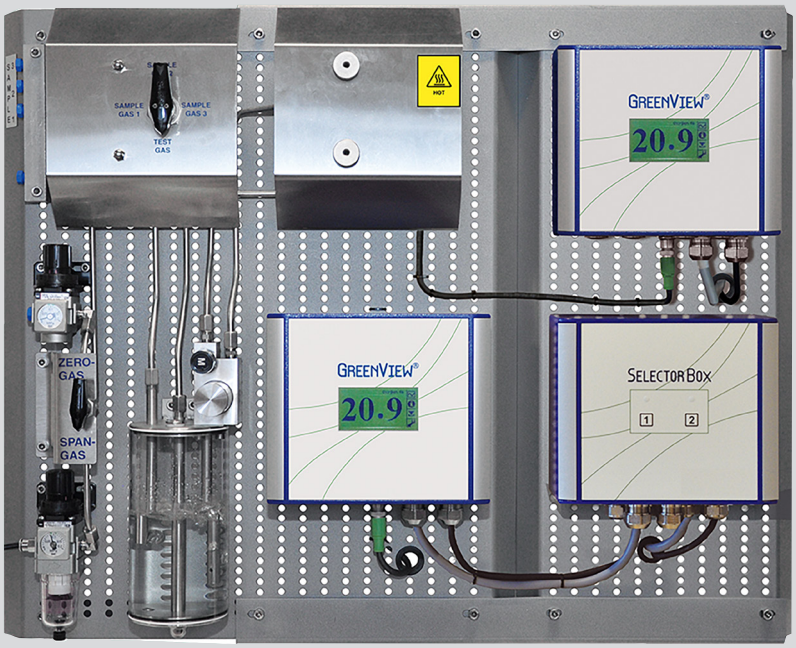
G3600/3601

Inert Gas Sampling Boards Manual



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Green Instruments

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1 Introduction

1.1 About this Manual

This manual contains data and instructions for the installation, operation, and maintenance of Green Instruments' inert gas sampling boards:

- G_{3600} IGOAS single board without flow alarm
- G_{3601} IGOAS double board without flow alarm
- G_{3602} IGOAS single board with flow alarm
- G_{3603} IGOAS double board with flow alarm
- G_{3609} IGOAS extension board (extension to G_{3600} and G_{3602})

Other system may be added at a later stage.

The sampling boards can be combined with the G_{36a} Oxygen Analyzer or the G_{36p} Oxygen Analyzer (panel mounted). One sampling board and one analyzer forms a complete inert gas oxygen analyzing system, hereafter named an IGOA System.

The instructions for installation, operation, and maintenance of the analyzers are provided in separate manuals:

- the G_{36a} Oxygen Analyzer manual (p#01245)
- the G_{36p} Oxygen Analyzer manual (p#01381)

Please read both this manual as well as the relevant oxygen analyzer manual carefully in their entirety. The instructions have been made in general terms and do not take into consideration the existing equipment of the inert gas system and its installation.

As such, the manual is designed for the standard Green Instruments IGOA System. Virtually all systems are fitted with a G_{36a} Oxygen Analyzer. Therefore, this manual focuses on the installation, operation, and maintenance of an IGOA System fitted with the G_{36a} Oxygen Analyzer.

This manual does not describe all possible situations but only the most common and known situations. It cannot replace the necessary education and training of the personnel.

Should situations not described in the manual occur, which cannot be solved in accordance with normal known practice and good workmanship, the operator should contact Green Instruments for instructions.

Green Instruments A/S reserves the right to minor alterations and improvements owing to developments without being obliged to enter the corresponding changes in this manual.

1.2 Inquiries and Feedback

All claims and inquiries for spares shall be addressed to Green Instruments A/S or our distributors.

In all correspondence or when ordering spare parts, please carefully state the equipment type and serial number, which you can find on the label on the back of the G_{36p} Oxygen Analyzer or on the right side of the G_{36a} Oxygen Analyzer.

Green Instruments A/S appreciates all feedback and suggestions for improvement. If you have any questions or find any errors in the manual, you are welcome to contact us at the following address:

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2 Specifications

Sampling Board for Inert Gas Application	
Sample inlet pressure & flow	0.05 to 1 bar – 2 to 8 l/min
Sample inlet temperature	0°C to 70°C
Sample manifold	3 ports – 1/8” BSP connection
Span gas reduction regulator	Max. 10 bar – 1/8” BSP connection
Zero gas reduction regulator	Max. 10 bar – 1/8” BSP connection
Sample selector valve	5-way and 4-position switching valve SS 316
Test gas selector valve	3-way and 2-position switching valve SS 316
Inert gas single sampling board	Dimensions: 60 × 50 × 14 cm (H × W × D) Weight: Approx. 12 kg without water & packaging
Inert gas double sampling board	Dimensions: 61 × 79 × 14 cm (H × W × D) Weight: Approx. 20 kg without water & packaging

Analyzer
See details in chapter 2 in the oxygen analyzer manual.

Optional Equipment	
Digital flow switch	0.2–10 l/min, 1 analog output 4–20 mA & 1 NPN output, display with LED type 3 digits, 1 alarm set point with the NPN output
Remote digital display	22…250 VAC/DC with 2 configurable alarm relays Ambient temperature: –20°C to 60°C Panel cut-out: 44.5 × 91.5 mm
Other optional equipment	Pre-filter for sample gas Signal amplifier for logarithmic output Visualization, recording, and data logging
Specifications are subject to changes without notice.	

3 Installation

Read this chapter in its entirety before installing the sampling board.

3.1 Control at Delivery

When you receive the shipment, please inspect and confirm that the received scope of supply is in accordance with the packing list and not damaged. Any discrepancy should be reported to the supplier immediately. If any of the received parts are damaged, the shipping company should be informed, and new parts should be made available before completing the installation.

