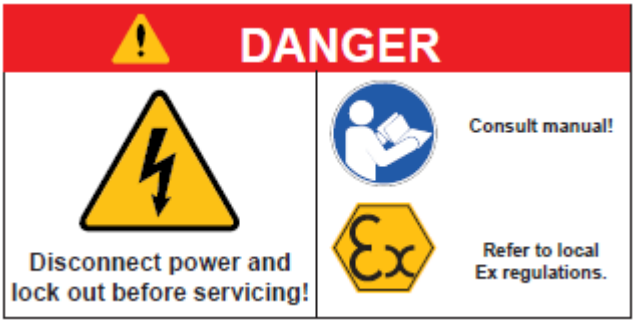


Figure 3 Analyser controller right side (terminals)

2.2 High voltage

Warning ***FGA operates at a potentially lethal AC voltage.***

Always switch off all power before installation or maintenance. Adhere to safety precautions and instructions as directed by company policy. For safety reasons during troubleshooting on the equipment with power ON, two persons must always be present.
Whenever installation or maintenance is carried out, it is essential that a first aid kit is available, and that personnel are familiar with the first aid instructions for electrical shock.

2.3 Hazardous components

Warning ***Many toxic gases are colourless, odourless, and non-irritating, and may overcome exposed persons without notice.***

The sample gas may contain trace amounts of hazardous components. Personnel should have a thorough knowledge and understanding of the physical properties and safety precautions for the relevant gas samples before operating the system.

Nitrogen is used for zero gas and for solenoid valve. If any leakage occurs, it can be potentially lethal to be in a small, confined space, since the nitrogen is odourless and colourless.

Make sure the ventilation is good especially if the analyser cabinet is in a small room. Ensure that gas has access to free air.

Norsk Analyse recommends using oxygen detector to alarm if oxygen levels are too low.

2.4 Heavy equipment

The cabinets are heavy units. Do not open cabinet doors while in rough seas. Doors may suddenly swing open and cause damage or injury. Use appropriate safety clothing and certified lifting equipment during installation or replacement of larger units!

2.5 Specific conditions for use of analyser controller

1) Flameproof joints are not intended to be repaired.
2) The property class of fastening screws used for fixing of the top lid of the flameproof enclosure (M10x62) is specified by the manufacturer as A4-Class 80.
3) The measuring function according to Annex II paragraph 1.5.5 of the Directive is not covered by this EU type examination. It shall comply with the requirements from the relevant European harmonized standards which provide guidance on the performance of gas detection equipment and safety devices.

3 System description

3.1 Main purpose

The main purpose of the fuel gas analyser is to measure concentration of gases, calculation of caloric value and methane number. In less than 30 seconds fuel calorific value and methane number together with full gas composition is available. The fuel gas analyser is scalable and can analyse multiple feed streams and be used to verify the LNG bunker delivery note. The analyser utilises infrared absorption as measuring principle.

FGA is designed and manufactured for the marine environment; hence ship movements, vibrations and temperature loadings are attended to during design of the system. The sample handling technology selected is optimised for this specific trace analysis.

If a potentially harmful fault occurs, appropriate actions will automatically be taken, for example by shutting down the sample gas pump.

3.2 Name plate and markings

1. Fuel Gas Analyser logotype
2. Name plate with CE marking
3. ATEX sign for analyser controller
4. Warnings for analyser controller left side. Refer to Figure 2.
5. Warnings for analyser controller right side. Refer to Figure 3.

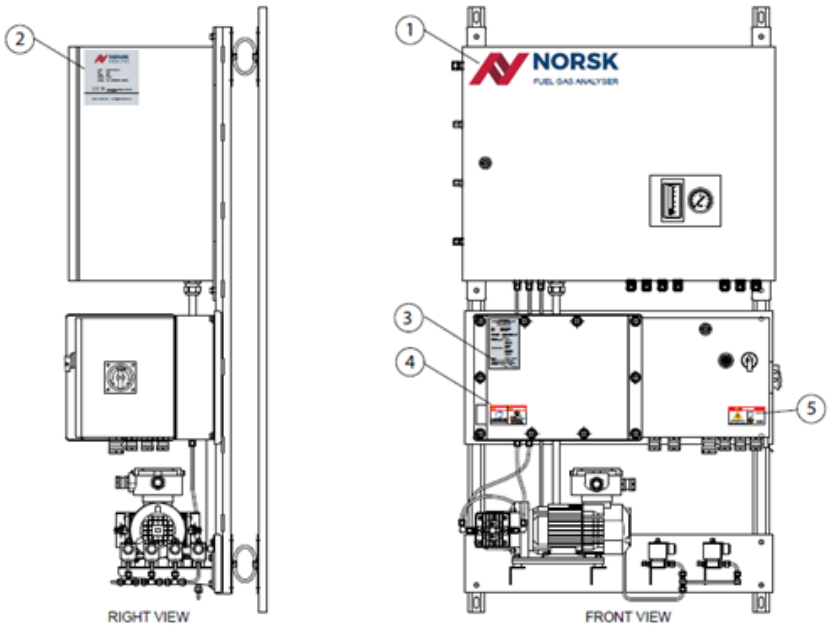


Figure 4 Name plate and markings

Figure 5 CE sign (name plate)

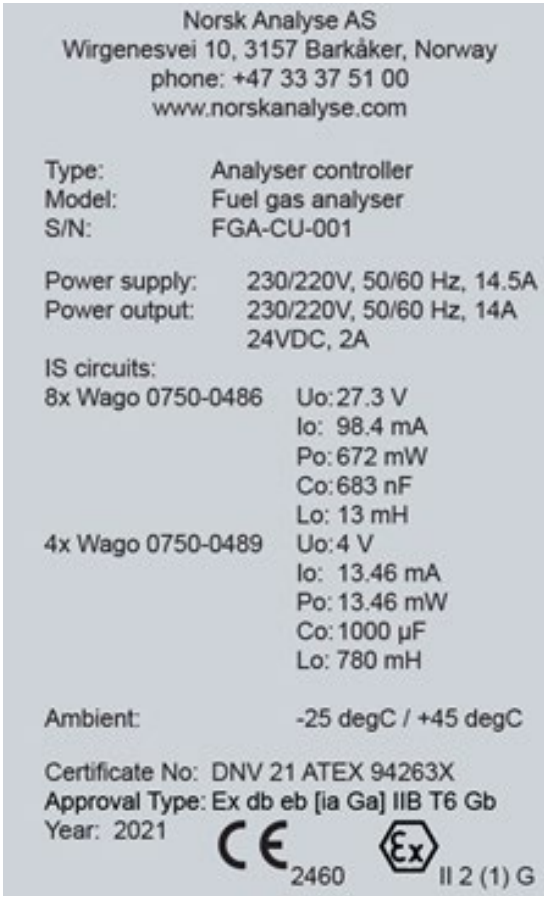


Figure 6 Analyser Controller Name Plate

3.3 Analyser cabinet

The Analyser cabinet is enclosed by a specially designed cabinet. This cabinet is made of stainless steel SS316L and is mounted to a Unistrut wall frame.

The complete assembly is designed for mounting to a support welded on the ship/plant casing. This support is prepared by the customer, and typically consists of two parallel angled steel bars.

The main components of the cabinet are:

- Analyser module
- Cabinet heater
- Filters 2-5µ
- Sensors for flow, pressure and temperature
- Flowmeters and regulator

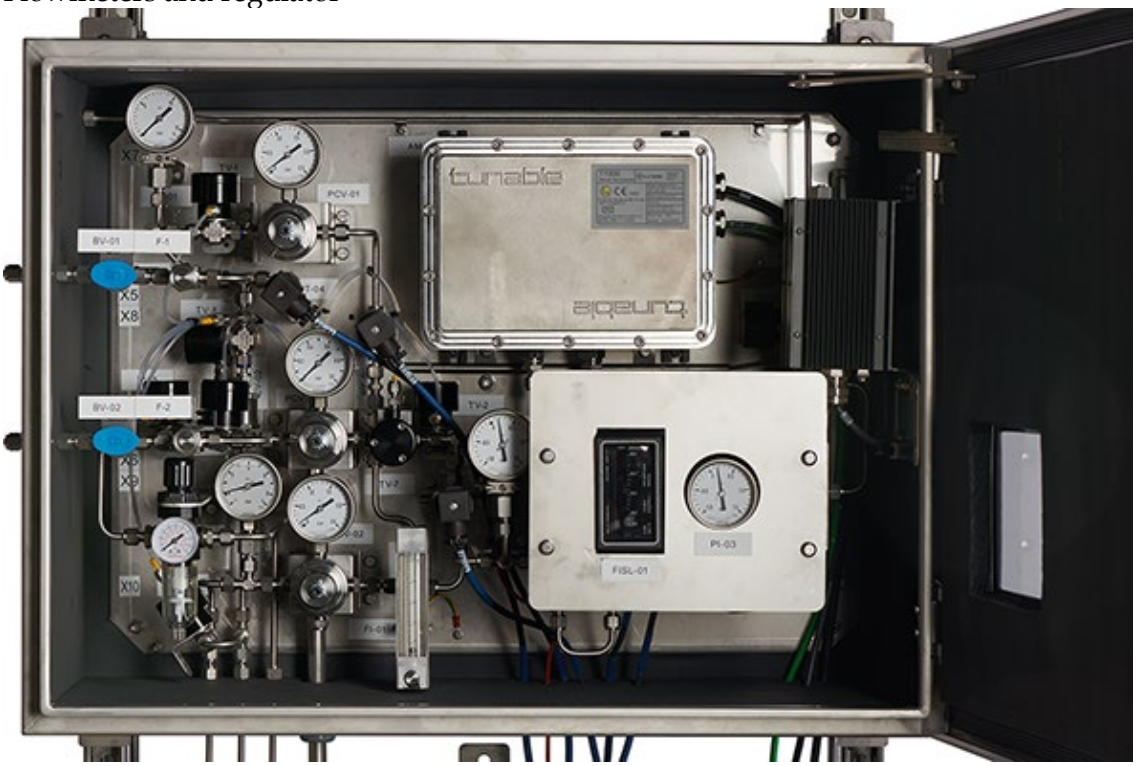


Figure 7 Analyser cabinet, internal view - front

The purpose of the Analyser cabinet is to regulate flow and pressure before gas sample is sent to the analyser module.

If sample recovery is needed (sample return is at a higher pressure than sample in) the system is equipped with a gas pump that provides a continuous sample flow through the system. The pump converts the sample from suction to pressure mode and moves the sample through analyser module.

The cabinet heater is used to maintain analyser temperature if ambient temperature is approx. 0°C.

Figure 8 Analyser cabinet, left side view

Inlet sample at X5.

Zero calibration and PRV-1 at X7

Sample outlet at X8

Calibration at X9.

Nitrogen (N2) at X6

Optional valve gas (instrument air) at X10

3.4 Calibration gas (span)

Calibration gas is used for sensitivity verifications as well as calibrations. The 10 litres span gas cylinder is the normal use for approx. 24 months.