3.2 Where to Install the System

Satisfactory operation, faultless functions, and minimal maintenance of the sampling board are achieved by paying attention to the following points:

- The sampling board shall be installed in a clean area away from dust, oil mist, and moisture. The elements of the system shall be installed at viewing level so that it is easily accessible in connection to operation and service.

- It is recommended that the sampling board is located very close to the sampling point of the inert gas system to obtain current and accurate readings. Large bore sample lines as well as longer sample lines will increase the response time due to dead volume.

3.3 Safety Aspects

Hot sensor

The sensor is hot and can cause severe burning of personnel if not handled with care.

Analyzer(s)

Before working with the analyzer(s), please read the analyzer manual in its entirety.

Installation and operation

Installation and operation of the sampling board and associated equipment must be carried out by skilled personnel, and that Green Instruments does not take any responsibility of the operation of the system and associated equipment whatsoever.

The successful and safe operation of this equipment is dependent upon proper handling, installation, operation, and maintenance.

Recycling

Do not dispose any part of the sampling system with regular waste. Disposal should be in accordance with the requirements of the current statutory regulations.

3.4 Single Board

3.4.1 Mounting Panel

The mounting panel has two angle iron mounting brackets. The brackets are made of ordinary mild steel and can be welded or bolted directly to a chosen structure as required. The two mounting brackets are mounted horizontal and parallel with a distance of 550 mm. For dimensions and layout see Figure 3-2 and Figure 3-3.

3.4.2 Sample Gas Connection

The sample gas must be extracted from a suitable location that represents the gas to be tested.

The connection for sample gas is located in the top left corner of the system board at the sample manifold. It is possible to connect up to three samples to the manifold. The three connections are all arranged as 1/8" BSP female connections, and marked from bottom: 1, 2, and 3. The system is supplied with the manifold sample ports plugged.