The recommended calibration gas blend is the following:

Part no: TBA
• 95% Methane • 2 % Ethane • 1% Propane • 0.5 % Butane • 0.5 % Pentane • Balance N2

It is normally enough only to have one calibration cylinder onboard.

3.5 Nitrogen (zero)

Zero gas is used for setting zero base point of the analyser module which is performed once every 24 hours (time of day can be adjusted).

If ship/plant nitrogen supply with a quality equal to or better than 97.5% N2 is available, it can be used as zero gas and valve gas.

If quality is insufficient nitrogen must be supplied on gas cylinder.
It is then recommended to connect instrument air for valve gas to save nitrogen for calibration. Request instructions for conversion to air supply.

3.6 Power supply

The customer must provide a continuous power supply 230/220 VAC, 50/60 Hz two-phase. Each cabinet is protected using a main two-pole incoming fuse.

FGA can be delivered with 120 V power supply.

Note	*Response time on the Modbus interface is 2-3 minutes after power cut.*

3.7 Connections

3.7.1 230V circuits

Power supply: 230/220V, 50/60Hz, 14.5A

3.7.2 24V circuits

Power output: 24VDC

3.7.3 Intrinsically safe circuits

8 current outputs:

Maximum output voltage	U_o:	27.3 V
Maximum output current	I_o:	98.4 mA
Maximum output power	P_o:	672 mW
Maximum external capacitance	C_o:	683 nF
Maximum external inductance	L_o:	13 mH

4 current outputs:

Maximum output voltage	Uo:	4 V
Maximum output current	Io:	13.46 mA
Maximum output power	Po:	13.46 mW
Maximum external capacitance	Co:	1000 µF
Maximum external inductance	Lo:	780 mH

3.8 External interfaces

Analyser readings of gas component values and system alarms generated by FGA are modbus TCP/RTU.

3.8.1 Standard version

The following signal interfaces are available:

- Modbus outputs
  - Measuring values
  - Temperature
  - Flow
  - System running
  - Power failure alarms
  - High/low temperature alarms
  - Pressure alarms

3.8.2 Network

The FGA system utilise Modbus TCP/IP or RTU. Refer to FGA Drawing Package:

→ *[FGA-8201] - Network map*

→ *[FGA D212] - Signal Exchange List*

4 Functional description

4.1 Overview

This chapter gives a brief description of the functional design of the analyser system. The flow of the gas sample is described from sample point until the processed readings are presented to the customer's workstation.

FGA is designed to measure gas composition, calculate calorific value (CV) and methane number. The intention of the gas monitoring system is to monitor the fuel blend (energy value), feeding the marine engine continuously.

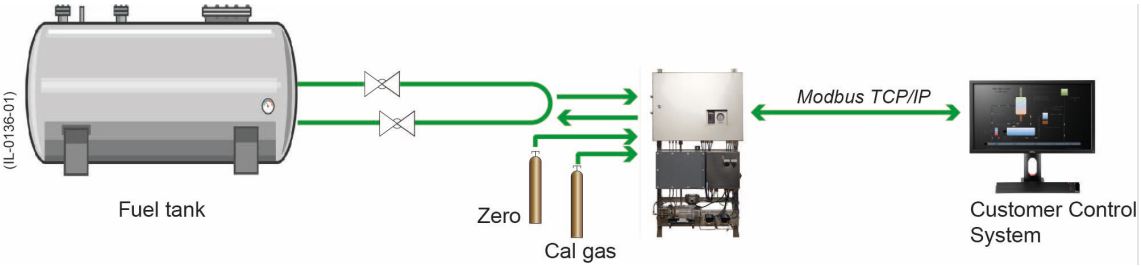


Figure 9 Block diagram for FGA

The Analyser cabinet provides a sample stream to the analyser module. The analyser utilises infrared absorption as measuring principle.

For a full understanding of this functional description chapter, please examine the following system drawings in FGA Drawing Package in parallel:

→ *[3001] – SYSTEM DIAGRAM FUEL GAS ANALYSER*

→ *[5001] – TERMINATION DIAGRAM POWER & SIGNALS*

→ *[5002] – TERMINATION DIAGRAM POWER DISTRIBUTION*

→ *[5003] – TERMINATION DIAGRAM SIGNAL DISTRIBUTION*

→ *[5004] – TERMINATION DIAGRAM – CUSTOMER CONNECTIONS*

Note that labelling of all individual components described, for example solenoid valve SV-1, conforms to labels in the corresponding system drawing.

4.2 Analyser cabinet

Sample IN is connected to X5. Pressure from PT-01 is transmitted to Analyser Controller. A backpressure regulator PCV-02 is used to maintain pressure upstream. Toggle valve TV-2 and TV-3 open for sample to analyser and inlet flow is transmitted to Analyser Controller from FISL-01.

Note	*Solenoid valves are numbered to match the toggle valves*

The sample pump increase outlet pressure to push sample OUT into a process tank or customer specified area.

Zero calibration is done by nitrogen supply to the analyser module.

Verification of gas readings is done by span gas applied to the analyser module and verification of gas cylinder values compared to analyser output values.

4.3 Analyser module

The gas monitor is based on infrared absorption (spectroscopy), and scans several wavelengths, to obtain results for different hydrocarbons and CO_2.

The sum of fuel energy is calculated.

Note	*Analyser module needs zero baseline verification daily (24 hours) and span verification monthly (30 days). If outside acceptance limit new ZERO calibration must be performed.*

5 Operation

5.1 HSSE

All operators and service personnel must have a solid knowledge of Ex equipment and its dangers.

DANGER	***FAILURE TO FOLLOW THE DIRECTIONS IN WARNINGS CAN RESULT IN BODILY HARM OR LOSS OF LIFE AND/OR EXTENSIVE DAMAGE TO EQUIPMENT.***

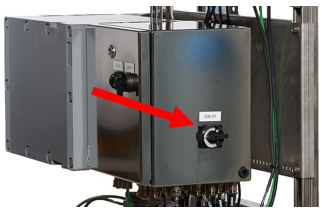
Nitrogen is used for zero gas and for solenoid valve. If any leakage occurs, it can be potentially lethal to be in a small, confined space, since the nitrogen is odourless and colourless.

Make sure the ventilation is good especially if the analyser cabinet is in a small room. Ensure that gas has access to free air.

Norsk Analyse recommends using oxygen detector to warn if oxygen levels are too low.

Note	*For systems that use instrument air to operate solenoid valve, the zero gas valve can be closed when not used.*

5.2 Start



Start the system using switch SW-01 on the right side of the analyser controller.

Note	*Response time on the Modbus interface is 2-3 minutes.*

5.3 User interface

The operator can interact with FGA using the FGA Web Management and the IP-address of the PLC in the Analyser Controller. Refer to section 5.3.1 on how to set static IP to enable communication with PLC.

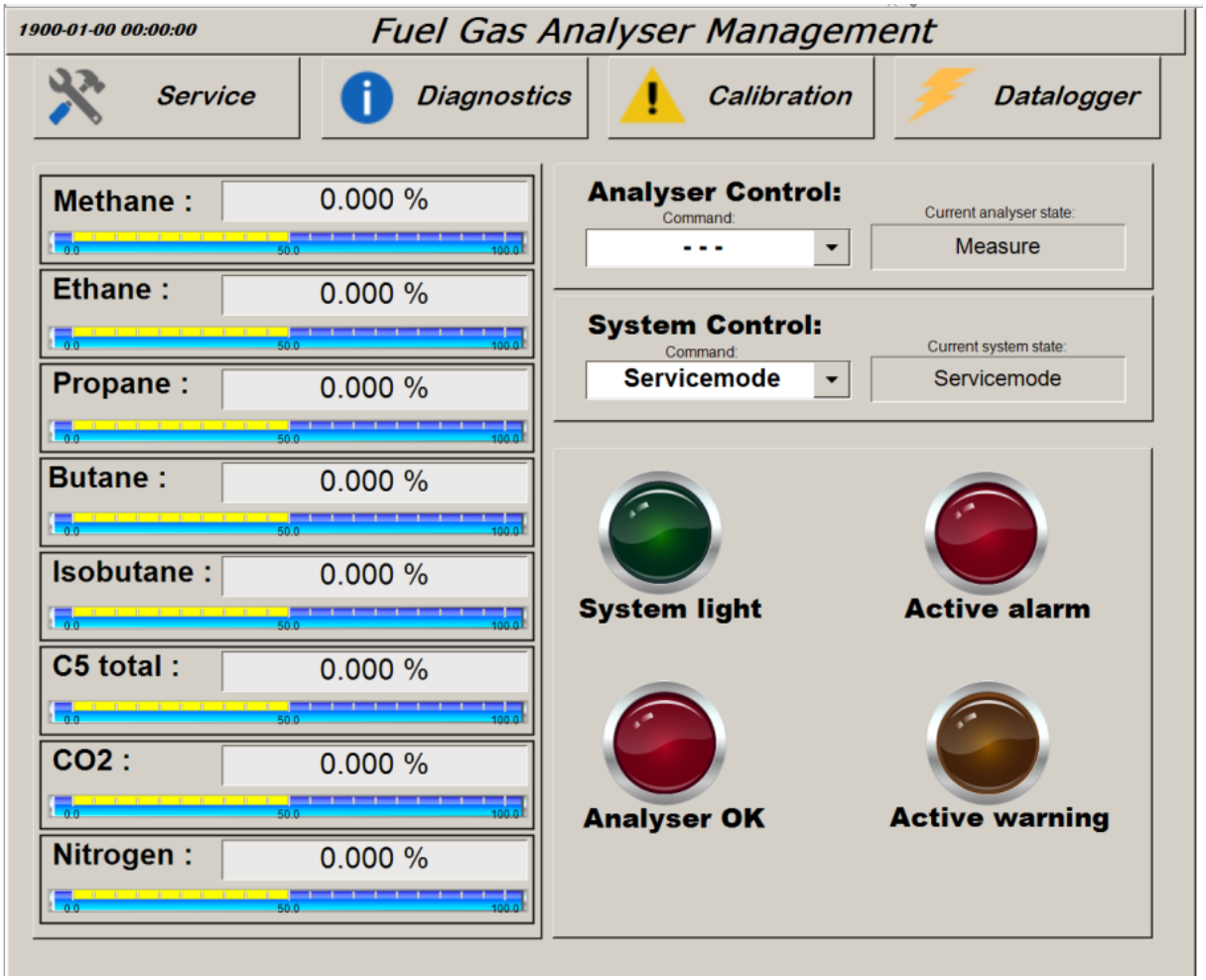


Figure 10 Home page (main)

The main screen provides the operator with an overview of measurements, selection of modes for both analyser module and system. There are light indicators for visual reference. The lights are as following:

- System light: Digital representation of SL-01, located at panel
- Active alarm: One or more alarms active
- Analyser OK: Analyser module status
- Active warning (message): One or more warnings active

There are dropdown menus for selection of modes.

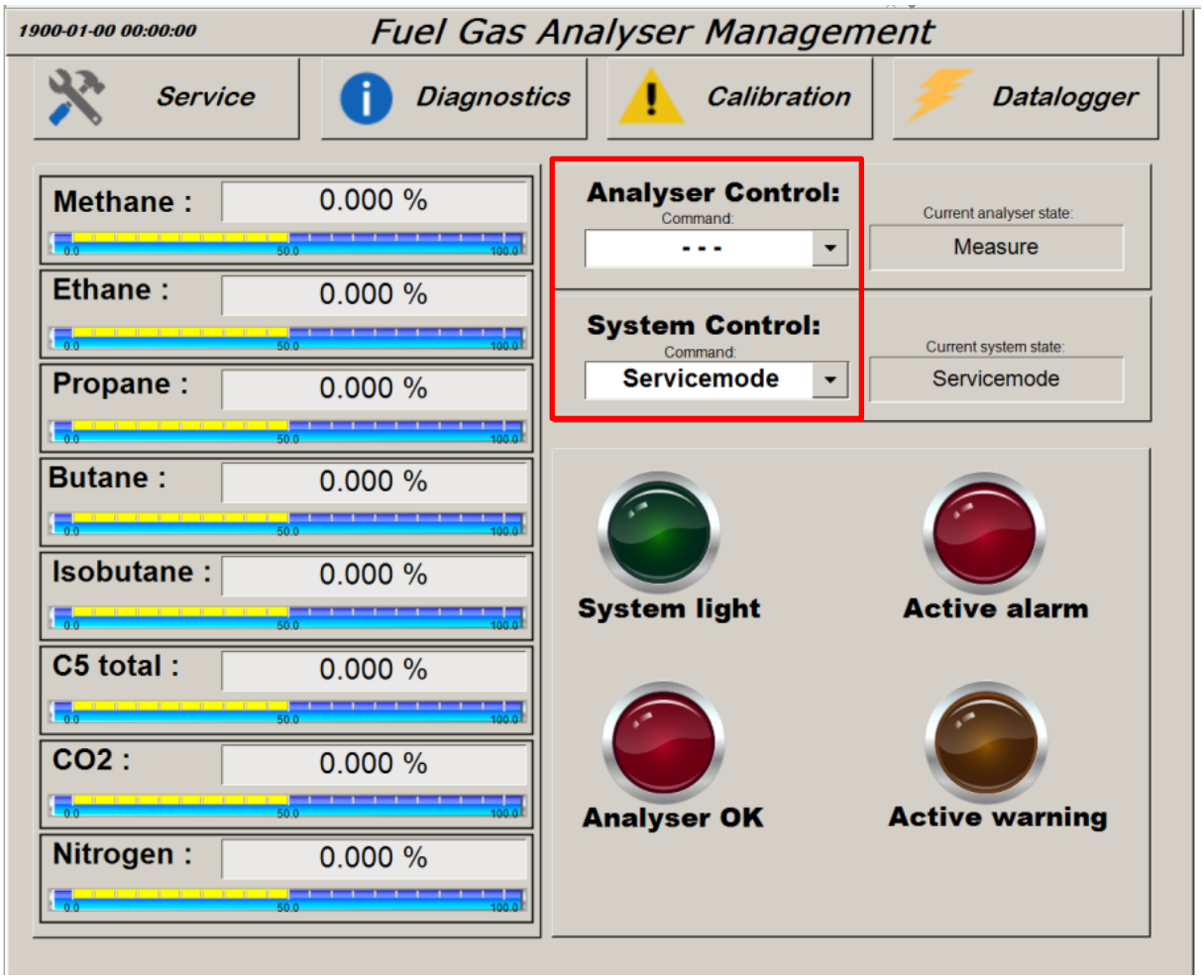


Figure 11 *Drop down menus*

In service mode it is possible to run solenoid valves manually, set time interval for automatic zero calibration and view/set timers.

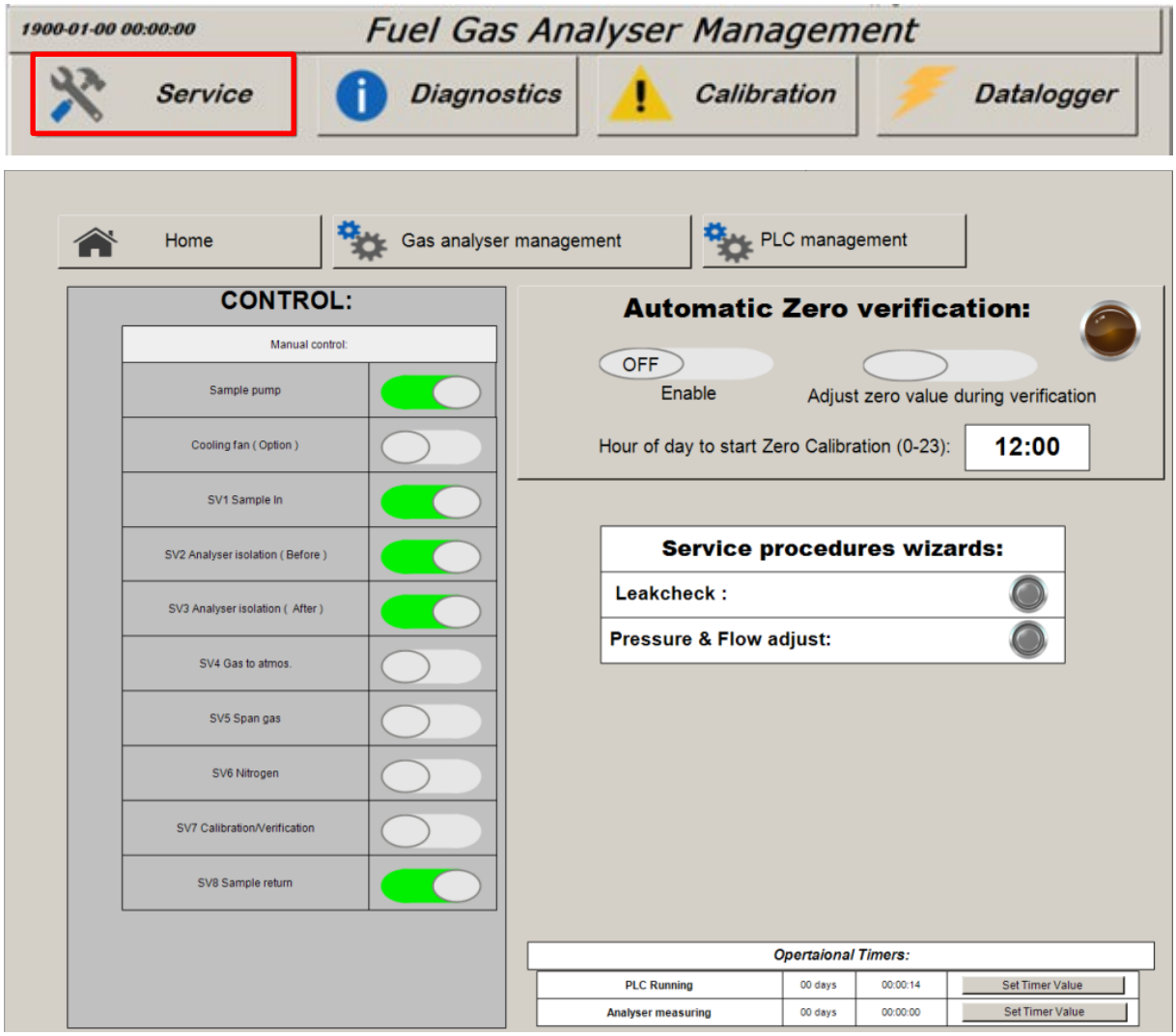
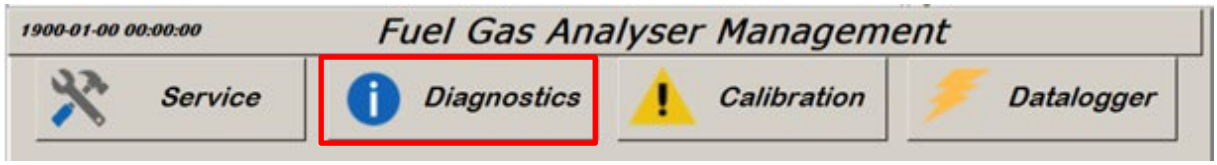


Figure 12 Service page

If automatic zero verification is activated on this page, the lamp will light up, indicating that an automatic sequence is active. Hour of day can be entered in full hours only.

For assisted troubleshooting, a diagnostic page provides the user with alarm list (top) and several measured values to quickly locate source of error.



1900-01-00 00:00:00 — Fuel Gas Analyser Management

	Timestamp	Message
0	02.12.2021 18:15:41	Alarm message: Tripped fuse ECB 4ch

Diagnostics :

Progression :	0	Analyser Electronics temperature	0.00 degC
Meascounter :	0	Analyser Electronics temperature	0.00 degC
Sample pressure :	0.000 BarA.	Analyser Electronics temperature	0.00 degC
Sample temperature :	0.0 degC	Analyser Electronics temperature	0.00 degC
Absolute transmission :	0 %	Analyser Electronics temperature	0.00 degC
Relative transmission :	0 %	Analyser Electronics temperature	0.00 degC
Analyser Electronics temperature	0.00 degC	Analyser Electronics temperature	0.00 degC
Filter temperature :	0.00 degC	Analyser Electronics temperature	0.00 degC
Filter humidity :	0.00 % RH	Analyser Electronics temperature	0.00 degC
HHV-Calorific value, high :	0.00 MJ/Kg	Analyser Electronics temperature	0.00 degC
LHV-Calorific value, low :	0.00 MJ/Kg	Analyser Electronics temperature	0.00 degC
Gas analyser error code :	0	Analyser Electronics temperature	0.00 degC

Figure 13 Diagnostic page with alarm list on top

The calibration page shows the values entered from the gas bottle and assist the user in enabling the automatic zero and span calibration and verification sequences. Lamp will light when sequences are running.