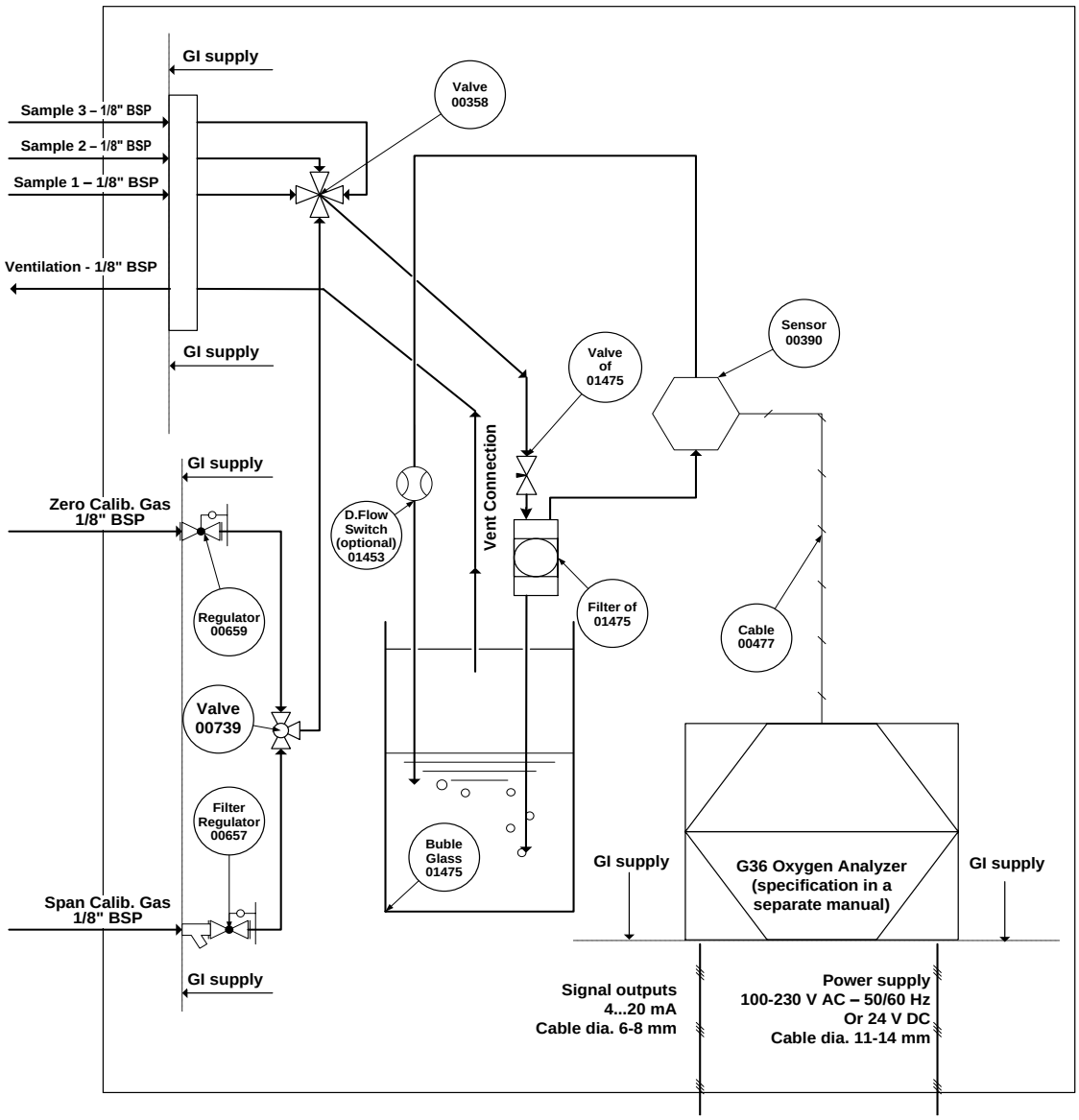
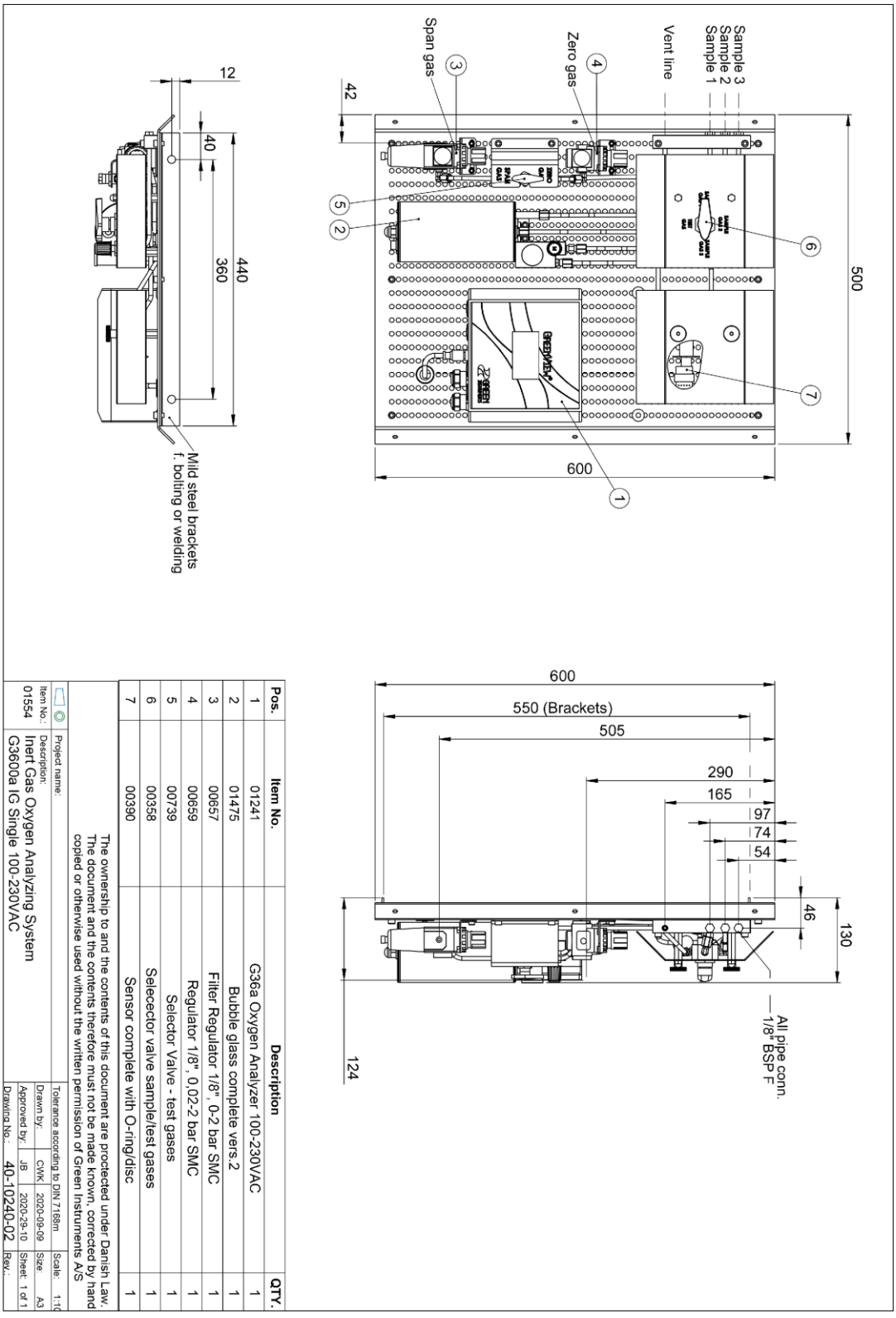


Figure 3-1: Piping and instrumentation diagram - single sampling board

3.4.3 Calibration Gas Connection

For test and calibration, use a calibration gas with known oxygen content e.g. a test gas with 2% oxygen content in pure nitrogen. For linearization, clean and dry compressed instrument air is normally used as span calibration gas. Both gases are connected directly to the respective reduction stations. The lower reduction station including filter and drain is for span gas (instrument air). The upper reduction station without filter is for the zero calibration gas taken from a bottle. Connections for both reduction stations are a 1/8" BSP female connection.



Pos.	Item No.	Description	QTY.
1	01241	G36a Oxygen Analyzer 100-230VAC	1
2	01475	Bubble glass complete vers.2	1
3	00657	Filter Regulator 1/8", 0-2 bar SMC	1
4	00659	Regulator 1/8", 0,02-2 bar SMC	1
5	00739	Selector Valve - test gases	1
6	00358	Selecector valve sample/test gases	1
7	00390	Sensor complete with O-ring/disc	1

Project name:	
Description:	Inert Gas Oxygen Analyzing System G3600a IG Single 100-230VAC
Item No.:	01554
Tolerance according to DIN 7168m	Scale: 1:10
Drawn by: CWK 2020-09-09	Size: A3
Approved by: JB 2020-29-10	Sheet: 1 of 1
Drawing No.: 40-10240-02	Rev.:

Figure 3-2: IGOA system – single sampling board

3.4.4 Vent Line Connection

The vent line connection for the bubble glass is placed right below the sample ports. It is for the connection of an external vent line which allows venting the sampled inert gas from the bubble glass to the outside air. The vent line must be dimensioned to allow a gas flow of at least 10 l/min and arranged in such a way that it avoids backpressure and secures a sufficient sample gas flow (i.e. bubbles in the water). The vent line must be uninterrupted and easily bring away the inert gas.