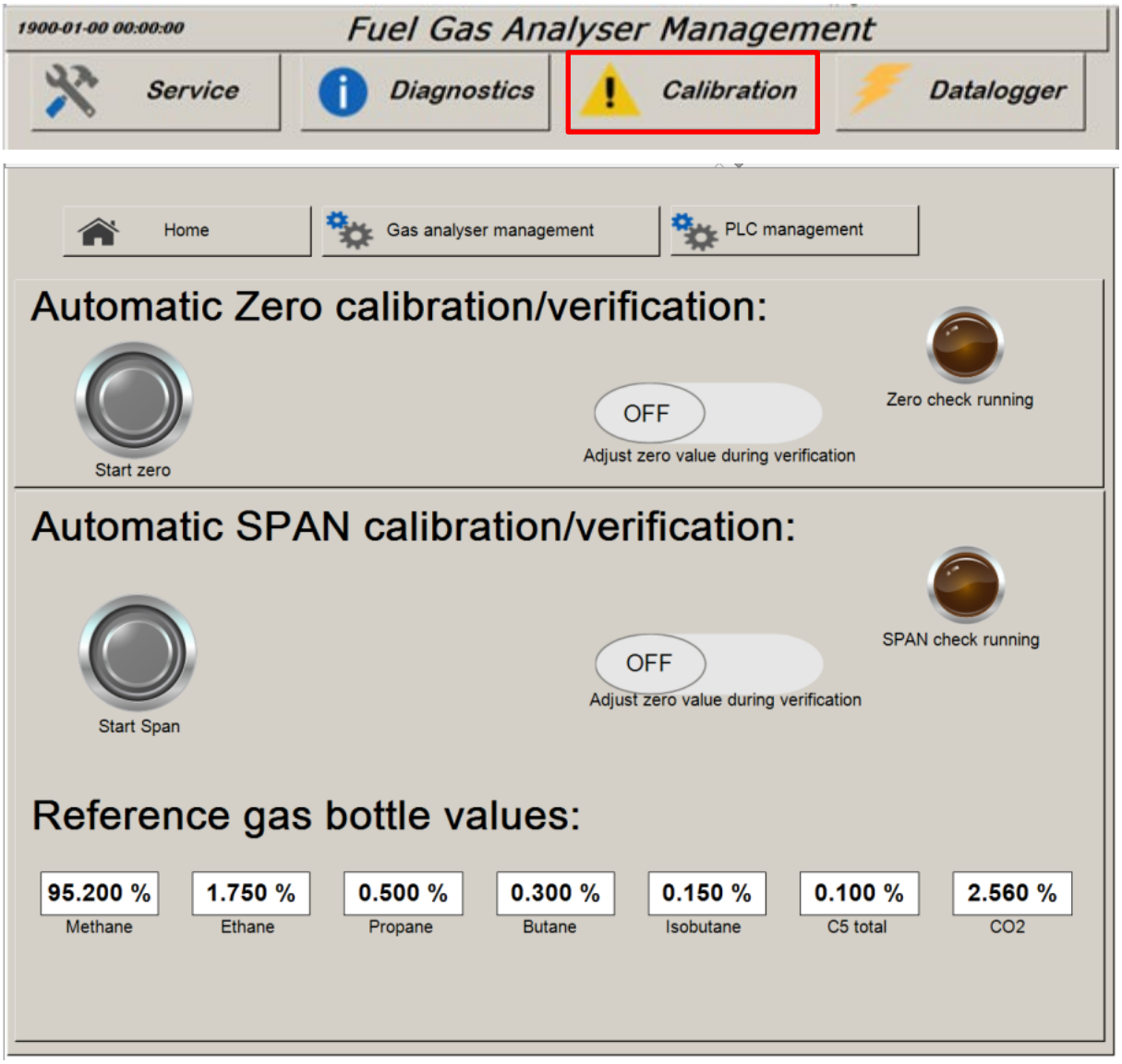


Figure 14 Calibration page

As an option, a datalogger to SD-card function is available

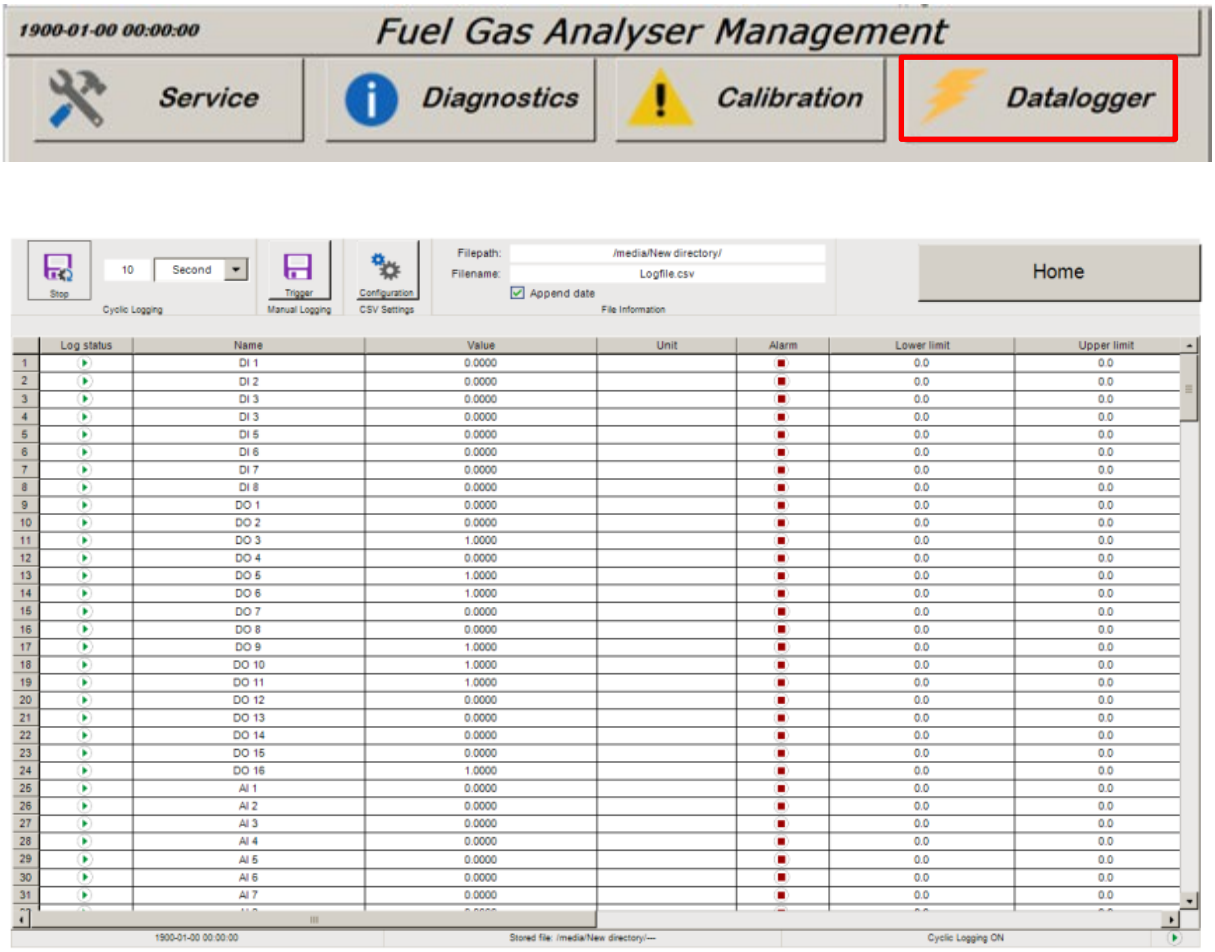
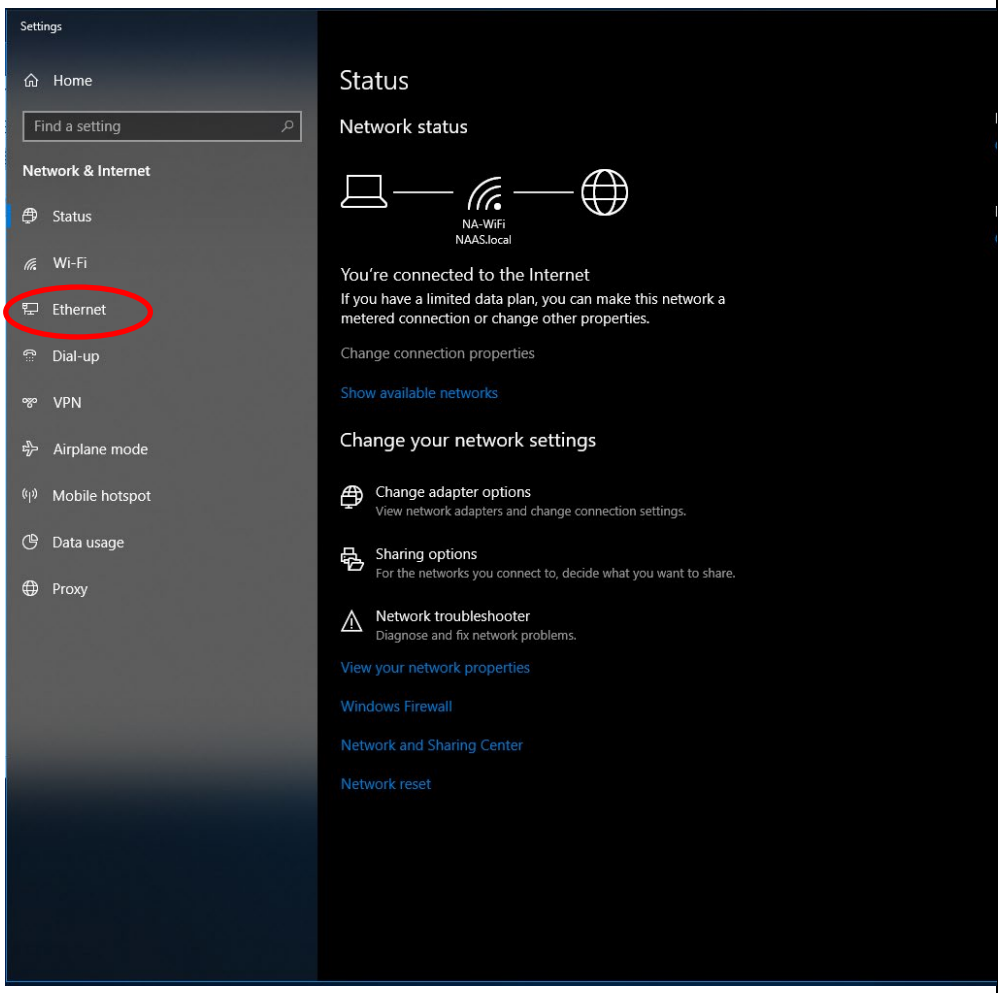
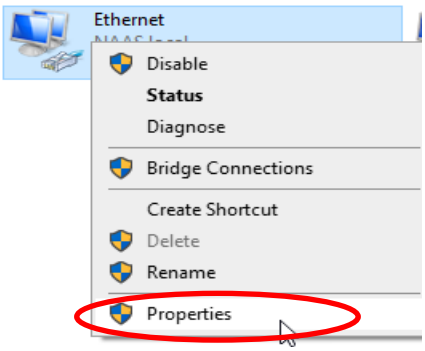
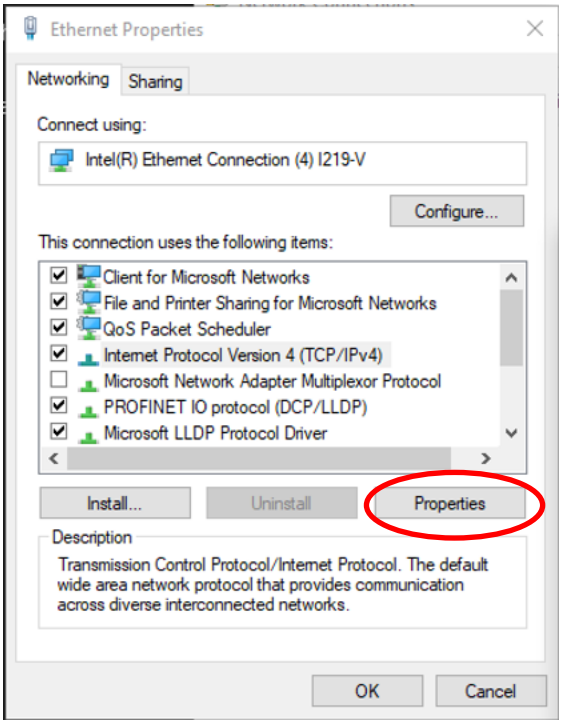