3.4.5 Analyzer and Electrical Connection

The instructions for electrical connections of the analyzer are described in section 3.4 in the analyzer manual.

3.4.6 Digital Flow Switch (Optional)

If the sampling board is configured with a digital flow switch, please see the enclosed leaflet for installation and operating instructions.

3.5 Double Sampling Board

The double sampling board is designed for an analyzing system with the configuration of two sensors and two oxygen analyzers for inert gas.

The double sampling board consists of a single sampling board described in the previous section and an extension board mounted on the right hand side of the single board. This extension board consists of a mounting panel, an oxygen analyzer, and a selector box for switching output signals between the two analyzers.

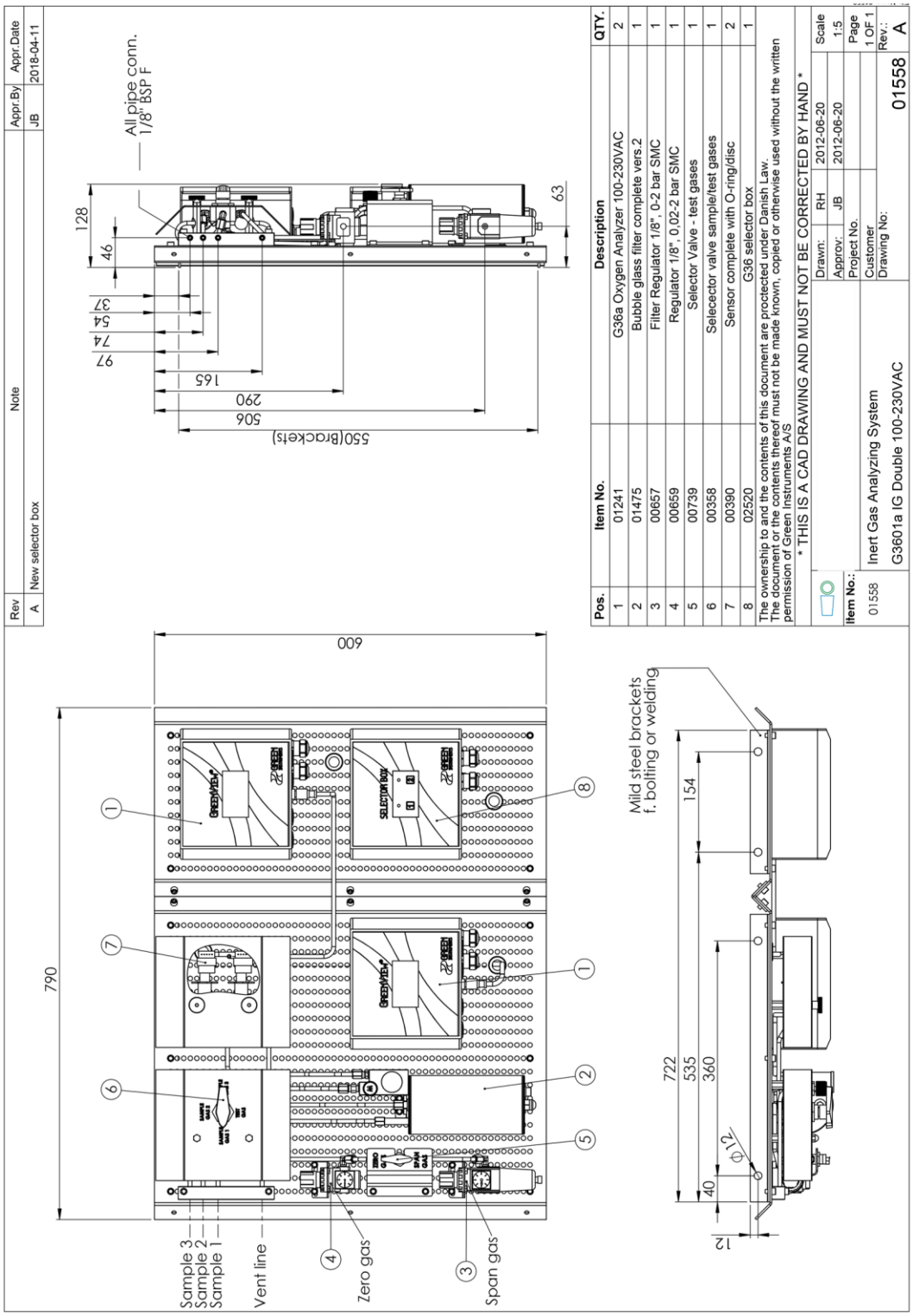


Figure 3-3: IGOA System - double sampling board

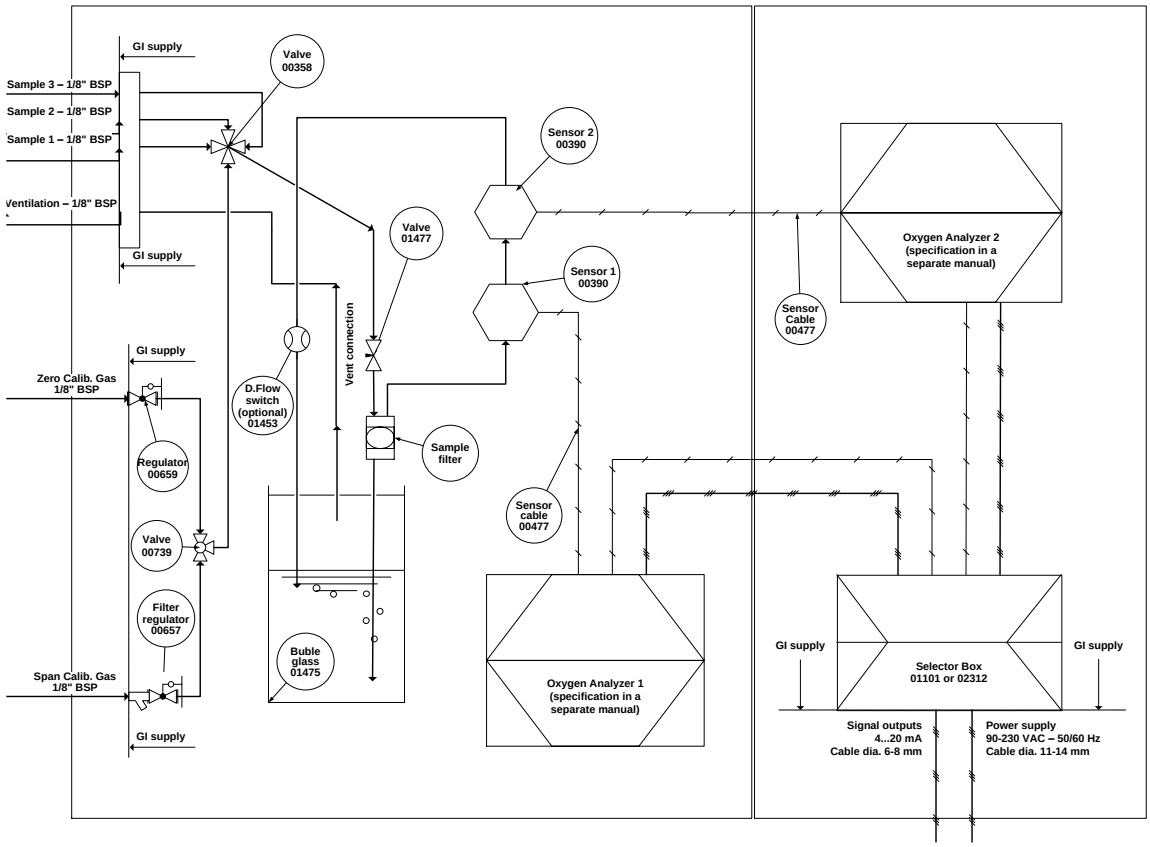