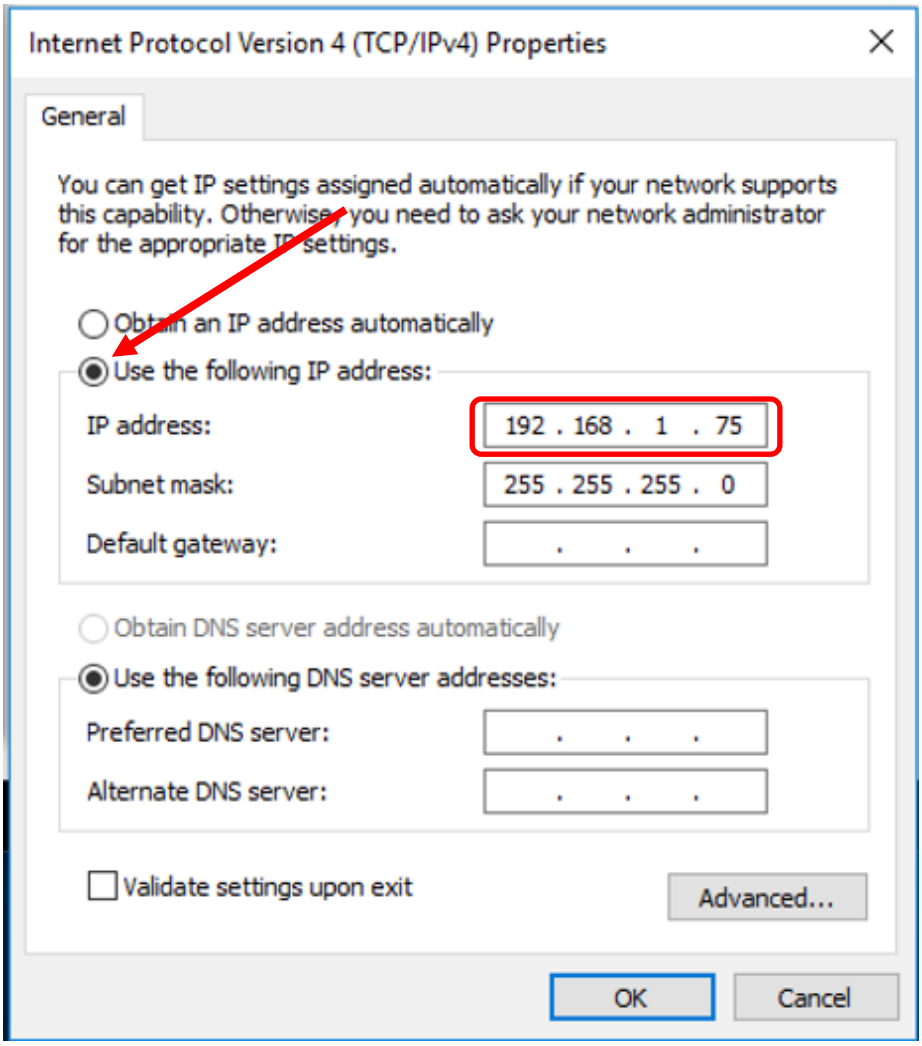
Figure 15 Datalogger

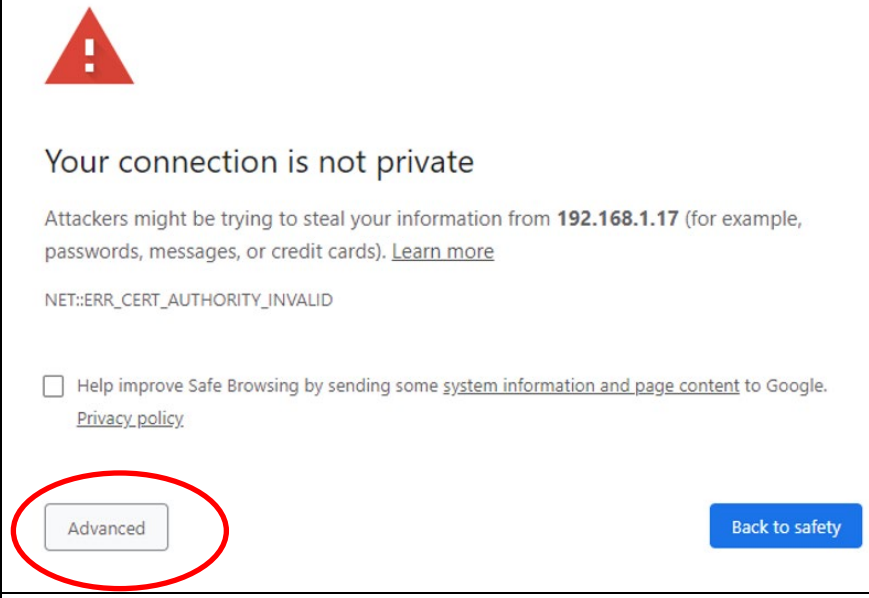
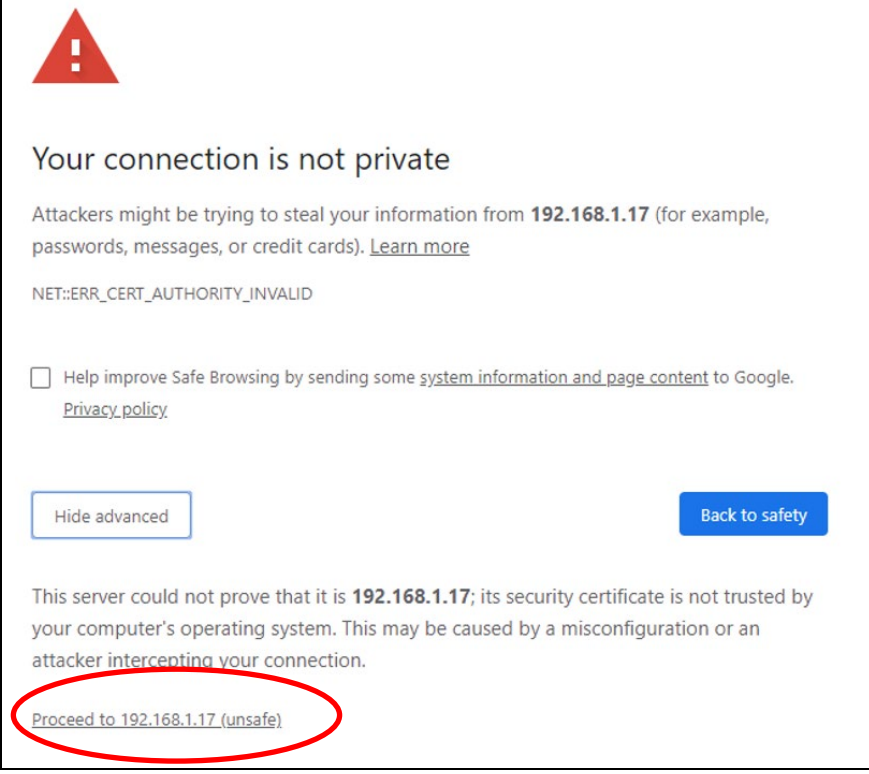
5.3.1 Set fixed IP address in PLC

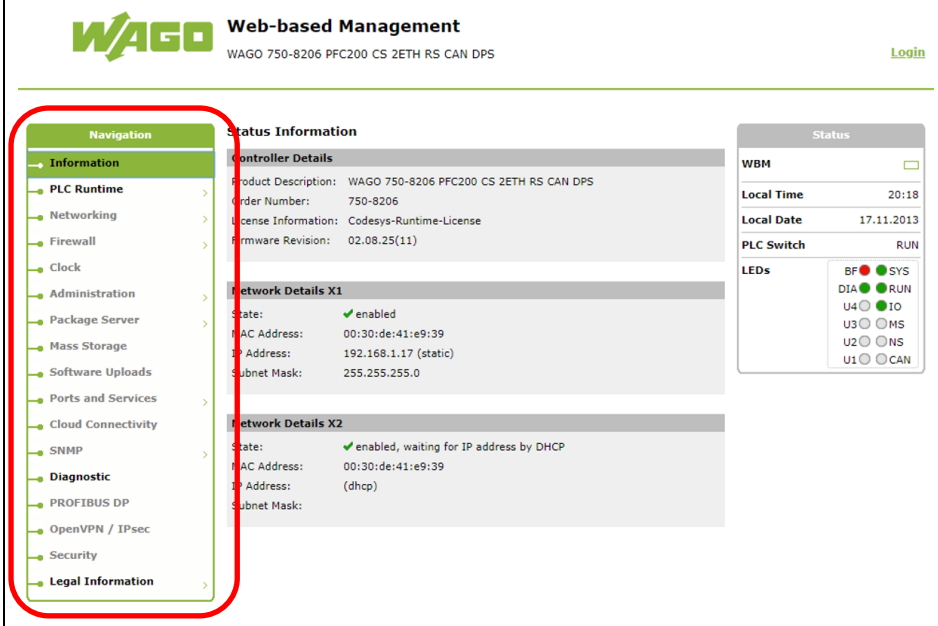
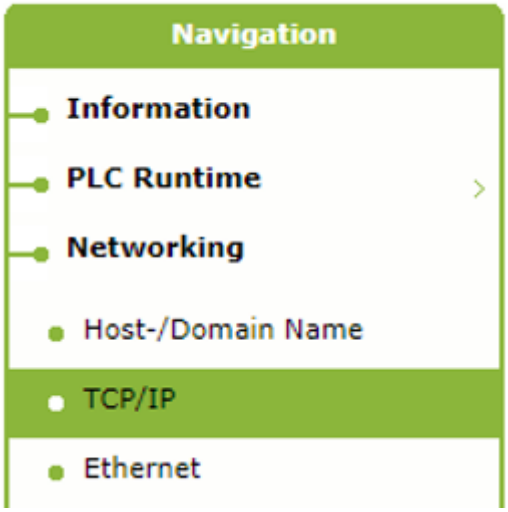
The PC and the PLC must be located within the same subnet. The instruction below shows how to change the IP address in PLC.