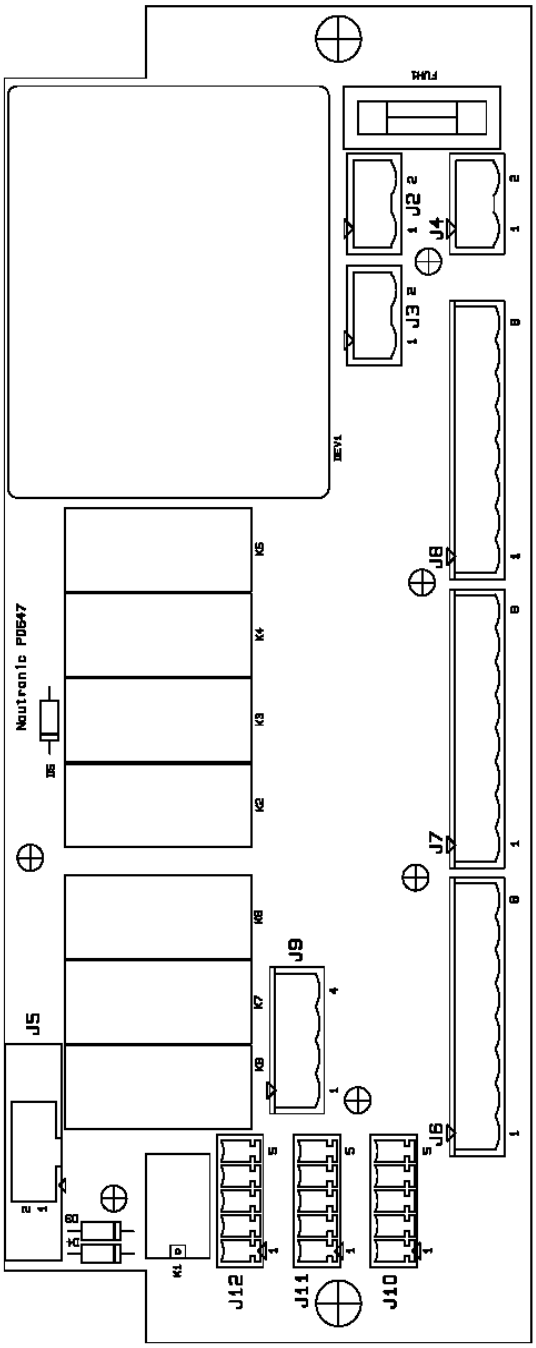
Figure 3-4: Piping and instrumentation diagram – double sampling board

Installation of the Double Sampling Board

The installation of the double board is carried out equivalent to the installation of the single board as described in the previous section. See Figure 3-3 and Figure 3-4 for the layout and piping and instrumentation diagram of a double sampling board.

The analyzers are prewired with the selector box, which can be Type G3505 (old type) or Type G36. The interfaces of the analyzer are the same as described in the analyzer manual.

The power supply and signal output cables are connected to the selector box. The electrical connections are dependent on the actual system configuration. Only those functions to be used shall be connected. Please see Figure 3-5 for details of all standard connections to the selector box Type G3505; and Figure 3-6 for details of all standard connections to the selector box Type G36.



Power Supply	
Protective earth	Spade
Mains IN	
Neutral Live	J3 - Terminal 1
Power lead	J3 - Terminal 2
Power Unit 1 - prewired	
Neutral Live	J2 - Terminal 1
Power lead	J2 - Terminal 2
Power Unit 2 - prewired	
Neutral Live	J4 - Terminal 1
Power lead	J4 - Terminal 2

Relay Output – J8	
R4–not used by default	J8 - Terminal 8
R4–not used by default	J8 - Terminal 7
R3–System failure alarm	J8 - Terminal 6
R3–System failure alarm	J8 - Terminal 5
R2–Alarm HI-HI O2 %	J8 - Terminal 4
R2–Alarm HI-HI O2 %	J8 - Terminal 3
R1–Alarm HI LOW O2 %	J8 - Terminal 2
R1–Alarm HI LOW O2 %	J8 - Terminal 1

Relay Input from Unit 2 – J7 - prewired	
R4–not used by default	J7 - Terminal 8&7
R3–System failure alarm	J7 - Terminal 6&5
R2–Alarm HI-HI O2 %	J7 - Terminal 4&3
R1–Alarm HI LOW O2 %	J7 - Terminal 2&1

Relay Input from Unit 1 – J6	
R4–not used by default	J6 - Terminal 8&7
R3–System failure alarm	J6 - Terminal 6&5
R2–Alarm HI-HI O2 %	J6 - Terminal 4&3
R1–Alarm HI LOW O2 %	J6 - Terminal 2&1

Analog Outputs– J12	
Analog output 2 (-)	J12 - Terminal 4
Analog output 2 (+)	J12 - Terminal 3
Analog output 1 (-)	J12 - Terminal 2
Analog output 1 (+)	J12 - Terminal 1

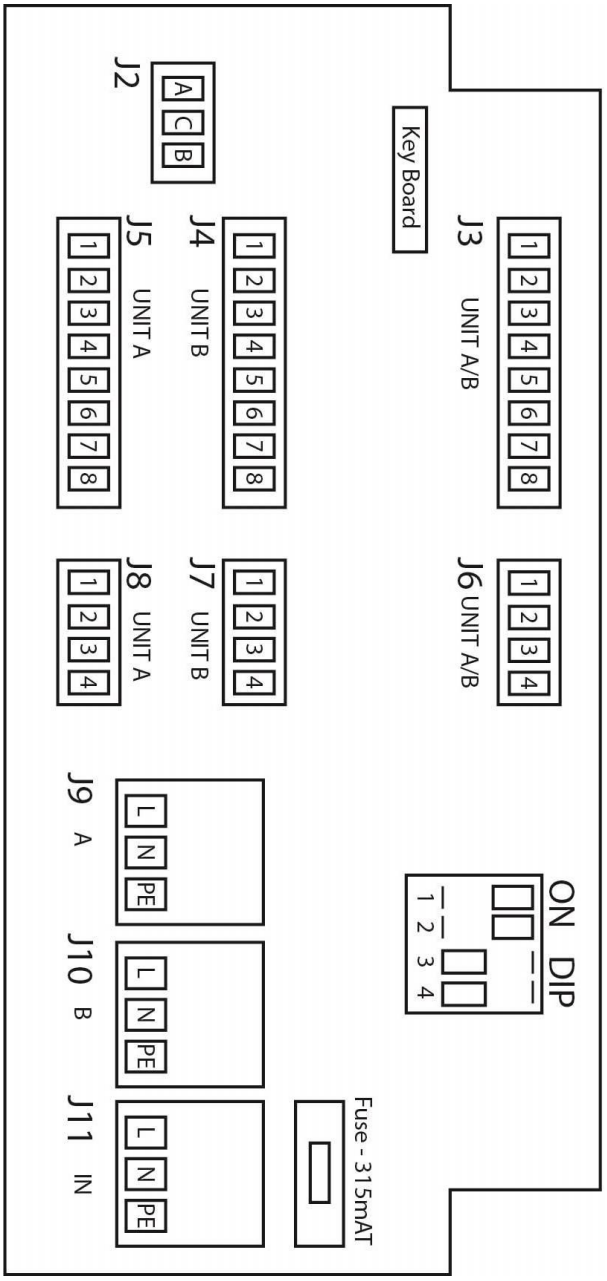
Analog Inputs from Unit 2 – J11	
Analog output 2 (-)	J11 - Terminal 4
Analog output 2 (+)	J11 - Terminal 3
Analog output 1 (-)	J11 - Terminal 2
Analog output 1 (+)	J11 - Terminal 1

Analog Inputs from Unit 1 – J10	
Analog output 2 (-)	J10 - Terminal 4
Analog output 2 (+)	J10 - Terminal 3
Analog output 1 (-)	J10 - Terminal 2
Analog output 1 (+)	J10 - Terminal 1

Figure 3-5: Electrical connections of the selector box G3505

Power Supply – Main In	**J11**
Power Lead	J11-L
Neutral Live	J11-N
Protective earth	PE
Power Supply – Unit 1 (A)	**J9**
Power Lead	J9-L
Neutral Live	J9-N
Protective earth	PE
Power Supply – Unit 2 (B)	**J10**
Power Lead	J10-L
Neutral Live	J10-N
Protective earth	PE
Relay Output – Common (A/B)	**J3**
R1 – Alarm High/Low O2 level	J3 Terminals 1-2
R2 – Alarm High High O2 level	J3 Terminals 3-4
R3 – System failure alarm	J3 Terminals 5-6
R4 – Not used by default	J3 Terminals 7-8
Relay Input from Unit 1 (A)	**J5**
R1 – Alarm High/Low O2 level	J5 Terminals 1-2
R2 – Alarm High High O2 level	J5 Terminals 3-4
R3 – System failure alarm	J5 Terminals 5-6
R4 – Not used by default	J5 Terminals 7-8
Relay Input from Unit 2 (B)	**J4**
R1 – Alarm High/Low O2 level	J4 Terminals 1-2
R2 – Alarm High High O2 level	J4 Terminals 3-4
R3 – System failure alarm	J4 Terminals 5-6
R4 – Not used by default	J4 Terminals 7-8
Analog Ouput – Common (A/B)	**J6**
Analog output 1 – O2 %	J6 Terminals 1-2
Analog output 2 – optional	J6 Terminals 3-4
Analog Input from Unit 1 (A)	**J8**
Analog output 1 – O2 %	J8 Terminals 1-2
Analog output 2 – optional	J8 Terminals 3-4
Analog Input from Unit 2 (B)	**J7**
Analog output 1 – O2 %	J7 Terminals 1-2
Analog output 2 – optional	J7 Terminals 3-4