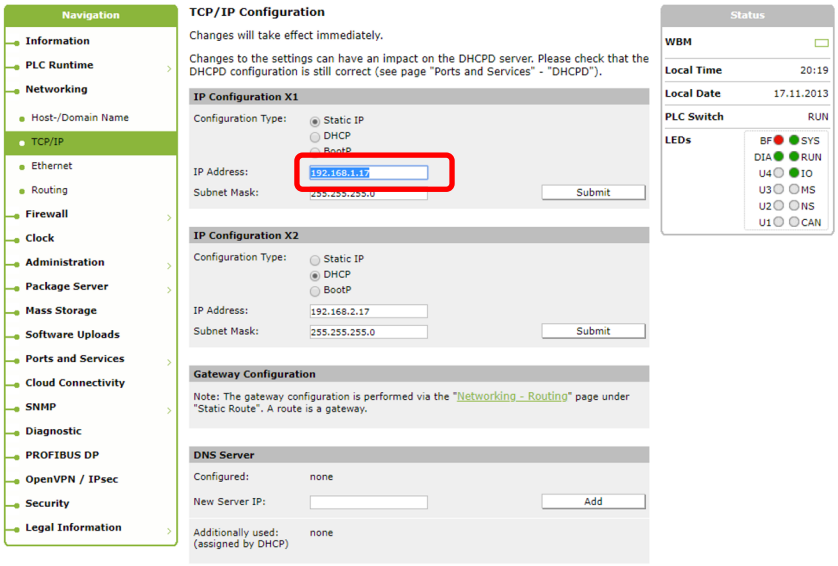
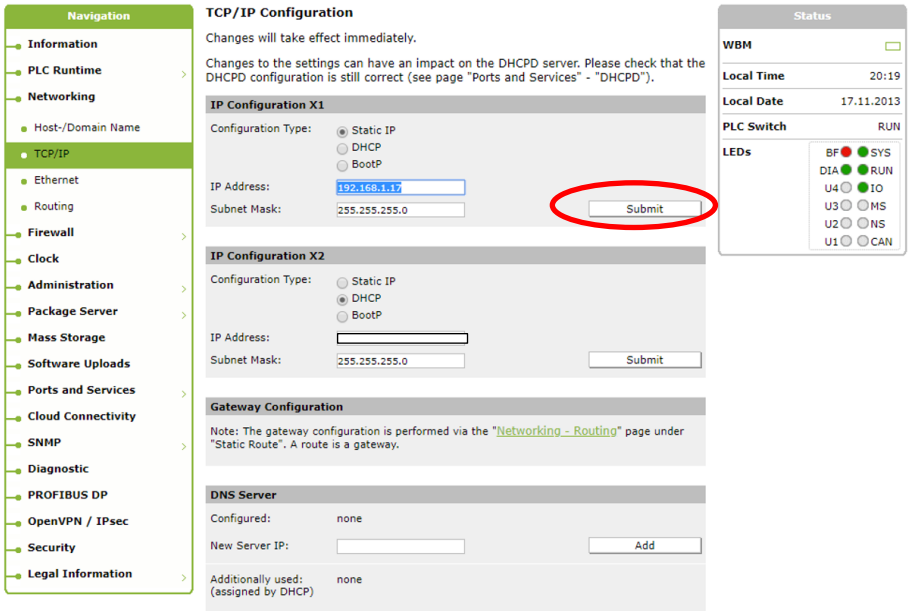
Step	Description	Sign
1.	Find the fixed IP address on the computer. Go to Settings>Network & Internet. Select *Ethernet*. 	

Step	Description	Sign
2.	Select *Change adapter options.* 	
3.	Right click on Ethernet and select *Properties.* 	
4.	Select *Properties* and *OK.* 	

Step	Description	Sign
5.	a) Select *Use the following IP address.* b) The marked filed is empty. Enter.**192.168.1.75.** c) Make sure that the subnet mask is 255.255.255.0. d) Click OK. 	

Step	Description	Sign
6.	Select *Advanced.* 	
7.	Select *Proceed to 192.168.1.17 (unsafe).* 	

Step	Description	Sign
8.	Wago web page opens. Click anywhere in the marked field to get to the login. 	
9.	Login: admin Password: wago	
10.	Select *Navigation* and then ***TCP/IP.*** 	

Step	Description	Sign
11.	The marked field has the following IP address: *192.168.1.17* 	
12.	Enter the new IP address: _____	
13.	Select *Submit.* (You will be logged out). 	

Step	Description	Sign
14.	Login with new IP address to verify successful IP address change: _____ _____ _____ _____ Open Firefox or Chrome browser. Enter "https//xxx.xxx.xxx.xxx/wbm/".	

5.4 Operational procedures

As FGA is designed to operate fully automatic, only a limited number of procedures are applicable during normal system operation.

Caution	*Do not access the analyser module menu for other purposes than listed in the following, as unskilled operation may result in system malfunction or equipment damage.*

5.4.1 Flow adjustment

Use preset mode in FGA web management.

Caution	*Do not make flow adjustment in **service mode** unless performed by skilled technician. This can damage the system! Use preset mode.*

5.4.2 Calibration /verification

The analyser module needs calibration/verification.

- **Zero Calibration (every 24h)**
  Resets base line zero value because it can slightly drift off zero.
- **Span verification (monthly)**
  Check to verify value against span gas.
- **Span calibration (every 12 months)**
  Calibration of measurement cell inside the analyser. Do not calibrate frequently because it will ruin the accuracy of measurements!

5.4.2.1 Zero Calibration (every 24h)

Zero calibration is automatic. Set starting time in FGA Web Management.

Caution	*Only use pure nitrogen with quality better than 97.5%.*

- Zero is calibrated with pure nitrogen through analyser cabinet inlet nozzle X6.
- During "zero" calibration

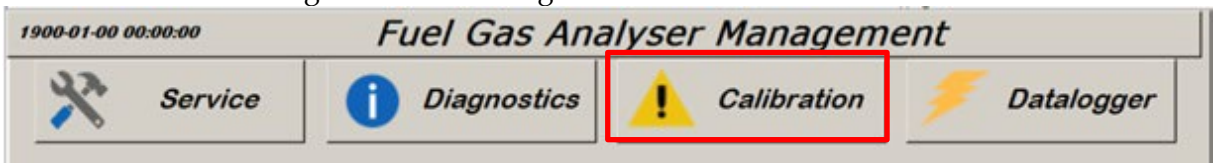
During calibration, the streaming solenoid valve will be closed and will stop sample gas, whilst simultaneously opening the zero gas solenoid valve. Both solenoid valves are controlled by the PLC. Vent goes to safe area.

5.4.2.2 Span Verification (every 30 days)

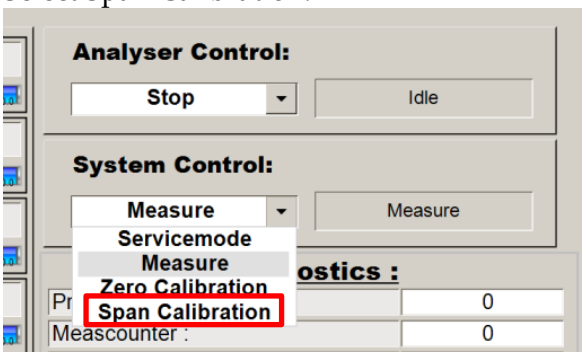
Calibration can be started manually as described below using FGA Web Management or triggered by modbus command. Calibration can also be configured to be performed automatically. (Verification or adjust)

Calibration procedure:

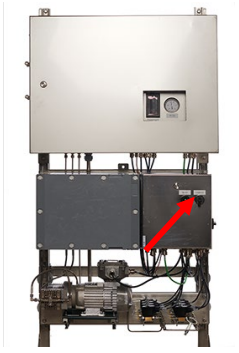
1. Initiate calibration using FGA Web Management

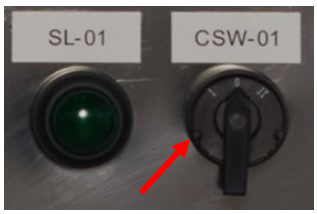


2. Select Span Calibration.



3. Open cal gas valve and adjust pressure.
4. Turn and hold (3 sec) switch CSW-01 to position I to start calibration.





5. Status lamp (green) (SL-01) blinks slowly with 1 Hz.

Caution	*Make sure the span gas valve is open and pressure adjusted!*
Caution	*Check the calibration gas blend on the cylinder and enter values into the FGA Web Management interface.*

The analyser module is span calibrated using span gas supplied through analyser cabinet inlet nozzle X9. During calibration, the streaming solenoid valve will be closed, stopping sample gas, whilst simultaneously opening the span solenoid valve. Both solenoid valves are controlled by the PLC. Vent goes to safe area.

Green lamp status:

Fixed light	=> System normal operation
1 Hz blink (slow)	=> Maintenance/calibration progress
3 Hz blink (quick)	=> Alarm active

5.4.2.3 Span calibration (every 12 months)

Calibration of measurement cell inside the analyser module.

Caution	*Do not calibrate frequently because it will ruin the accuracy of measurements! Warranty will be voided.*

Contact Norsk Analyse if in doubt about the accuracy of the analyser module.

6 Troubleshooting

6.1 Troubleshooting philosophy

FGA can recognise system irregularities and will send messages accordingly.
If signal lamp, SL-01 blinks quickly with 3 Hz, there is an alarm. Go to FGA Web Management for information.

All alarms and information messages are displayed in the ***FGA Web Management*** and available on ***modbus connection.***

Caution	*Alarms must be attended to immediately, as these indicate system faults that may be harmful to the equipment.*

Information messages need not influence the measuring ability of the analyser module at the time they occur. It is however recommended to carry out remedial measures to guarantee reliable measurements.

6.2 Signals

If the lamp SL-01 is blinking quickly (3Hz) there is an alarm. Attend immediately to the alarm in FGA Web Management.

Refer to FGA Drawing Package:

→ *[FGA-5001] - TERMINATION DIAGRAM SIGNAL DISTRIBUTION*

6.2.1 Status signals

No light	=> System is turned off
Fixed light	=> System normal operation
1 Hz blink	=> Maintenance in progress
3 Hz blink	=> Alarm active. Warning

6.3 Alarms

Refer to the following document in FGA Drawing Package:

→ *[FGA D212] – Signal Exchange List*

6.4 General troubleshooting procedure

Troubleshooting may be complex and requires good knowledge of FGA. Onboard service personnel should therefore compile and update troubleshooting guidelines over time while gathering system experience.

The following procedure therefore indicates some check points that could be included in a troubleshooting routine when an alarm has been received.