DIP Switches	
A or B Power on (Default setting)	DIP 1 & 2: ON, & DIP 3 & 4: OFF
A & B powered on	DIP 1 & 2: OFF, & DIP 3 & 4: ON



Keyboard
Connection to the two keys on the top cover.

Figure 3-6: Electrical connections of the selector box G36

3.6 Retrofitting of Extension Board

The G_{3609} Extension Board including a G36 Oxygen Analyzer and a selector box Type G36 can be retrofitted to an existing single sampling board (G_{3600} or G_{3602}). This makes the single board function like a double board.

The extension board is delivered with two angle irons that are used to mount the extension board. These extension mounting brackets are delivered with holes and bolts, so that the extension board can be mounted directly to the right side of the single sampling board. Alternatively, the extension board can be installed at a distance of up to 1.3 meters from the sampling board.

Sensor housing

When retrofitting a single sampling board with an extension board, the sensor housing must be changed to a double type for two sensors (unless the single sampling board is already arranged with a double sensor house). When installing the double sensor housing, please tighten the tube fittings carefully by using a second wrench to prevent the fixed body from turning.

Internal power supply and interfaces

The new analyzer (2) on the extension board is pre-wired to the selector box. The existing analyzer (1) on the single sampling board needs to be wired to the selector box on the extension board in the following way:

	Analyzer 1	Selector box - Type G36
AC power supply	Power supply	J9 – L, N, PE
Relay outputs*	D-OUT*	J5
Analog outputs	A-OUT – terminal 1 & 2	J8

*For the configuration of the relay outputs D-OUT, see section 3.4.3 in the analyzer manual.

General power supply – selector box J11

Before connecting the general power supply to J11 terminal L, N & PE in the selector box, please make sure that the power supply rating on the name plate on the right side of both analyzers corresponds with the available power supply.

General Analog signal and relay output – selector box J3 & J6

The three alarm relay outputs (High/Low O_2, High/High O_2, and system failure alarm) are taken from the J3 in the selector box. The analog 4…20 mA signal output cable is connected to J6 in the selector box. See Figure 3-6 for a detailed description of the electrical connections of the selector box.

Standby Redundancy – selector box DIP

The system can be configured that both analyzers are powered ON at the same time or only one of them is powered ON.
The setting is at DIP switches at the selector box G36.

Power Supply	**DIP Switches**			
	1	2	3	4
Unit 1 **or** Unit 2 powered ON	ON	ON	OFF	OFF
Unit 1 **and** Unit 2 powered ON	OFF	OFF	ON	ON

Please note that you will have to configure each analyzer separately when you want to change the settings for the alarms or the analog signal. See chapter 5 in the analyzer manual for configuration and commissioning.

4 Commissioning

Before starting the system for the first time after completing the installation, please check the installation of the system.

4.1 Installation Checks of the Sampling Board

- Check that the span and zero calibration gases are connected, and that all connections are secured and not leaking. ***A leaking connection will result in loss of calibration gas and may result in poor calibration.***

- Check that the sample gases are connected, and that the connections are secured and not leaking. Sample gas connections should be as close to the process as possible, preferably made from 6 mm stainless piping in order to reduce the dead volume in the sampling system. If the sample gas is heavily contaminated with particles, a pre-filter should be installed. The sample gas has to be taken from a suitable location representative for the gas to be tested.

4.2 Commissioning of the Analyzer

Check the connection and settings of the analyzer by following the instructions in sections 3 to 5 in the oxygen analyzer manual. When working with a double sampling board, this step needs to be carried out for each analyzer separately.

4.3 Start of the System

- Start the analyzer following the instructions in chapter 5 in the analyzer manual.

- Fill the bubble glass with clean (preferably distilled) water to the water line marked on the glass.

- Introduce sample gas to a sample port and turn the selector valve to the selected sample port (1-3).

- Open the flow control valve slowly until bubbles are noted. Open the flow control valve until there is a steady stream of bubbles from both the by-pass and sample return pipes inside the bubble glass. The longest pipe is for by-passing of sample gas against the water static pressure to secure a sufficient flow rate and constant sample pressure at the sensor. The short pipe is the return of sample gas from the sensor(s). Increased gas flow indicated by more bubbles from both pipes will reduce the sampling delay time. Howev-

er, too high velocity – indicated by an enormous number of bubbles, will change the sensor temperature and consequently the readings.

- Turn the selector valve to Test Gas and the calibration selector valve to Zero Gas and adjust the zero gas reduction station until the flow is about the same as noted for the sample gas by observing the bubble flow.

- Turn the calibration selector valve to Span Gas and adjust the span gas reduction station until the flow is about the same as noted for the sample gas by observing the bubble flow.

Now, the system is ready for calibration following the instructions in chapter 6 in the analyzer manual.

5 Routine Maintenance

5.1 Sampling System

Routine inspection and maintenance of the sampling system is required to make sure no gas is leaking from the test or calibration gas supply. Failure to periodically inspect and maintain the above requirements may lead to imprecise analyzer readings and thus a malfunction of the inert gas system.

The system including sample and test gas selector valves and flow control valves is tested from the factory.

For the selector valve packing, adjustment may be required for leak-tight performance. Adjust the packing by turning the packing bolt clockwise in 1/16-turn increments until leak-tight performance is achieved. Always verify proper operation upon installation.

Protect the reduction units from the ultraviolet rays and adhesion of organic solvents. Depressurize the reduction stations before cleaning and service.

Clean with neutral detergent.

5.2 Filter and Bubble glass

The system including filter, bubble glass, and sensor is tested from the factory.

Filter

The filter element located on top of the bubble glass will require periodical replacement. The changing period will be determined based on actual sample condition and how dirty the filter gets. When changing the filter, the sample flow control valve must be closed so that the system is completely isolated from the sample or calibration gas. The filter element is removed by unscrewing the filter top.

Check the condition of the filter O-ring seals and replace if required. For spare parts, see the list of spare parts in chapter 6.

Bubble glass

Check the level in the bubble glass daily and refill with clean (preferably distilled) water as required. It is recommended to drain the bubble glass monthly and refill with clean (preferably distilled) water. The bubble glass may need internal cleaning. Clean with neu-

tral detergent. O-rings for the bubble glass may require replacement for leak free operation.

Prevent the glass from ultraviolet rays and adhesion of organic solvents. For spare parts, see the list of spare parts in chapter 6.

Please also check that the vent line functions uninterrupted and secures a sufficient gas flow. There must not be a build-up of pressure in the bubble glass.

Note

After you change the gasket ring or clean the bubble glass tube, do not tight the nut at the bottom of the bubble glass too hard. Otherwise, the bubble glass tube can break.

5.3 Analyzer

See chapter 7 in the oxygen analyzer manual for routine maintenance of the analyzer.

5.4 Sensor

The sensor is considered a consumable part. A reduced lifetime can occur if the sensor is exposed to lead, phosphorus, silicon, halogens, or high concentration of sulfur. Furthermore, the ceramic element of the sensor can be damaged if it is exposed to water or shock.

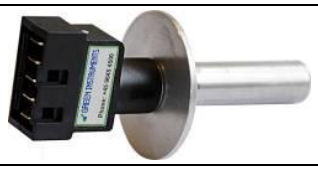
To replace the sensor please follow the following steps:

- Disconnect the power.
- Unscrew the two finger nuts and remove the cover plate. Please note that the sensor and sensor housing are hot and can cause severe burning of personnel if not handled with care.

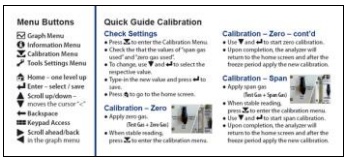
- Unplug the sensor cable connection.
- Pull the sensor out.
- Insert a new sensor and reconnect the sensor cable connection
- Put the cover plate and the finger nuts back on and tighten the finger nuts.

6 Spare Parts

Spare parts are not included in the standard delivery. Spare parts can be ordered when necessary. When ordering spare parts, please mention the serial number of the analyzer, which you can find on the label on the right side of the blue analyzer box.

Part No.	Part Description	the specific appearance of the spare parts is subject change without notice; the function however will not change
00328	O-ring for IG sensor	
00358	Selector valve sample/test gases	
00373	O-ring for filter house	
00379	Bubble glass tube	
00380	Sample filter glass	
00390	SEN1 complete with O ring/disc (includes 00328)	
00395	Filter elements (pkg of 5)	
00657	Filter regulator – 1/8”, 0-2 bar	

Part No.	Part Description	the specific appearance of the spare parts is subject change without notice; the function however will not change
00659	Zero gas regulator – 1/8”, 0.02–2 bar	
00477	Sensor cable complete 0.8 m	
01121	Sensor cable complete 1.5 m	
00922	Sensor cable complete 3.0 m	
00605	Gasket for drain plug	
00739	Selector valve test gases	
00754	Gasket set bubble glass (2 teflon gaskets, 2 big O-rings and 1 small O-ring)	
01047	Cable gland – M20 (11-14 mm)	
02520	Selector box – 90-230 VAC	
01251	Fuse 2 AT (pkg of 10) – O2 analyzer G36	
02551	Fuse 315 mAT (pkg of 10) – selector box G36	
01471	SD card with G_{36} software & standard settings files – please quote the serial number of the analyzer when you order an SD card.	

Part No.	Part Description	the specific appearance of the spare parts is subject change without notice; the function however will not change
01475	Bubble glass complete	
01477	Needle consol valve for bubble glass	
01241	G_{36a} Oxygen Analyzer 100-230 VAC	
01245	G_{36a} Oxygen Analyzer manual	
01594	Spares parts Kit	Includes 1 x 00328, 2 x 00373, 1 x 00390, 1 x 00395, 1 x 00605, 1 x 00754, and 1 x 01251
01597	This manual	
01656	G_{36} Quick Guide	

Optional Items

01562	G_{3609a} IGOAS extension board AC (for G_{3600a} and G_{3602a})	

Part No.	Part Description	the specific appearance of the spare parts is subject change without notice; the function however will not change
01453	Digital flow switch 0.2-10 l/min (optional)	
33594	Pre-Filter incl. filter cartridge	
00980	Filter cartridge for pre-filter	

Other optional equipment can be supplied e.g.:

Flow alarm, visualization, recording and data logging, monitoring of inert gas temperature, pressure, and load, remote digital display, signal amplifier for logarithmic output.

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