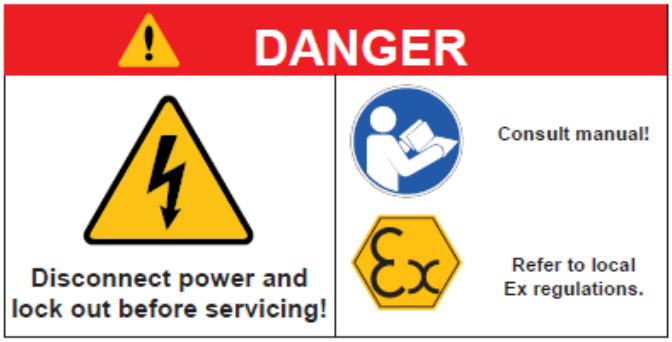
If necessary, contact Norsk Analyse for further advice or for service request.

7 Maintenance

7.1 Ex precautions

During service and maintenance of the FGA it is of utmost importance that unit is not energised!

1. Turn off external power at client's end.
2. Lock out external power at client's end.
3. Then turn off FGA using SW-01.



DANGER	***NEGLIGENCE TO FOLLOW INSTRUCTIONS CAN CAUSE RISK OF EXPLOSION AND DEATH.***

7.2 Maintenance philosophy

The maintenance philosophy recommended by Norsk Analyse is:

- Maintenance should be carried out by skilled personnel. The maintenance should include the following:
  - Calibrations and validations
  - Functional tests
- Replacement of faulty parts should be limited to the replaceable units recommended in the spare part list.

Whenever a faulty unit has been replaced, the unserviceable unit should be sent to Norsk Analyse, or an appointed dealer, for repair.

Note	*Always follow the recommended maintenance of the different units. System performance and reliability may decline if these recommendations are not followed and may also render the warranty void.*

7.3 Maintenance schedule

Maintenance routines must be performed regularly as stated in the following tables to ensure optimal performance and a long operational life of the system and its components.

The preventive maintenance program shall by defined time intervals guide the Norsk Analyse technician through an inspection, repair and replacement program. This will enable FGA to be operational, to reduce the number of expected alarms, to eliminate the number of unexpected alarms and to measure correctly.

The proposed maintenance schedule must be accommodated to authoritative legislation and actual operational conditions. The customer should thus work out a local maintenance plan.

Note *The maintenance schedule indicates the maximum recommended intervals between which the various routines should be performed.*

7.3.1 Daily routine

Unit	**Remarks**
All instruments	Check instrument displays for fault messages.

7.3.2 Weekly routine

Unit	**Remarks**
Filters	Check filters: • F-1 • F-2 • AF-1 Replace filter element if required.

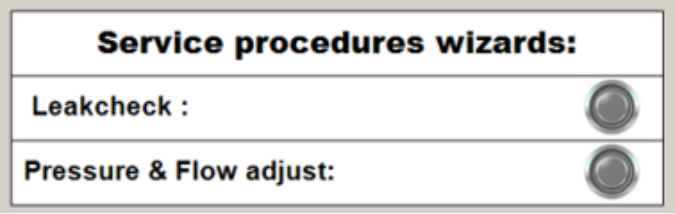
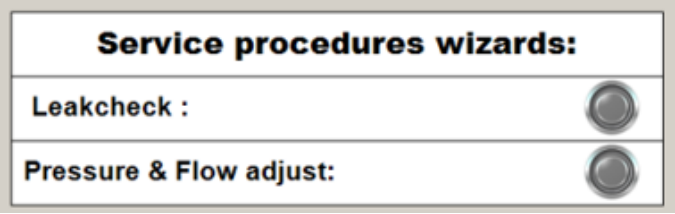
7.3.3 Monthly routine

Unit	Remarks
Analyser module	Perform a gas composition mixture (span) verification monthly (every 30 days). Refer to section 5.4.2.2
Cabinet and unit exterior	Clean all surfaces.
Analyser controller	Check: • Integrity and tightness of the enclosure. • Integrity of the flameproof joints on the enclosure body and enclosure cover. • Integrity of the seals, cable feeds and cable entries. Any damaged parts shall be replaced immediately using original parts or the damaged parts shall be repaired by the manufacturer. ***DANGER*** ***REPAIRS CAN AFFECT EXPLOSION PROTECTION!*** ***ONLY USE ORIGNAL SPARE PARTS!***

7.3.4 Routine every six months

Unit	Remarks
Span gas cylinder	Replace cylinder
Gas pump membrane	Replace the membrane. Request instructions.
Filters	Replace filters: • F-1 • F-2 • AF-1

7.3.5 Yearly routine

Unit	Remarks
Cabinet and units	Check bolts. Tighten if necessary. Check earth cable on right analyser controller (terminals). Tighten with 28Nm.
Analyser calibration	See instructions. Refer to Section 5.4.2.3.
Analyser controller	Clean boxes with compressed air. Lubricate flameproof joints with grease (E.g. Renocal, Unitemp 2, -50°C up to +100°C, FN 745/94, DIN VW TL 745 or similar.) Contact Norsk Analyse for more information. ***Warning*** ***Negligence to follow instructions can cause risk of explosion and death.***
Solenoid valves	Perform functional test. Refer to: → *NA-E-CHECK-123-01 FGA Functional check*
System	Perform leak test wizard on main page. 
System	Perform pressure and flow test wizard on main page. 

7.4 Maintenance procedures

7.4.1 Analyser module

Lenses can be cleaned. Refer to section 7.4.5.

This is the only permitted maintenance of the analyser module! Contact Norsk Analyse for more information.

DANGER ***DO NOT OPEN THE ANALYSER MODULE!***

Caution *If this is not followed, the warranty will no longer be valid.*

7.4.2 Cleaning cabinet exterior and surfaces

1) Clean the exterior of cabinets and other surfaces with a sponge or cloth soaked in water contained cleansing agent.
2) Wipe down all surfaces afterward with a clean, damp cloth to remove the detergent.

Note *The surface of screen display areas must only be cleaned using a slight pressure to prevent damage to the thin foil.*

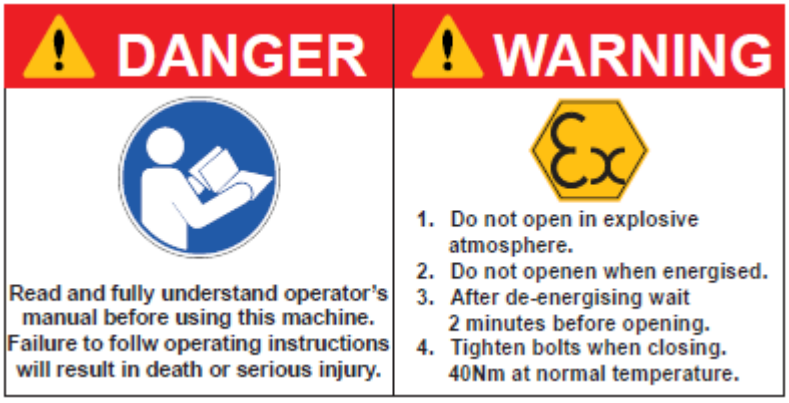
Note *Make sure that water does not enter the analyser module or other units when cleaning.*

3) If necessary, dust may be removed from the interior of cabinets by carefully using a compressed air gun.

7.4.3 Maintenance / Servicing Analyser controller

7.4.3.1 Analyser controller (Left box, control equipment)

Turn off power according to section 7.1 Follow warnings on box.



The valid national regulations for the servicing / maintenance of electrical apparatus for use in potentially explosive atmospheres shall be observed (EN 60079-17).

The necessary intervals between servicing depend upon the specific application and shall be stipulated by the operator according to the respective operating conditions.

Special attention should be given to ensuring:

- Integrity and tightness of the enclosure.
- Integrity of the flameproof joints on the enclosure body and enclosure cover.
- Integrity of the seals, cable feeds and cable entries.

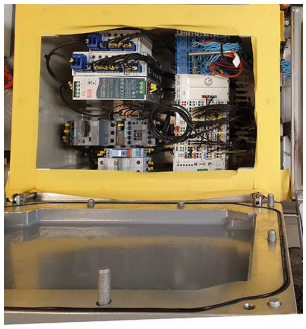
Clean the Ex-d flameproof joints. Do not use sharp tools. The Ex-d flameproof joints must be smooth and without damages.

The Ex-d flameproof joints have to be greased. Preferably with type of fat:

Renocal, Unitemp 2-50°C up to +100°C, FN 745/94, DIN VW TL 745.

Any damaged parts shall be replaced immediately using original parts or the damaged parts shall be repaired by the manufacturer.

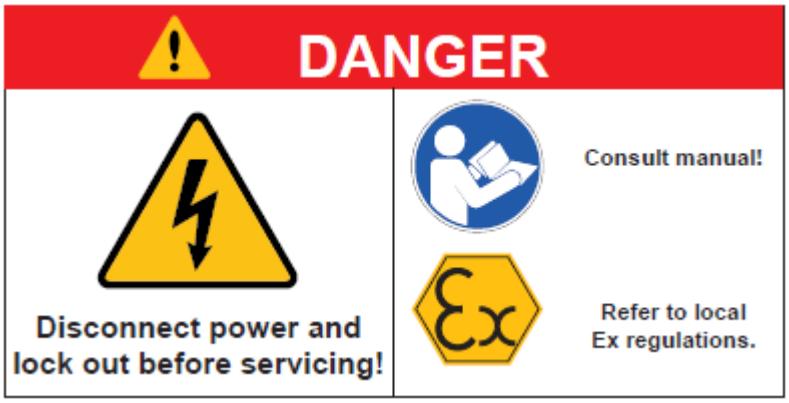
If, in the course of servicing, it is ascertained, that repairs are necessary, contact Norsk Analyse.



DANGER ***THE SEALING SURFACE MUST BE PROTECTED WITH TAPE, IF THE LID IS OPEN TO AVOID SCRATCHES.***

7.4.3.2 Analyser controller (Right box, terminals)

Turn off power according to section 7.1 Follow warnings on box.



The relevant national regulations which apply to the maintenance/ repair of electrical equipment in explosive atmospheres, shall be observed (IEC/EN 60079-17).

The required maintenance intervals depend on the specific application and shall therefore be determined by the user dependent on the conditions of use.

When servicing the equipment, particularly those parts that are decisive for the type of protection against explosion, shall be checked (e.g., intactness and tightness of the enclosure, efficiency of the gaskets and the cable devices).

If, while servicing, it is ascertained, that repairs are necessary, contact Norsk Analyse.

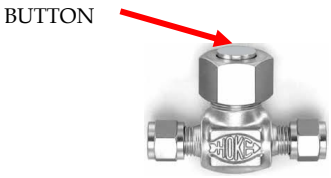
7.4.4 Replacing Filter element

Part no: 140010 (filter element, F-1, F-2)
Part no: 140001 (filter station, AF-1)

The sample inlet contains a 2-5 mikron tee filter in a union bonnet design. The filter element is passive and does not add or absorb any of the trace components to be measured. It is not necessary to shut off power during filter replacement.

Filter F-1:

1) Isolate ball valve, BV-01.
2) Bleed off pressure using filter house. Loosen lid with max. one turn and tap on button with plastic hammer (non-sparking) to ensure that pressure is bled off before removing the filter housing.



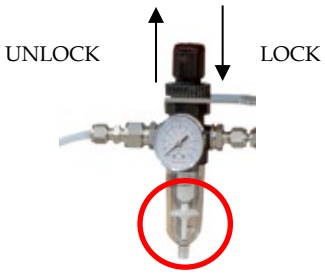
3) Remove old filter and replace.
4) Mount new gasket and reassemble in reverse order. Tighten firmly, but not too hard.

Filter F-2:

1) Isolate ball valve, BV-02.
2) Bleed off pressure using filter house. Loosen lid with max. one turn and tap on button with plastic hammer (non-sparking) to ensure that pressure is bled off before removing the filter housing. Refer to picture above.
3) Remove old filter and replace
4) Mount new gasket and reassemble in reverse order. Tighten firmly, but not too hard.

Filter AF-1:

1) Isolate ball valve, BV-02 if nitrogen is used (otherwise turn off air supply).
2) Bleed off pressure by lifting the turn knob on the AF-1 regulator (to unlock) Turn counterclockwise until stop.



3) Loosen the plastic bowl in the bottom.
4) Unscrew the old filter and replace
5) Mount in reverse order.
6) Open BV-02 if nitrogen is used (otherwise turn on air supply).
7) Adjust pressure to 4 barg on the regulator AF-1 knob.
8) Push knob down to lock the regulator.

7.4.5 Dry cleaning lenses (analyser module)

Caution *Only qualified technicians can perform the operation!*

Part no: 140012

This is the only access point to the lenses.

1) Stop sample in by closing BV-01.
2) Disconnect two the gas pipes connected to the analyser module (in and out).
3) Use a 22 mm spanner or pipe to remove the gas adapters as shown in Figure 16.
4) Clean the adapters by flushing measurement cell with N2.
5) Dispose the two O-rings and replace with new. Make sure that the O-ring and the sealing surface on the instrument is free of debris before mounting (use e.g. lens cloth for e.g., camera lens for cleaning sealing surface, if needed. DO NOT USE LIQUID! Do not apply any kind of thread securing liquids in this process.
6) Reassemble and fasten the adapters using a torque of 5 Nm.

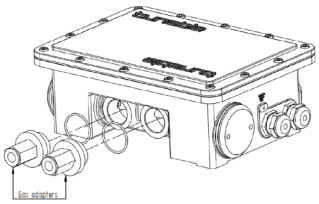


Figure 16 *Analyser module with gas adapters and O-rings*

7.4.6 Replace pump membrane

Part no: 140000

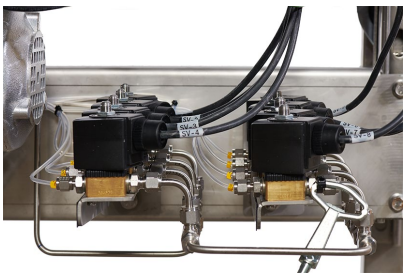
Request instructions.

7.4.7 Solenoid valves

Part no: 140003 (NO), 140002 (NC)

The eight solenoid valves provide pneumatic pressure to the eight shut-off toggle valves in the sample flow line. Solenoid valve SV-1 is connected to toggle valve TV-1 etc.

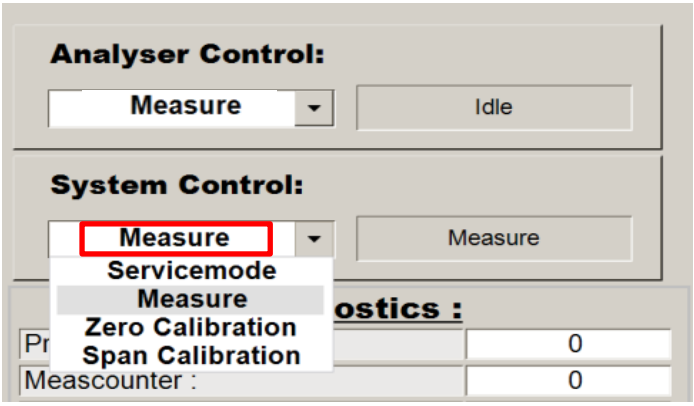
The nitrogen enters the system at nozzle X6 with a nominal pressure of 8.5 barg. The pressure to the solenoid valves is reduced to 4 barg in air filter unit AF-1.



Note *Optional instrument air can be used to operate the solenoid valves, but reconstruction of tubing is necessary.*

7.4.7.1 Functional test

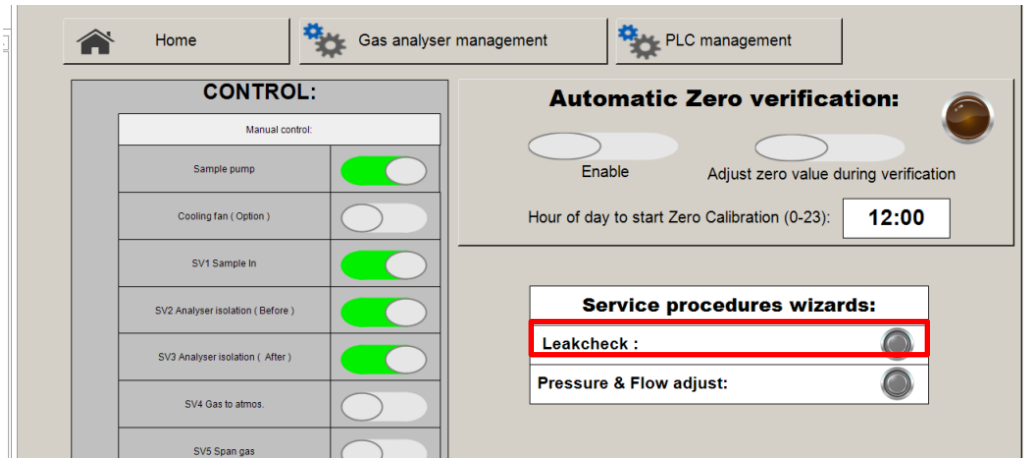
Check function with service mode from FGA Web Management.



1) Go to web server.
2) Select Service mode (manual mode) in the System Control box.
3) Analyser Control. Select *Measure* after test.
4) System Control. Select *Measure* after test.

7.4.7.2 Leak test

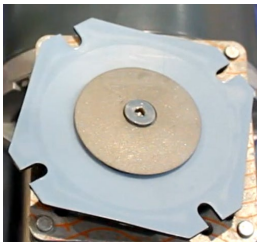
TBA



8 Spare parts lists

8.1 Analyser system

Note that item numbers refer to general arrangement drawing [1002].

Item no.	Description	Part no.	
Drawings [1002]			
	Solenoid Valve 3-way	139999	
	Recovery Pump - membrane kit	140000	
Drawings [1002]			
(part of 12)	Filter element for Station filter	140001	
4	Toggel Ventil NC	140002	

Item no.	Description	Part no.	
13	Toggel Ventil NO	140003	
	Teflon hose 1/8" (between solenoid and toggle valves)	140004	
(9)	Teflon hose 6mm	140005	
20	Check Valve 1/3 psi	140006	
2	Pressure Regulator Sample in	140007	
26	Pressure Regulator Calibration Gas	140008	
15	Pressure Regulator Maintain Pressure level in system	140009	

Item no.	Description	Part no.	
7	Filter element sample inlet (F-1 and F-2)	140010	 (Filter housing) 
(7)	Gasket for T-filter element (F-1 and F-2)	140011	
(1)	O-ring set (2 x Ø33FKM O-rings) - In/out	140012	

8.2 Calibration gas

Item no.	Description	Part no.	
N/A			

9 Technical specifications

9.1 Environmental requirements

FGA is designed to comply with:

- IACS E10 - Test Specification for Type Approval
- IEC 60945
  – Maritime navigation and radio communication equipment and systems
  – General requirements
  – Methods of testing and required test results
- IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code)

9.2 Type approvals

FGA is designed in accordance with the requirements of:

- DNV DNV 21 ATEX 94263X
- Lloyds Register LR2201492TA

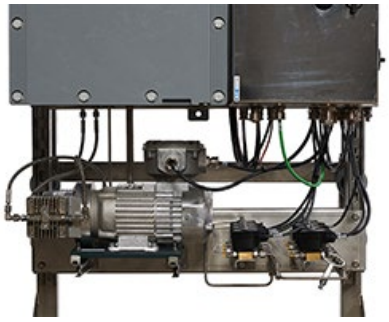
9.3 Measuring range

Component	Range	Accuracy
Methane	0-100%	0.5% Vol
Ethane	0-20%	0.5% Vol
Propane	0-20%	0.5% Vol
Iso-Butane	0-5%	0.2% Vol
N-Butane	0-5%	0.2% Vol
C5 total	0-2%	0.2% Vol
CO_2	0-10%	1.0 %Vol
Nitrogen	0-100%	Balance

9.4 Physical dimensions

Item	Specification
Dimensions (WxDxH) Weight	1550 x 800 x 514 mm 170 kg (375 lbs.)

9.5 Materials

Item	Specification
Analyser Cabinet and framing	SS316L
Analyser Controller (control equipment) (left)	Coated Aluminium alloy
Analyser Controller (terminals) (right) 	SS316L
Tubing	SS316L (6 mm) PFA/PTFE (toggle valves)
Fittings	SS316L

9.6 Ingress protection

- IP65

9.7 Maximum temperature

The system is approved for zone C; -25 till +45°

9.8 Power requirements

Item	Specification
Power consumption	590W
Voltage	230VAC , 50/60 Hz
Power cable specifications	3 * 2.5mm2 + scr

9.9 Calibration gas (span)

Item	Specification
Gas composition:	Hydrocarbon mix
Consumption	40 l/h during validation/ calibration

9.10 Nitrogen

Item	Specification
Nitrogen	97.5% nitrogen (minimum), with nominal pressure 8.5 barg.
Consumption for zero gas and solenoids	Typical 2.5 litre per day
Pressure range	6 to 8 barg (90 to 120 psig)

9.11 Option: Instrument air

Instrument air can be used for pneumatics, but rebuilding is necessary.

Item	Specification
Instrument air	Dry, oil-free according to **ISO 8573-1:2010 class 4.3.4** Dew point: ≤ -17°C Particles per m^3 (1-5µm): ≤ 10 Total oil: 0.01 mg/m^3

10 References

Note that [nnnn] is used as number identification for standard product drawings, but this is subject to change when specified by contract.

DWG/DOC	Description
Drawings:	
FGA Drawing Package	
Documents	
FGA-D22	INSTALLATION MANUAL
FGA-D15	SPARE PARTS INTERCHANGEABILITY RECORD (SPIR)
FGA-D40	UTILITIES SPECIFICATION